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DAKOTA, A Multilevel Parallel Object-Oriented Framework for Design Optimization, Parameter Estimation, Uncertainty Quantification, and Sensitivity Analysis

Version 5.2+ Developers Manual

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Abstract

The DAKOTA (Design Analysis Kit for Optimization and Terascale Applications) toolkit provides a flexible and extensible interface between simulation codes and iterative analysis methods. DAKOTA contains algorithms for optimization with gradient and nongradient-based methods; uncertainty quantification with sampling, reliability, and stochastic expansion methods; parameter estimation with nonlinear least squares methods; and sensitivity/variance analysis with design of experiments and parameter study methods. These capabilities may be used on their own or as components within advanced strategies such as surrogate-based optimization, mixed integer nonlinear programming, or optimization under uncertainty. By employing object-oriented design to implement abstractions of the key components required for iterative systems analyses, the DAKOTA toolkit provides a flexible and extensible problem-solving environment for design and performance analysis of computational models on high performance computers.

This report serves as a developers manual for the DAKOTA software and describes the DAKOTA class hierarchies and their interrelationships. It derives directly from annotation of the source code and provides detailed class documentation, including all member functions and attributes.

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Chapter 1

DAKOTA Developers Manual

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1.1 Introduction

The DAKOTA (Design Analysis Kit for Optimization and Terascale Applications) toolkit provides a flexible, extensible interface between analysis codes and iteration methods. DAKOTA contains algorithms for optimization with gradient and nongradient-based methods, uncertainty quantification with sampling, reliability, stochastic expansion, and interval estimation methods, parameter estimation with nonlinear least squares methods, and sensitivity/variance analysis with design of experiments and parameter study capabilities. (Solution verification and Bayesian approaches are also in development.) These capabilities may be used on their own or as components within advanced algorithms such as surrogate-based optimization, mixed integer nonlinear programming, mixed aleatory-epistemic uncertainty quantification, or optimization under uncertainty. By employing object-oriented design to implement abstractions of the key components required for iterative systems analyses, the DAKOTA toolkit provides a flexible problem-solving environment for design and performance analysis of computational models on high performance computers.

The Developers Manual focuses on documentation of DAKOTA design principles and class structures; it derives principally from annotated source code. For information on input command syntax, refer to the `Reference Manual`, and for more details on DAKOTA features and capabilities, refer to the Users Manual.

1.2 Overview of DAKOTA

In DAKOTA, the *strategy* creates and manages *iterators* and *models*. In the simplest case, the strategy creates a single iterator and a single model and executes the iterator on the model to perform a single study. In a more advanced case, a hybrid optimization strategy might manage a global optimizer operating on a low-fidelity model in coordination with a local optimizer operating on a high-fidelity model. And on the high end, a surrogate-based optimization under uncertainty strategy would employ an uncertainty quantification iterator nested within an optimization iterator and would employ truth models layered within surrogate models. Thus, iterators and

models provide both stand-alone capabilities as well as building blocks for more sophisticated studies.

A model contains a set of *variables*, an *interface*, and a set of *responses*, and the iterator operates on the model to map the variables into responses using the interface. Each of these components is a flexible abstraction with a variety of specializations for supporting different types of iterative studies. In a DAKOTA input file, the user specifies these components through strategy, method, model, variables, interface, and responses keyword specifications.

The use of class hierarchies provides a mechanism for extensibility in DAKOTA components. In each of the various class hierarchies, adding a new capability typically involves deriving a new class and providing a set of virtual function redefinitions. These redefinitions define the coding portions specific to the new derived class, with the common portions already defined at the base class. Thus, with a small amount of new code, the existing facilities can be extended, reused, and leveraged for new purposes. The following sections tour DAKOTA's class organization.

1.2.1 Strategies

Class hierarchy: Strategy.

Strategies provide a control layer for creation and management of iterators and models. Specific strategies include:

- SingleMethodStrategy: the simplest strategy. A single iterator is run on a single model to perform a single study.
- HybridStrategy: hybrid minimization using a set of iterators employing a corresponding set of models of varying fidelity. Coordination approaches among the iterators include collaborative, embedded, and sequential approaches, as embodied in the CollaborativeHybridStrategy, EmbeddedHybridStrategy, and SequentialHybridStrategy derived classes.
- ConcurrentStrategy: two similar algorithms are available: (1) multi-start iteration from several different starting points, and (2) pareto set optimization for several different multiobjective weightings. Employs a single iterator with a single model, but runs multiple instances of the iterator concurrently for different settings within the model.

1.2.2 Iterators

Class hierarchy: Iterator. Iterator implementations may choose to split operations up into run-time phases as described in Understanding Iterator Flow.

The iterator hierarchy contains a variety of iterative algorithms for optimization, uncertainty quantification, nonlinear least squares, design of experiments, and parameter studies. The hierarchy is divided into Minimizer and Analyzer branches. The Minimizer classes address optimization and deterministic calibration and are grouped into:

- Optimization: Optimizer provides a base class for the DOTOptimizer, CONMINOptimizer, NPSOLOptimizer, NLPQLPOptimizer, and SNLLOptimizer gradient-based optimization libraries and the APPSOptimizer, COLINOptimizer, JEGAOptimizer, and NCSUOptimizer nongradient-based optimization methods and libraries.
- Parameter estimation: LeastSq provides a base class for NL2SOLLeastSq, a least-squares solver based on NL2SOL, SNLLLeastSq, a Gauss-Newton least-squares solver, and NLSSOLLeastSq, an SQP-based least-squares solver.

- Surrogate-based minimization (both optimization and nonlinear least squares): SurrBasedMinimizer provides a base class for SurrBasedLocalMinimizer, SurrBasedGlobalMinimizer, and EffGlobalMinimizer. The surrogate-based local and global methods employ a single iterator with any of the available SurrogateModel capabilities (local, multipoint, or global data fits or hierarchical approximations) and perform a sequence of approximate optimizations, each involving build, optimize, and verify steps. The efficient global method, on the other hand, hard-wires a recursion involving Gaussian process surrogate models coupled with the DIRECT global optimizer to maximize an expected improvement function.

The Analyzer classes are grouped into:

- Uncertainty quantification: NonD provides a base class for non-deterministic methods NonDSampling, NonDReliability (reliability analysis), NonDExpansion (stochastic expansion methods), and NonDInterval (interval-based epistemic methods). Bayesian calibration methods are prototyped in NonDBayesCalibration.
  - NonDSampling is further specialized with the NonDLHSSampling class for Latin hypercube and Monte Carlo sampling, the NonDIncremLHSSampling class for incremental Latin hypercube sampling, and NonDAdaptImpSampling for multimodal adaptive importance sampling.
  - NonDReliability is further specialized with local and global methods (NonDLocalReliability and NonDGlobalReliability).
  - NonDExpansion includes specializations for generalized polynomial chaos (NonDPolynomialChaos) and stochastic collocation (NonDStochCollocation) and is supported by the NonDIntegration helper class, which supplies cubature, tensor-product quadrature and Smolyak sparse grid methods (NonDCubature, NonDQuadrature, and NonDSparseGrid).
  - NonDInterval provides a base class for epistemic interval-based UQ methods. Three interval analysis approaches are provided: LHS (NonDLHSInterval), efficient global optimization (NonDGlobalInterval), and local optimization (NonDLocalInterval). Each of these three has specializations for single interval (NonDLHSSingleInterval, NonDGlobalSingleInterval, NonDLocalSingleInterval) and Dempster-Shafer Theory of Evidence (NonDLHSEvidence, NonDGlobalEvidence, NonDLocalEvidence) approaches.
- Parameter studies and design of experiments: PStudyDACE provides a base class for ParamStudy, which provides capabilities for directed parameter space interrogation, PSUADEDesignCompExp, which provides access to the Morris One-At-a-Time (MOAT) method for parameter screening, and DDACEDesignCompExp and FSUDesignCompExp, which provide for parameter space exploration through design and analysis of computer experiments. NonDLHSSampling from the uncertainty quantification branch also supports design of experiments when in `all_variables` mode.
- Solution verification studies: Verification provides a base class for RichExtrapVerification (verification via Richardson extrapolation) and other solution verification methods in development.

1.2.3 Models

Class hierarchy: Model.

The model classes are responsible for mapping variables into responses when an iterator makes a function evaluation request. There are several types of models, some supporting sub-iterators and sub-models for enabling layered and nested relationships. When sub-models are used, they may be of arbitrary type so that a variety of recursions are supported.

- SingleModel: variables are mapped into responses using a single Interface object. No sub-iterators or sub-models are used.

- SurrogateModel: variables are mapped into responses using an approximation. The approximation is built and/or corrected using data from a sub-model (the truth model) and the data may be obtained using a sub-iterator (a design of experiments iterator). SurrogateModel has two derived classes: DataFitSurrModel for data fit surrogates and HierarchSurrModel for hierarchical models of varying fidelity. The relationship of the sub-iterators and sub-models is considered to be "layered" since they are not used as part of every response evaluation on the top level model, but rather used periodically in surrogate update and verification steps.

- NestedModel: variables are mapped into responses using a combination of an optional Interface and a sub-iterator/sub-model pair. The relationship of the sub-iterators and sub-models is considered to be "nested" since they are used to perform a complete iterative study as part of every response evaluation on the top level model.

- RecastModel: recasts the inputs and outputs of a sub-model for the purposes of variable transformations (e.g., variable scaling, transformations to standardized random variables) and problem reformulation (e.g., multiobjective optimization, response scaling, augmented Lagrangian merit functions, expected improvement).

1.2.4 Variables

Class hierarchy: Variables.

The Variables class hierarchy manages design, aleatory uncertain, epistemic uncertain, and state *variable types* for continuous, discrete integer, and discrete real *domain types*. This hierarchy is specialized according to how the domain types are managed:

- MixedVariables: domain type distinctions are retained, such that separate continuous, discrete integer, and discrete real domain types are managed. This is the default Variable perspective, and draws its name from "mixed continuous-discrete" optimization.

- MergedVariables: domain types are combined through relaxation of discrete constraints; i.e., continuous and discrete variables are merged into continuous arrays through relaxation of integrality (for discrete integer ranges) or set membership (for discrete integer or discrete real sets) requirements. The branch and bound minimizer is the only method using this approach at present.

Whereas domain types are controlled through the derived class selection, selection of active variable types are handled within each of these derived classes using variable views. These permit different algorithms to work on different subsets of variables. For details, see Working with Variable Containers and Views.

The Constraints hierarchy manages bound, linear, and nonlinear constraints and utilizes the same specializations for managing bounds on the variables (see MixedConstraints and MergedConstraints).

1.2.5 Interfaces

Class hierarchy: Interface.

Interfaces provide access to simulation codes or, conversely, approximations based on simulation code data. In the simulation case, an ApplicationInterface is used. ApplicationInterface is specialized according to the simulation invocation mechanism, for which the following nonintrusive approaches

- SysCallApplicInterface: the simulation is invoked using a system call (the C function `system()`). Asynchronous invocation utilizes a background system call. Utilizes the SysCallAnalysisCode class to define syntax for input filter, analysis code, output filter, or combined spawning, which in turn utilize the CommandShell utility.

- ForkApplicInterface: the simulation is invoked using a fork (the `fork/exec/wait` family of functions). Asynchronous invocation utilizes a nonblocking fork. Utilizes the ForkAnalysisCode class for lower level fork operations.

and the following semi-intrusive approach

- DirectApplicInterface: the simulation is linked into the DAKOTA executable and is invoked using a procedure call. Asynchronous invocations will utilize nonblocking threads (capability not yet available).

are supported. Scheduling of jobs for asynchronous local, message passing, and hybrid parallelism approaches is performed in the ApplicationInterface class, with job initiation and job capture specifics implemented in the derived classes.

In the approximation case, global, multipoint, or local data fit approximations to simulation code response data can be built and used as surrogates for the actual, expensive simulation. The interface class providing this capability is

- ApproximationInterface: builds an approximation using data from a truth model and then employs the approximation for mapping variables to responses. This class contains an array of Approximation objects, one per response function, which support a variety of approximation types using the different Approximation derived classes. These include SurfpackApproximation (provides kriging, MARS, moving least squares, neural network, polynomial regression, and radial basis functions), GaussProcApproximation (Gaussian process models), PecosApproximation (multivariate orthogonal and Lagrange interpolation polynomials from Pecos), TANA3Approximation (two-point adaptive nonlinearity approximation), and TaylorApproximation (local Taylor series).

which is an essential component within the DataFitSurrModel capability described above in Models.

1.2.6 Responses

Class: Response.

The Response class provides an abstract data representation of response functions and their first and second derivatives (gradient vectors and Hessian matrices). These response functions can be interpreted as objective functions and constraints (optimization data set), residual functions and constraints (least squares data set), or generic response functions (uncertainty quantification data set). This class is not currently part of a class hierarchy, since the abstraction has been sufficiently general and has not required specialization.

1.3 Services

A variety of services are provided in DAKOTA for parallel computing, failure capturing, restart, graphics, etc. An overview of the classes and member functions involved in performing these services is included below.

- Multilevel parallel computing: DAKOTA supports multiple levels of nested parallelism. A strategy can manage concurrent iterators, each of which manages concurrent function evaluations, each of which manages concurrent analyses executing on multiple processors. Partitioning of these levels with MPI communicators is managed in ParallelLibrary and scheduling routines for the levels are part of Strategy, ApplicationInterface, and ForkApplicInterface.

- Parsing: DAKOTA employs the NIDR parser (New Input Deck Reader) to retrieve information from user input files. Parsing options are processed in CommandLineHandler and parsing occurs in ProblemDescDB::manage_inputs() called from main.C. NIDR uses the keyword handlers in the NIDRProblemDescDB derived class to populate data within the ProblemDescDB base class, which maintains a DataStrategy specification and lists of DataMethod, DataModel, DataVariables, DataInterface, and DataResponses specifications. Procedures for modifying the parsing subsystem are described in Instructions for Modifying DAKOTA's Input Specification.

- Failure capturing: Simulation failures can be trapped and managed using exception handling in ApplicationInterface and its derived classes.

- Restart: DAKOTA maintains a record of all function evaluations both in memory (for capturing any duplication) and on the file system (for restarting runs). Restart options are processed in CommandLineHandler and retrieved in ParallelLibrary::specify_outputs_restart(), restart file management occurs in ParallelLibrary::manage_outputs_restart(), and restart file insertions occur in ApplicationInterface. The `dakota_restart_util` executable, built from restart_util.C, provides a variety of services for interrogating, converting, repairing, concatenating, and post-processing restart files.

- Memory management: DAKOTA employs the techniques of reference counting and representation sharing through the use of letter-envelope and handle-body idioms (Coplien, "Advanced C++"). The former idiom provides for memory efficiency and enhanced polymorphism in the following class hierarchies: Strategy, Iterator, Model, Variables, Constraints, Interface, ProblemDescDB, and Approximation. The latter idiom provides for memory efficiency in data-intensive classes which do not involve a class hierarchy. The Response and parser data (DataStrategy, DataMethod, DataModel, DataVariables, DataInterface, and DataResponses) classes use this idiom. When managing reference-counted data containers (e.g., Variables or Response objects), it is important to properly manage shallow and deep copies, to allow for both efficiency and data independence as needed in a particular context.

- Graphics: DAKOTA provides 2D iteration history graphics using Motif widgets. Graphics data can also be cataloged in a tabular data file for post-processing with 3rd party tools such as Matlab, Tecplot, etc. These capabilities are encapsulated within the Graphics class.

1.4 Development Practices and Guidance

The following links provide guidance for core software components or specific development activities:

- Coding Style Guidelines and Conventions - coding practices used by the DAKOTA development team.

- Instructions for Modifying DAKOTA's Input Specification - how to interact with NIDR and the associated DAKOTA classes.
- Interfacing with DAKOTA as a Library - embed DAKOTA as a service within your application.
- Understanding Iterator Flow - explanation of the full granularity of steps in Iterator execution.
- Performing Function Evaluations - an overview of the classes and member functions involved in performing function evaluations synchronously or asynchronously.
- Working with Variable Containers and Views - discussion of data storage for variables and explanation of active and inactive views of this data.

1.5 Additional Resources

Additional development resources include:

- The DAKOTA Developer Portal linked from `http://dakota.sandia.gov/developer/` includes information on getting started as a developer and links to project management resources.
- Project web pages are maintained at `http://dakota.sandia.gov/` including links to frequently asked questions, documentation, publications, mailing lists, and other resources.

Chapter 2

Coding Style Guidelines and Conventions

Chapter 3

Introduction

Common code development practices can be extremely useful in multiple developer environments. Particular styles for code components lead to improved readability of the code and can provide important visual cues to other developers. Much of this recommended practices document is borrowed from the CUBIT mesh generation project, which in turn borrows its recommended practices from other projects, yielding some consistency across Sandia projects. While not strict requirements, these guidelines suggest a best-practices starting point for coding in DAKOTA.

Chapter 4

C++/c Style Guidelines

Style guidelines involve the ability to discern at a glance the type and scope of a variable or function.

4.1 Class and variable styles

Class names should be composed of two or more descriptive words, with the first character of each word capitalized, e.g.:

```
class ClassName;
```

Class member variables should be composed of two or more descriptive words, with the first character of the second and succeeding words capitalized, e.g.:

```
double classMemberVariable;
```

Temporary (i.e. local) variables are lower case, with underscores separating words in a multiple word temporary variable, e.g.:

```
int temporary_variable;
```

Constants (i.e. parameters) and enumeration values are upper case, with underscores separating words, e.g.:

```
const double CONSTANT_VALUE;
```

4.2 Function styles

Function names are lower case, with underscores separating words, e.g.:

```
int function_name();
```

There is no need to distinguish between member and non-member functions by style, as this distinction is usually clear by context. This style convention allows member function names which set and return the value of a similarly-named private member variable, e.g.:

```
int memberVariable;
void member_variable(int a) { // set
  memberVariable = a;
}
int member_variable() const { // get
  return memberVariable;
}
```

In cases where the data to be set or returned is more than a few bytes, it is highly desirable to employ const references to avoid unnecessary copying, e.g.:

```
void continuous_variables(const RealVector& c_vars) { // set
  continuousVariables = c_vars;
}
const RealVector& continuous_variables() const {      // get
  return continuousVariables;
}
```

Note that it is not necessary to always accept the returned data as a const reference. If it is desired to be able change this data, then accepting the result as a new variable will generate a copy, e.g.:

```
// reference to continuousVariables cannot be changed
const RealVector& c_vars = model.continuous_variables();
// local copy of continuousVariables can be changed
RealVector c_vars = model.continuous_variables();
```

4.3 Miscellaneous

Appearance of typedefs to redefine or alias basic types is isolated to a few header files (`data_types.h`, `template_defs.h`), so that issues like program precision can be changed by changing a few lines of typedefs rather than many lines of code, e.g.:

```
typedef double Real;
```

`xemacs` is the preferred source code editor, as it has C++ modes for enhancing readability through color (turn on "Syntax highlighting"). Other helpful features include "Paren highlighting" for matching parentheses and the "New Frame" utility to have more than one window operating on the same set of files (note that this is still the same edit session, so all windows are synchronized with each other). Window width should be set to 80 internal columns, which can be accomplished by manual resizing, or preferably, using the following alias in your shell resource file (e.g., .cshrc):

```
alias xemacs "xemacs -g 81x63"
```

where an external width of 81 gives 80 columns internal to the window and the desired height of the window will vary depending on monitor size. This window width imposes a coding standard since you should avoid line wrapping by continuing anything over 80 columns onto the next line.

Indenting increments are 2 spaces per indent and comments are aligned with the code they describe, e.g.:

```
void abort_handler(int code)
{
  int initialized = 0;
  MPI_Initialized(&initialized);
  if (initialized) {
    // comment aligned to block it describes
    int size;
```

```
    MPI_Comm_size(MPI_COMM_WORLD, &size);
    if (size>1)
      MPI_Abort(MPI_COMM_WORLD, code);
    else
      exit(code);
  }
  else
    exit(code);
}
```

Also, the continuation of a long command is indented 2 spaces, e.g.:

```
  const String& iterator_scheduling
    = problem_db.get_string("strategy.iterator_scheduling");
```

and similar lines are aligned for readability, e.g.:

```
  cout << "Numerical gradients using " << finiteDiffStepSize*100. << "%"
       << finiteDiffType << " differences\nto be calculated by the "
       << methodSource << " finite difference routine." << endl;
```

Lastly, #ifdef's are not indented (to make use of syntax highlighting in xemacs).

Chapter 5

File Naming Conventions

In addition to the style outlined above, the following file naming conventions have been established for the DAKOTA project.

File names for C++ classes should, in general, use the same name as the class defined by the file. Exceptions include:

- with the introduction of the Dakota namespace, base classes which previously utilized prepended Dakota identifiers can now safely omit the identifiers. However, since file names do not have namespace protection from name collisions, they retain the prepended Dakota identifier. For example, a class previously named DakotaModel which resided in DakotaModel.[CH], is now Dakota::Model (class Model in namespace Dakota) residing in the same filenames. The retention of the previous filenames reduces the possibility of multiple instances of a Model.H causing problems. Derived classes (e.g., NestedModel) do not require a prepended Dakota identifier for either the class or file names.
- in a few cases, it is convenient to maintain several closely related classes in a single file, in which case the file name may reflect the top level class or some generalization of the set of classes (e.g., DakotaResponse.[CH] files contain Dakota::Response and Dakota::ResponseRep classes, and DakotaBinStream.[CH] files contain the Dakota::BiStream and Dakota::BoStream classes).

The type of file is determined by one of the four file name extensions listed below:

- **.H** A class header file ends in the suffix .H. The header file provides the class declaration. This file does not contain code for implementing the methods, except for the case of inline functions. Inline functions are to be placed at the bottom of the file with the keyword inline preceding the function name.
- **.C** A class implementation file ends in the suffix .C. An implementation file contains the definitions of the members of the class.
- **.h** A header file ends in the suffix .h. The header file contains information usually associated with procedures. Defined constants, data structures and function prototypes are typical elements of this file.
- **.c** A procedure file ends in the suffix .c. The procedure file contains the actual procedures.

Chapter 6

Class Documentation Conventions

Class documentation uses the doxygen tool available from http://www.doxygen.org and employs the JAVA-doc comment style. Brief comments appear in header files next to the attribute or function declaration. Detailed descriptions for functions should appear alongside their implementations (i.e., in the .C files for non-inlined, or in the headers next to the function definition for inlined). Detailed comments for a class or a class attribute must go in the header file as this is the only option.

NOTE: Previous class documentation utilities (class2frame and class2html) used the "//-" comment style and comment blocks such as this:

```
//- Class:       Model
//- Description: The model to be iterated by the Iterator.
//-              Contains Variables, Interface, and Response objects.
//- Owner:       Mike Eldred
//- Version: $Id: Dev_Recomm_Pract.dox 4549 2007-09-20 18:25:03Z mseldre $
```

These tools are no longer used, so remaining comment blocks of this type are informational only and will not appear in the documentation generated by doxygen.

Chapter 7

CMake Style Guidelines

DAKOTA conventions for CMake files, such as CMakeLists.txt, FooConfig.cmake, etc., follow. Our goal is ease of reading, maintenance, and support, similar to the C++ code itself. Current CMake versions and build hints are maintained at the Developer Portal http://dakota.sandia.gov/developer/.

7.1 CMake Code Formatting

- Indentation is 2 spaces, consistent with DAKOTA C++ style.
- Lines should be kept to less than 80 chars per line where possible.
- Wrapped lines may be indented two spaces or aligned with prior lines.
- For ease of viewing and correctness checking in Emacs, a customization file is available: http://www.cmake.org/CMakeDocs/cmake-mode.el

7.2 CMake Variable Naming Conventions

These variable naming conventions are especially important for those that ultimately become preprocessor defines and affect compilation of source files.

- Classic/core elements of the CMake language are set in lower_case, e.g., option, set, if, find_library.
- Static arguments to CMake functions and macros are set in UPPER_CASE, e.g. REQUIRED, NO_-MODULE, QUIET.
- Minimize "global" variables, i.e., don't use 2 variables with the same meaning when one will do the job.
- Feature toggling: when possible, use the "HAVE_<pkg/feature>" convention already in use by many CMake-enabled TPLs, e.g.,

```
$ grep HAVE_SYSTEM Dakota/src/CMakeLists.txt

check_function_exists(system HAVE_SYSTEM)
```

```
if(HAVE_SYSTEM)
  add_definitions("-DHAVE_SYSTEM")
endif(HAVE_SYSTEM)

$ grep HAVE_CONMIN Dakota/src/CMakeLists.txt Dakota/packages/CMakeLists.txt
Dakota/src/CMakeLists.txt:if(HAVE_CONMIN)
Dakota/src/CMakeLists.txt:endif(HAVE_CONMIN)
Dakota/packages/CMakeLists.txt:option(HAVE_CONMIN "Build the CONMIN package." ON)

Dakota/packages/CMakeLists.txt:if(HAVE_CONMIN)
Dakota/packages/CMakeLists.txt:endif(HAVE_CONMIN)
```

- When a variable/preprocessor macro could result in name clashes beyond DAKOTA scope, e.g., for library_mode users, consider prefixing the "HAVE_<pkg>" name with DAKOTA_, e.g. DAKOTA_-HAVE_MPI. Currently, MPI is the only use case for such a variable in DAKOTA, but many examples can be found in the CMake Modules source, e.g.

```
grep _HAVE_ <cmake_prefix_dir>/share/cmake-2.8/Modules/*
```

Chapter 8

Instructions for Modifying DAKOTA's Input Specification

To modify DAKOTA's input specification (for maintenance or addition of new input syntax), specification maintenance mode must be enabled at DAKOTA configure time with the `--enable-spec-maint` option, e.g.,

```
./configure --enable-spec-maint
```

This will enable regeneration of NIDR and DAKOTA components which must be updated following a spec change.

Chapter 9

Modify dakota.input.nspec

The master input specification dakota.input.nspec in Dakota/src is the primary file to update when making a specification change. It uses the following syntactic elements:

- () for required group specifications
- [] for optional specifications
- | for alternatives
- {} for functions to process keywords to express logical relationships. These syntactic elements can be used to express various dependency relationships in the input specification. It is recommended that you review the existing specification and have an understanding of the constructs in use before attempting to add new ones.

Warning:

- Do *not* skip this step. Attempts to modify the NIDR_keywds.H file in Dakota/src without using the NIDR table generator are very error-prone. Moreover, the input specification provides a reference to the allowable inputs of a particular executable and should be kept in synch with the parser files; modifying the parser files independent of the input specification creates, at a minimum, undocumented features.
- All keywords in dakota.input.nspec are lower case by convention. All user inputs are converted to lower case by the parser prior to keyword match testing, resulting in case insensitive parsing.
- Since the NIDR parser allows abbreviation of keywords, you *must* avoid adding a keyword that could be misinterpreted as an abbreviation for a different keyword within the same top-level keyword, such as "strategy" and "method". For example, adding the keyword "expansion" within the method specification would be a mistake if the keyword "expansion_factor" already was being used in this specification.
- The NIDR input is somewhat order-dependent, allowing the same keyword to be reused multiple times in the specification. This often happens with aliases, such as `lower_bounds`, `upper_bounds` and `initial_point`. Ambiguities are resolved by attaching a keyword to the most recently seen context in which it could appear, if such exists, or to the first relevant context that subsequently comes along in the input file. With the earlier IDR parser, non-exclusive specifications (those not in mutually exclusive blocks) were required to be unique. That is why there are such aliases for `initial_point` as `cdv_initial_point` and `ddv_initial_point`: so older input files can be used with no or fewer changes.

Chapter 10

Rebuild generated files

As of DAKOTA 5.1, a separate make command in `packages/nidr` is no longer necessary. When configured with `--enable-spec-maint`, performing a make in Dakota/src will regenerate all files which derive from dakota.input.nspec, including NIDR_keywds.H, **dakota.input.summary**, NIDR_guikywds.H, and dakota.input.desc. If you commit changes to a source repository, be sure to commit any automatically generated files in addition to any modified in the following steps. It is not strictly necessary to run make at this point in the sequence, and in fact may generate errors if necessary handlers aren't yet available. One may optionally

```
cd Dakota/src
make nidr-files
```

to only rebuild generated dependencies of dakota.input.nspec.

Chapter 11

Update NIDRProblemDescDB.C in Dakota/src

Many keywords have data associated with them: an integer, a floating-point number, a string, or arrays of such entities. Data requirements are specified in dakota.input.nspec by the tokens INTEGER, REAL, STRING, INTEGERLIST, REALLIST, STRINGLIST. (Some keywords have no associated data and hence no such token.) After each keyword and data token, the dakota.input.nspec file specifies functions that the NIDR parser should call to record the appearance of the keyword and deal with any associated data. The general form of this specification is

{ startfcn, startdata, stopfcn, stopdata }

i.e., a brace-enclosed list of one to four functions and data pointers, with trailing entities taken to be zero if not present; zero for a function means no function will be called. The startfcn must deal with any associated data. Otherwise, the distinction between startfcn and stopfcn is relevant only to keywords that begin a group of keywords (enclosed in parentheses or square brackets). The startfcn is called before other entities in the group are processed, and the stop function is called after they are processed. Top-level keywords often have both startfcn and stopfcn; stopfcn is uncommon but possible for lower-level keywords. The startdata and (if needed) stopdata values are usually pointers to little structures that provide keyword-specific details to generic functions for startfcn and stopfcn. Some keywords that begin groups (such as "approx_problem" within the top-level "strategy" keyword) have no need of either a startfcn or a stopfcn; this is indicated by "`{0}`".

Most of the things within braces in dakota.input.nspec are invocations of macros defined in NIDRProblemDescDB.C. The macros simplify writing dakota.input.nspec and make it more readable. Most macro invocations refer to little structures defined in NIDRProblemDescDB.C, usually with the help of other macros, some of which have different definitions in different parts of NIDRProblemDescDB.C. When adding a keyword to dakota.input.nspec, you may need to add a structure definition or even introduce a new data type. NIDRProblemDescDB.C has sections corresponding to each top-level keyword. The top-level keywords are in alphabetical order, and most entities in the section for a top-level keyword are also in alphabetical order. While not required, it is probably good practice to maintain this structure, as it makes things easier to find.

Any integer, real, or string data associated with a keyword are provided to the keyword's startfcn, whose second argument is a pointer to a `Values` structure, defined in header file `nidr.h`.

Example 1: if you added the specification:

```
[method_setting REAL {method_setting_start, &method_setting_details} ]
```

you would provide a function

```
    void NIDRProblemDescDB::
method_setting_start(const char *keyname, Values *val, void **g, void *v)
{ ... }
```

in NIDRProblemDescDB.C. In this example, argument `&method_setting_details` would be passed as `v`, `val->n` (the number of values) would be 1 and `*val->r` would be the REAL value given for the `method_setting` keyword. The `method_setting_start` function would suitably store this value with the help of `method_setting_details`.

For some top-level keywords, `g` (the third argument to the startfcn and stopfcn) provides access to a relevant context. For example, `method_start` (the startfcn for the top-level `method` keyword) executes

```
DataMethod *dm = new DataMethod;
*g = (void*)dm;
```

(and supplies a couple of default values to `dm`). The start functions for lower-level keywords within the `method` keyword get access to `dm` through their `g` arguments. Here is an example:

```
 void NIDRProblemDescDB::
method_str(const char *keyname, Values *val, void **g, void *v)
{
        (*(DataMethod**)g)->**(String DataMethod::**)v = *val->s;
        }
```

In this example, `v` points to a pointer-to-member, and an assignment is made to one of the components of the DataMethod object pointed to by `*g`. The corresponding stopfcn for the top-level `method` keyword is

```
 void NIDRProblemDescDB::
method_stop(const char *keyname, Values *val, void **g, void *v)
{
        DataMethod *p = *(DataMethod**)g;
        pDDBInstance->dataMethodList.insert(*p);
        delete p;
        }
```

which copies the now populated DataMethod object to the right place and cleans up.

Example 2: if you added the specification

```
[method_setting REALLIST {{N_mdm(RealL,methodCoeffs)}
```

then method_RealL (defined in NIDRProblemDescDB.C) would be called as the startfcn, and methodCoeffs would be the name of a (currently nonexistent) component of DataMethod. The N_mdm macro is defined in NIDRProblemDescDB.C; among other things, it turns `RealL` into `NIDRProblemDescDB::method_RealL`. This function is used to process lists of REAL values for several keywords. By looking at the source, you can see that the list values are val->r[i] for 0 <= `i` < val->n.

Chapter 12

Update ProblemDescDB.C in Dakota/src

12.1 Augment/update get_<data_type>() functions

The next update step involves extending the database retrieval functions in ProblemDescDB.C. These retrieval functions accept an identifier string and return a database attribute of a particular type, e.g., a RealVector:

```
const RealVector& get_rdv(const String& entry_name);
```

The implementation of each of these functions contains tables of possible entry_name values and associated pointer-to-member values. There is one table for each relevant top-level keyword, with the top-level keyword omitted from the names in the table. Since binary search is used to look for names in these tables, each table must be kept in alphabetical order of its entry names. For example,

```
...
else if ((L = Begins(entry_name, "model."))) {
  if (dbRep->methodDBLocked)
      Locked_db();

  #define P &DataModelRep::
  static KW<RealVector, DataModelRep> RVdmo[] = {     // must be sorted
      {"nested.primary_response_mapping", P primaryRespCoeffs},
      {"nested.secondary_response_mapping", P secondaryRespCoeffs},
      {"surrogate.kriging_conmin_seed", P krigingConminSeed},
      {"surrogate.kriging_correlations", P krigingCorrelations},
      {"surrogate.kriging_max_correlations", P krigingMaxCorrelations},
      {"surrogate.kriging_min_correlations", P krigingMinCorrelations}};
  #undef P

  KW<RealVector, DataModelRep> *kw;
  if ((kw = (KW<RealVector, DataModelRep>*)Binsearch(RVdmo, L)))
      return dbRep->dataModelIter->dataModelRep->*kw->p;
}
```

is the "model" portion of ProblemDescDB::get_rdv(). Based on entry_name, it returns the relevant attribute from a DataModel object. Since there may be multiple model specifications, the `dataModelIter` list iterator identifies which node in the list of DataModel objects is used. In particular, `dataModelList` contains a list of all of the `data_model` objects, one for each time a top-level `model` keyword was seen by the parser. The particular model object used for the data retrieval is managed by `dataModelIter`, which is set in a `set_db_list_nodes()` operation that will not be described here.

There may be multiple DataMethod, DataModel, DataVariables, DataInterface, and/or DataResponses objects. However, only one strategy specification is currently allowed so a list of DataStrategy objects is not needed. Rather, ProblemDescDB::strategySpec is the lone DataStrategy object.

To augment the get_<data_type>() functions, add table entries with new identifier strings and pointer-to-member values that address the appropriate data attributes from the Data class object. The style for the identifier strings is a top-down hierarchical description, with specification levels separated by periods and words separated with underscores, e.g., `"keyword.group_specification.individual_specification"`. Use the `dbRep->listIter->attribute` syntax for variables, interface, responses, and method specifications. For example, the `method_setting` example attribute would be added to `get_drv()` as:

```
{"method_name.method_setting", P methodSetting},
```

inserted at the beginning of the `RVdmo` array shown above (since the name in the existing first entry, i.e., "nested.primary_response_mapping", comes alphabetically after "method_name.method_setting").

Chapter 13

Update Corresponding Data Classes

In this step, we extend the Data class definitions (DataStrategy, DataMethod, DataModel, DataVariables, DataInterface, and/or DataResponses) to include the new attributes referenced in Update NIDRProblemDescDB.C in Dakota/src and Augment/update get_<data_type>() functions.

13.1 Update the Data class header file

Add a new attribute to the public data for each of the new specifications. Follow the style guide for class attribute naming conventions (or mimic the existing code).

13.2 Update the .C file

Define defaults for the new attributes in the constructor initialization list. Add the new attributes to the assign() function for use by the copy constructor and assignment operator. Add the new attributes to the write(MPIPackBuffer&), read(MPIUnpackBuffer&), and write(ostream&) functions, paying careful attention to the use of a consistent ordering.

Chapter 14

Use get_<data_type>() Functions

At this point, the new specifications have been mapped through all of the database classes. The only remaining step is to retrieve the new data within the constructors of the classes that need it. This is done by invoking the get_-<data_type>() function on the ProblemDescDB object using the identifier string you selected in Augment/update get_<data_type>() functions. For example:

```
const String& interface_type = problem_db.get_string("interface.type");
```

passes the `"interface.type"` identifier string to the ProblemDescDB::get_string() retrieval function, which returns the desired attribute from the active DataInterface object.

Warning:

> Use of the get_<data_type>() functions is restricted to class constructors, since only in class constructors are the data list iterators (i.e., `dataMethodIter`, `dataModelIter`, `dataVariablesIter`, `dataInterfaceIter`, and `dataResponsesIter`) guaranteed to be set correctly. Outside of the constructors, the database list nodes will correspond to the last set operation, and may not return data from the desired list node.

Chapter 15

Update the Documentation

Doxygen comments should be added to the Data class headers for the new attributes, and the reference manual sections describing the portions of dakota.input.nspec that have been modified should be updated. In particular, the reference manual tables summarizing keywords provide help data to the Jaguar user interface so need to be kept updated.

Chapter 16

Understanding Iterator Flow

This page explains the various phases comprising Iterator::run_iterator(). Prior to Iterator construction, when command-line options are parsed, Boolean run mode flags corresponding to PRERUN, RUN, and POSTRUN are set in ParallelLibrary. If the user didn't specify any specific run modes, the default is for all three to be true (all phases will execute).

Iterator is constructed.

When called, `run_iterator()` sequences:

- `initialize_run()`: unconditionally called, virtual. Performs common initialization such as allocating workspaces, setting communicators and evaluation counts. When re-implementing this virtual, a derived class must call its nearest parent's initialize_run(), typically *before* performing its own implementation steps.
- *Not implemented: pre-run input*
- IF PRERUN, invoke `pre_run()`: virtual function; default no-op. Purpose: derived classes should implement `pre_run()` if they are able to generate all parameter sets (variables) at once, separate from `run()`. Derived implementations should call their nearest parent's pre_run(), typically *before* performing their own steps.
- IF PRERUN, invoke `pre_output()`: non-virtual function; if user requested, output variables to file.
- *Not implemented: run input*
- IF RUN, invoke virtual function `run()`. Purpose: at a minimum, evaluate parameter sets through computing responses; for iterators without pre/post capability, their entire implementation is in `run()` and this is a reasonable default for new Iterators.
- *Not implemented: run output*
- IF POSTRUN, invoke `post_input()`: virtual function, default only print helpful message on mode. Purpose: derived iterators supporting post-run input from file must implement to read file and populate variables/responses (and possibly best points) appropriately. Implementations must check if the user requested file input.

- IF POSTRUN, invoke `post_run()`: virtual function. Purpose: generate statistics / final results. Any analysis that can be done solely on tabular data read by `post_input()` can be done here. Derived re-implementations should call their nearest parent's post-run(), typically *after* performing their specific post-run activities.
- *Not implemented: post-run output*
- `finalize_run()`: unconditionally called, virtual. Purpose: free workspaces. Default base class behavior is no-op, however, derived implementations should call their nearest parent's finalize_run *after* performing their specialized portions.

Iterator is destructed.

Chapter 17

Interfacing with DAKOTA as a Library

Chapter 18

Introduction

It is possible to link the DAKOTA toolkit into another application for use as an algorithm library. This section describes facilities which permit this type of integration.

As part of the normal DAKOTA build process, where `Dakota/configure --prefix=PREFIX` has been run prior to `make` and `make install`, a `libdakota.a` is created and a copy of it is placed in `PREFIX/lib` (PREFIX defaults to /usr/local/Dakota). This library contains all source files from `Dakota/src` excepting the main.C, restart_util.C, and library_mode.C main programs. This library may be linked with another application through inclusion of `-ldakota` on the link line. Library and header paths may also be specified using the `-L` and `-I` compiler options (using `PREFIX/lib` and `PREFIX/include`, respectively). Depending on the configuration used when building this library, other libraries for the vendor optimizers and vendor packages will also be needed to resolve DAKOTA symbols for DOT, NPSOL, OPT++, NCSUOpt, LHS, Teuchos, etc. Copies of these libraries are also placed in `Dakota/lib`. Refer to Linking against the DAKOTA library for additional information.

Warning:

> Users may interface to DAKOTA as a library within other software applications provided that they abide by the terms of the GNU Lesser General Public License (LGPL). Refer to `http://www.gnu.org/licenses/lgpl.html` or contact the DAKOTA team for additional information.

Attention:

> The use of DAKOTA as an algorithm library should be distinguished from the linking of simulations within DAKOTA using the direct application interface (see DirectApplicInterface). In the former, DAKOTA is providing algorithm services to another software application, and in the latter, a linked simulation is providing analysis services to DAKOTA. It is not uncommon for these two capabilities to be used in combination, where a simulation framework provides both the "front end" and the "back end" for DAKOTA.

Chapter 19

Quick start: examples and test code

To learn by example, refer to the files PluginSerialDirectApplicInterface.[CH] and PluginParallelDirectApplicInterface.[CH] in Dakota/src for simple examples of serial and parallel plug-in interfaces. The file library_mode.C in Dakota/src provides example usage of these plug-ins within a mock simulator program that demonstrates the required object instantiation syntax in combination with the three problem database population approaches (input file parsing, data node insertion, and mixed mode). All of this code may be compiled and tested by configuring DAKOTA using the `--with-plugin` option.

Chapter 20

Comparison to main.C

The procedure for utilizing DAKOTA as a library within another application involves a number of steps that are similar to those used in the stand-alone DAKOTA application. The stand-alone procedure can be viewed in the file main.C, and the differences for the library approach are most easily explained with reference to that file. The basic steps of executing DAKOTA include instantiating the ParallelLibrary, CommandLineHandler, and ProblemDescDB objects; managing the DAKOTA input file (ProblemDescDB::manage_inputs()); specifying restart files and output streams (ParallelLibrary::specify_outputs_restart()); and instantiating the Strategy and running it (Strategy::run_strategy()). When using DAKOTA as an algorithm library, the operations are quite similar, although command line information (argc, argv, and therefore CommandLineHandler) will not in general be accessible. In particular, main.C can pass argc and argv into the ParallelLibrary and CommandLineHandler constructors and then pass the CommandLineHandler object into ProblemDescDB::manage_inputs() and ParallelLibrary::specify_outputs_restart(). In an algorithm library approach, a CommandLineHandler object is not instantiated and overloaded forms of the ParallelLibrary constructor, ProblemDescDB::manage_inputs(), and ParallelLibrary::specify_outputs_restart() are used.

The overloaded forms of these functions are as follows. For instantiation of the ParallelLibrary object, the default constructor may be used. This constructor assumes that MPI is administered by the parent application such that the MPI configuration will be detected rather than explicitly created (i.e., DAKOTA will not call MPI_Init or MPI_Finalize). In code, the instantiation

```
ParallelLibrary parallel_lib(argc, argv);
```

is replaced with

```
ParallelLibrary parallel_lib;
```

In the case of specifying restart files and output streams, the call to

```
parallel_lib.specify_outputs_restart(cmd_line_handler);
```

should be replaced with its overloaded form in order to pass the required information through the parameter list

```
parallel_lib.specify_outputs_restart(std_output_filename, std_error_filename,
  read_restart_filename, write_restart_filename, stop_restart_evals);
```

where file names for standard output and error and restart read and write as well as the integer number of restart evaluations are passed through the parameter list rather than read from the command line of the main DAKOTA

program. The definition of these attributes is performed elsewhere in the parent application (e.g., specified in the parent application input file or GUI). In this function call, specify `NULL` for any files not in use, which will elicit the desired subset of the following defaults: standard output and standard error are directed to the terminal, no restart input, and restart output to file `dakota.rst`. The `stop_restart_evals` specification is an optional parameter with a default of 0, which indicates that restart processing should process all records. If no overrides of these defaults are intended, the call to `specify_outputs_restart()` may be omitted entirely.

With respect to alternate forms of ProblemDescDB::manage_inputs(), the following section describes different approaches to populating data within DAKOTA's problem description database. It is this database from which all DAKOTA objects draw data upon instantiation.

Chapter 21

Problem database population

Now that the ProblemDescDB object has been instantiated, we must populate it with data, either via parsing an input file, direct data insertion, or a mixed approach, as described in the following sections.

21.1 Input file parsing

The simplest approach to linking an application with the DAKOTA library is to rely on DAKOTA's normal parsing system to populate DAKOTA's problem database (ProblemDescDB) through the reading of an input file. The disadvantage to this approach is the requirement for an additional input file beyond those already required by the parent application.

In this approach, the main.C call to

```
problem_db.manage_inputs(cmd_line_handler);
```

would be replaced with its overloaded form

```
problem_db.manage_inputs(dakota_input_file);
```

where the file name for the DAKOTA input is passed through the parameter list rather than read from the command line of the main DAKOTA program. Again, the definition of the DAKOTA input file name is performed elsewhere in the parent application (e.g., specified in the parent application input file or GUI). Refer to run_dakota_parse() in library_mode.C for a complete example listing.

ProblemDescDB::manage_inputs() invokes ProblemDescDB::parse_inputs() (which in turn invokes ProblemDescDB::check_input()), ProblemDescDB::broadcast(), and ProblemDescDB::post_process(), which are lower level functions that will be important in the following two sections. Thus, the input file parsing approach may employ a single coarse grain function to coordinate all aspects of problem database population, whereas the two approaches to follow will use lower level functions to accomplish a finer grain of control.

21.2 Data node insertion

This approach is more involved than the previous approach, but it allows the application to publish all needed data to DAKOTA's database directly, thereby eliminating the need for the parsing of a separate DAKOTA input file.

In this case, ProblemDescDB::manage_inputs() is not called. Rather, DataStrategy, DataMethod, DataModel, DataVariables, DataInterface, and DataResponses objects are instantiated and populated with the desired problem data. These objects are then published to the problem database using ProblemDescDB::insert_node(), e.g.:

```
// instantiate the data object
DataMethod data_method;

// set the attributes within the data object
data_method.methodName = "nond_sampling";
...

// publish the data object to the ProblemDescDB
problem_db.insert_node(data_method);
```

The data objects are populated with their default values upon instantiation, so only the non-default values need to be specified. Refer to the DataStrategy, DataMethod, DataModel, DataVariables, DataInterface, and DataResponses class documentation and source code for lists of attributes and their defaults.

The default strategy is `single_method`, which runs a single iterator on a single model, and the default model is `single`, so it is not necessary to instantiate and publish a DataStrategy or DataModel object if advanced multi-component capabilities are not required. Rather, instantiation and insertion of a single DataMethod, DataVariables, DataInterface, and DataResponses object is sufficient for basic DAKOTA capabilities.

Once the data objects have been published to the ProblemDescDB object, calls to

```
problem_db.check_input();
problem_db.broadcast();
problem_db.post_process();
```

will perform basic database error checking, broadcast a packed MPI buffer of the specification data to other processors, and post-process specification data to fill in vector defaults (scalar defaults are handled in the Data class constructors), respectively. For parallel applications, processor rank 0 should be responsible for Data node population and insertion and the call to ProblemDescDB::check_input(), and all processors should participate in ProblemDescDB::broadcast() and ProblemDescDB::post_process(). Moreover, preserving the order shown assures that large default vectors are not transmitted by MPI. Refer to run_dakota_data() in library_mode.C for a complete example listing.

21.3 Mixed mode

In this case, we will combine the parsing of a DAKOTA input file with some direct database updates. The motivation for this approach arises in large-scale applications where large vectors can be awkward to specify in a DAKOTA input file. The first step is to parse the input file, but rather than using

```
problem_db.manage_inputs(dakota_input_file);
```

as described in Input file parsing, we will use the lower level function

```
problem_db.parse_inputs(dakota_input_file);
```

to provide a finer grain of control. The passed input file `dakota_input_file` must contain all required inputs. Since vector data like variable values/bounds/tags, linear/nonlinear constraint coefficients/bounds, etc. are optional, these potentially large vector specifications can be omitted from the input file. Only the variable/response counts, e.g.:

```
method
        linear_inequality_constraints = 500

variables
        continuous_design = 1000

responses
        objective_functions = 1
        nonlinear_inequality_constraints = 100000
```

are required in this case. To update the data omissions from their defaults, one uses the ProblemDescDB::set() family of overloaded functions, e.g.

```
Dakota::RealVector drv(1000, 1.); // vector of length 1000, values initialized
    to 1.
problem_db.set("variables.continuous_design.initial_point", drv);
```

where the string identifiers are the same identifiers used when pulling information from the database using one of the get_<datatype>() functions (refer to the source code of ProblemDescDB.C for a full list). However, the supported ProblemDescDB::set() options are a restricted subset of the database attributes, focused on vector inputs that can be large scale.

If performing these updates within the constructor of a DirectApplicInterface extension/derivation (see Defining the direct application interface), then this code is sufficient since the database is unlocked, the active list nodes of the ProblemDescDB have been set for you, and the correct strategy/method/model/variables/interface/responses specification instance will get updated. The difficulty in this case stems from the order of instantiation. Since the Variables and Response instances are constructed in the base Model class, prior to construction of Interface instances in derived Model classes, database information related to Variables and Response objects will have already been extracted by the time the Interface constructor is invoked and the database update will not propagate.

Therefore, it is preferred to perform these operations at a higher level (e.g., within your main program), prior to Strategy instantiation and execution, such that instantiation order is not an issue. However, in this case, it is necessary to explicitly manage the list nodes of the ProblemDescDB using a specification instance identifier that corresponds to an identifier from the input file, e.g.:

```
problem_db.set_db_variables_node("MY_VARIABLES_ID");
Dakota::RealVector drv(1000, 1.); // vector of length 1000, values initialized
    to 1.
problem_db.set("variables.continuous_design.initial_point", drv);
```

Alternatively, rather than setting just a single data node, all data nodes may be set using a method specification identifier:

```
problem_db.set_db_list_nodes("MY_METHOD_ID");
```

since the method specification is responsible for identifying a model specification, which in turn identifies variables, interface, and responses specifications. If hardwiring specification identifiers is undesirable, then

```
problem_db.resolve_top_method();
```

can also be used to deduce the active method specification and set all list nodes based on it. This is most appropriate in the case where only single specifications exist for method/model/variables/interface/responses. In each of these cases, setting list nodes unlocks the corresponding portions of the database, allowing set/get operations.

Once all direct database updates have been performed in this manner, calls to ProblemDescDB::broadcast() and ProblemDescDB::post_process() should be used on all processors. The former will broadcast a packed MPI

buffer with the aggregated set of specification data from rank 0 to other processors, and the latter will post-process specification data to fill in any vector defaults that have not yet been provided through either file parsing or direct updates (Note: scalar defaults are handled in the Data class constructors). Refer to run_dakota_mixed() in library_mode.C for a complete example listing.

Chapter 22

Instantiating the strategy

With the ProblemDescDB object populated with problem data, we may now instantiate the strategy.

```
// instantiate the strategy
Strategy selected_strategy(problem_db);
```

Following strategy construction, all MPI communicator partitioning has been performed and the ParallelLibrary instance may be interrogated for parallel configuration data. For example, the lowest level communicators in DAKOTA's multilevel parallel partitioning are the analysis communicators, which can be retrieved using:

```
// retrieve the set of analysis communicators for simulation initialization:
// one analysis comm per ParallelConfiguration (PC), one PC per Model.
Array<MPI_Comm> analysis_comms = parallel_lib.analysis_intra_communicators();
```

These communicators can then be used for initializing parallel simulation instances, where the number of MPI communicators in the array corresponds to one communicator per ParallelConfiguration instance.

Chapter 23

Defining the direct application interface

When employing a library interface to DAKOTA, it is frequently desirable to also use a direct interface between DAKOTA and the simulation. There are two approaches to defining this direct interface.

23.1 Extension

The first approach involves extending the existing DirectApplicInterface class to support additional direct simulation interfaces. In this case, a new simulation interface function can be added to Dakota/src/DirectApplicInterface.[CH] for the simulation of interest. If the new function will not be a member function, then the following prototype should be used in order to pass the required data:

```
int sim(const Dakota::Variables& vars, const Dakota::ActiveSet& set,
        Dakota::Response& response);
```

If the new function will be a member function, then this can be simplified to

```
int sim();
```

since the data access can be performed through the DirectApplicInterface class attributes.

This simulation can then be added to the logic blocks in DirectApplicInterface::derived_map_ac(). In addition, DirectApplicInterface::derived_map_if() and DirectApplicInterface::derived_map_of() can be extended to perform pre- and post-processing tasks if desired, but this is not required.

While this approach is the simplest, it has the disadvantage that the DAKOTA library may need to be recompiled when the simulation or its direct interface is modified. If it is desirable to maintain the independence of the DAKOTA library from the host application, then the following derivation approach should be employed.

23.2 Derivation

The second approach is to derive a new interface from DirectApplicInterface in order to redefine several virtual functions. A typical derived class declaration might be

```
namespace SIM {
```

```
class SerialDirectApplicInterface: public Dakota::DirectApplicInterface
{
public:

  // Constructor and destructor

  SerialDirectApplicInterface(const Dakota::ProblemDescDB& problem_db);
  ~SerialDirectApplicInterface();

protected:

  // Virtual function redefinitions

  int derived_map_if(const Dakota::String& if_name);
  int derived_map_ac(const Dakota::String& ac_name);
  int derived_map_of(const Dakota::String& of_name);

private:

  // Data
}

} // namespace SIM
```

where the new derived class resides in the simulation's namespace. Similar to the case of Extension, the DirectApplicInterface::derived_map_ac() function is the required redefinition, and DirectApplicInterface::derived_map_if() and DirectApplicInterface::derived_map_of() are optional.

The new derived interface object (from namespace SIM) must now be plugged into the strategy. In the simplest case of a single model and interface, one could use

```
  // retrieve the interface of interest
  ModelList& all_models  = problem_db.model_list();
  Model&     first_model = *all_models.begin();
  Interface& interface   = first_model.interface();
  // plug in the new direct interface instance (DB does not need to be set)
  interface.assign_rep(new SIM::SerialDirectApplicInterface(problem_db), false);
```

from within the Dakota namespace. In a more advanced case of multiple models and multiple interface plug-ins, one might use

```
  // retrieve the list of Models from the Strategy
  ModelList& models = problem_db.model_list();
  // iterate over the Model list
  for (ModelLIter ml_iter = models.begin(); ml_iter != models.end(); ml_iter++) {

    Interface& interface = ml_iter->interface();
    if (interface.interface_type() == "direct" &&
        interface.analysis_drivers().contains("SIM") ) {
      // set the correct list nodes within the DB prior to new instantiations
      problem_db.set_db_model_nodes(ml_iter->model_id());
      // plug in the new direct interface instance
      interface.assign_rep(new SIM::SerialDirectApplicInterface(problem_db), fals
      e);
    }
  }
```

In the case where the simulation interface instance should manage parallel simulations within the context of an MPI communicator, one should pass in the relevant analysis communicator(s) to the derived constructor. For the

latter case of looping over a set of models, the simplest approach of passing a single analysis communicator would use code similar to

```
const ParallelLevel& ea_level =
  ml_iter->parallel_configuration_iterator()->ea_parallel_level();
const MPI_Comm& analysis_comm = ea_level.server_intra_communicator();
interface.assign_rep(new SIM::ParallelDirectApplicInterface(problem_db, analysi
    s_comm),
                     false);
```

Since Models may be used in multiple parallel contexts and may therefore have a set of parallel configurations, a more general approach would extract and pass an array of analysis communicators to allow initialization for each of the parallel configurations.

New derived direct interface instances inherit various attributes of use in configuring the simulation. In particular, the ApplicationInterface::parallelLib reference provides access to MPI communicator data (e.g., the analysis communicators discussed in Instantiating the strategy), DirectApplicInterface::analysisDrivers provides the analysis driver names specified by the user in the input file, and DirectApplicInterface::analysisComponents provides additional analysis component identifiers (such as mesh file names) provided by the user which can be used to distinguish different instances of the same simulation interface. It is worth noting that inherited attributes that are set as part of the parallel configuration (instead of being extracted from the ProblemDescDB) will be set to their defaults following construction of the base class instance for the derived class plug-in. It is not until run-time (i.e., within derived_map_if/derived_map_ac/derived_map_of) that the parallel configuration settings are re-propagated to the plug-in instance. This is the reason that the analysis communicator should be passed in to the constructor of a parallel plug-in, if the constructor will be responsible for parallel application initialization.

Chapter 24

Additional updates

As part of strategy instantiation, all problem specification data is extracted from ProblemDescDB as various objects are constructed. Therefore, any updates that need to be performed following strategy instantiation must be performed through direct set operations on the constructed objects. In the previous section, the process for updating the Interface object used within a Model was shown. To update other data such as variable values/bounds/tags or response bounds/targets/tags, refer to the set functions documented in Iterator and Model. As an example, the following code updates the active continuous variable values, which will be employed as the initial guess for certain classes of Iterators:

```
ModelList& all_models  = problem_db.model_list();
Model&     first_model = *all_models.begin();
Dakota::RealVector drv(1000, 1.); // vector of length 1000, values initialized
    to 1.
first_model.continuous_variables(drv);
```

Chapter 25

Executing the strategy

Finally, with simulation configuration and plug-ins completed, we execute the strategy:

```
// run the strategy
selected_strategy.run_strategy();
```

Chapter 26

Retrieving data after a run

After executing the strategy, final results can be obtained through the use of Strategy::variables_results() and Strategy::response_results(), e.g.:

```
// retrieve the final parameter values
const Variables& vars = selected_strategy.variables_results();

// retrieve the final response values
const Response& resp  = selected_strategy.response_results();
```

In the case of optimization, the final design is returned, and in the case of uncertainty quantification, the final statistics are returned.

Chapter 27

Linking against the DAKOTA library

This section presumes DAKOTA has been compiled with configure/make and installed to `PREFIX` using 'make install'. While the DAKOTA build system offers the most up-to-date guidance for what libraries are needed to link against a particular version of DAKOTA, a typical case is presented here. Note that depending on how you configured DAKOTA, some of the following libraries may not be available (for example NPSOL, DOT, NLPQL) -- check which appear in `$PREFIX/lib`.

As of DAKOTA 5.0, `-levidence` is no longer required and `-lgsl` is optional (discouraged due to GPL), depending on how DAKOTA was configured.

Post DAKOTA 5.0, `-lquadrature` has been renamed to `-lsparsegrid`. Also the DFFTPACK library should be integrated into libpecos, so `-ldfftpack` should not be needed and NKM should be integrated into libsurfpack, so `-lnkm` should not be needed.

Note that as of DAKOTA 5.2, `-lnewmat` is no longer required but additional Boost libraries are needed (`-lboost_regex -lboost_filesystem -lboost_system`) as a result of migration from legacy DAKOTA utilities to more modern Boost components. It should also be noted that DAKOTA relies on VERSION 2 of Boost.Filesystem which is provided in the source distribution under packages/boost (Boost.Filesystem VERSION 3 is NOT supported at this time).

```
DAKOTA_LIBS = -L${PREFIX}/lib -ldakota -lteuchos -lpecos -llhs         \
              -lsparsegrid -lsurfpack -lconmin -lddace -ldot -lfsudace \
              -ljega -lcport -lnlpql -lnpsol -loptpp -lpsuade          \
              -lncsuopt -lcolin -linterfaces -lmomh -lscolib -lpebbl   \
              -ltinyxml -lutilib -l3po -lhopspack -lnidr -lamplsolver  \
              -lboost_signals -lboost_regex -lboost_filesystem         \
              -lboost_system -llapack -lblas
```

You may also need `funcadd0.o`, `-lfl`, `-lexpat`, and, if linking with system-provided GSL, `-lgslcblas`. The AMPL solver library may require `-ldl`. System compiler and math libraries may also need to be included. If configuring with graphics, you will need to add `-lDGraphics` and system X libraries (partial list here):

```
-lXpm -lXm -lXt -lXmu -lXp -lXext -lX11 -lSM -lICE
```

CMake support for library users is experimental. At present library names and inclusion requirements differ slightly when using CMake, e.g, libpecos_src and libdakota_src instead of libpecos and libdakota, respectively. A representative (non-authoritative) set of necessary link libraries is shown here for illustration purposes only:

```
-ldakota_src -lteuchos -lnidr -lpecos -lpecos_src -llhs -lmods -lmod
```

```
-ldfftpack -lsparsegrid -lsurfpack -lsurfpack -lutilib -lcolin -linterfaces
-lscolib -l3po -lpebbl -ltinyxml -lconmin -ldace -lanalyzer -lrandom
-lsampling -lbose -ldot -lfsudace -lhopspack -ljega -ljega_fe -lmoga
-lsoga -leutils -lutilities -lncsuopt -lnlpql -lcport -lnpsol -loptpp
-lpsuade -lDGraphics -lamplsolver -lboost_regex -lboost_signals
-lboost_filesystem -lboost_system -lSM -lICE -lX11 -lXext -lXm -lXpm
-lXmu -lpthread -llapack -lcurl -ldl -lutilib -ltinyxml -lm -lboost_regex
-lboost_filesystem -lboost_system -lexpat -lboost_signals -ljega -lteuchos
-lblas -llapack
```

We have experienced problems with the creation of `libamplsolver.a` on some platforms. Please use the DAKOTA mailing lists for help with any problems.

Finally, it is important to use the same C++ compiler (possibly an MPI wrapper) for compiling DAKOTA and your application and declare the compiler define `-DHAVE_CONFIG_H` when including header files from DAKOTA. This ensures that the platform configuration settings are properly propagated.

Chapter 28

Summary

To utilize the DAKOTA library within a parent software application, the basic steps of main.C and the order of invocation of these steps should be mimicked from within the parent application. Of these steps, ParallelLibrary instantiation, ProblemDescDB::manage_inputs() and ParallelLibrary::specify_outputs_restart() require the use of overloaded forms in order to function in an environment without direct command line access and, potentially, without file parsing. Additional optional steps not performed in main.C include the extension/derivation of the direct interface and the retrieval of strategy results after a run.

DAKOTA's library mode is now in production use within several Sandia and external simulation codes/frameworks.

Chapter 29

Performing Function Evaluations

Performing function evaluations is one of the most critical functions of the DAKOTA software. It can also be one of the most complicated, as a variety of scheduling approaches and parallelism levels are supported. This complexity manifests itself in the code through a series of cascaded member functions, from the top level model evaluation functions, through various scheduling routines, to the low level details of performing a system call, fork, or direct function invocation. This section provides an overview of the primary classes and member functions involved.

Chapter 30

Synchronous function evaluations

For a synchronous (i.e., blocking) mapping of parameters to responses, an iterator invokes Model::compute_-response() to perform a function evaluation. This function is all that is seen from the iterator level, as underlying complexities are isolated. The binding of this top level function with lower level functions is as follows:

- Model::compute_response() utilizes Model::derived_compute_response() for portions of the response computation specific to derived model classes.
- Model::derived_compute_response() directly or indirectly invokes Interface::map().
- Interface::map() utilizes ApplicationInterface::derived_map() for portions of the mapping specific to derived application interface classes.

Chapter 31

Asynchronous function evaluations

For an asynchronous (i.e., nonblocking) mapping of parameters to responses, an iterator invokes Model::asynch_compute_response() multiple times to queue asynchronous jobs and then invokes either Model::synchronize() or Model::synchronize_nowait() to schedule the queued jobs in blocking or nonblocking fashion. Again, these functions are all that is seen from the iterator level, as underlying complexities are isolated. The binding of these top level functions with lower level functions is as follows:

- Model::asynch_compute_response() utilizes Model::derived_asynch_compute_response() for portions of the response computation specific to derived model classes.
- This derived model class function directly or indirectly invokes Interface::map() in asynchronous mode, which adds the job to a scheduling queue.
- Model::synchronize() or Model::synchronize_nowait() utilize Model::derived_synchronize() or Model::derived_synchronize_nowait() for portions of the scheduling process specific to derived model classes.
- These derived model class functions directly or indirectly invoke Interface::synch() or Interface::synch_nowait().
- For application interfaces, these interface synchronization functions are responsible for performing evaluation scheduling in one of the following modes:
  - asynchronous local mode (using ApplicationInterface::asynchronous_local_evaluations() or ApplicationInterface::asynchronous_local_evaluations_nowait())
  - message passing mode (using ApplicationInterface::self_schedule_evaluations() or ApplicationInterface::static_schedule_evaluations() on the iterator master and ApplicationInterface::serve_evaluations_synch() or ApplicationInterface::serve_evaluations_peer() on the servers)
  - hybrid mode (using ApplicationInterface::self_schedule_evaluations() or ApplicationInterface::static_schedule_evaluations() on the iterator master and ApplicationInterface::serve_evaluations_asynch() on the servers)
- These scheduling functions utilize ApplicationInterface::derived_map() and ApplicationInterface::derived_map_asynch() for portions of asynchronous job launching specific to derived application interface classes, as well as ApplicationInterface::derived_synch() and

ApplicationInterface::derived_synch_nowait() for portions of job capturing specific to derived application interface classes.

Chapter 32

Analyses within each function evaluation

The discussion above covers the parallelism level of concurrent function evaluations serving an iterator. For the parallelism level of concurrent analyses serving a function evaluation, similar schedulers are involved (ForkApplicInterface::synchronous_local_analyses(), ForkApplicInterface::asynchronous_local_analyses(), ApplicationInterface::self_schedule_analyses(), ApplicationInterface::serve_analyses_synch(), ForkApplicInterface::serve_analyses_asynch()) to support synchronous local, asynchronous local, message passing, and hybrid modes. Not all of the schedulers are elevated to the ApplicationInterface level since the system call and direct function interfaces do not yet support nonblocking local analyses (and therefore support synchronous local and message passing modes, but not asynchronous local or hybrid modes). Fork interfaces, however, support all modes of analysis parallelism.

Chapter 33

Working with Variable Containers and Views

Variable views control the subset of variable types that are active and inactive within a particular iterative study. For design optimization and uncertainty quantification (UQ), for example, the active variables view consists of design or uncertain types, respectively, and any other variable types are carried along invisible to the iterative algorithm being employed. For parameter studies and design of experiments, however, a variable subset view is not imposed and all variables are active. Selected UQ methods can also be toggled into an "All" view using the `all_variables` input specification. When not in an All view, finer gradations within the uncertain variable sets are also relevant: probabilistic methods (reliability, stochastic expansion) view aleatory uncertain variables as active, nonprobabilistic methods (interval, evidence) view epistemic uncertain variables as active, and a few UQ methods (sampling) view both as active. In a more advanced NestedModel use case such as optimization under uncertainty, design variables are active in the outer optimization context and the uncertain variables are active in the inner UQ context, with an additional requirement on the inner UQ level to return derivatives with respect to its "inactive" variables (i.e., the design variables) for use in the outer optimization loop.

For efficiency, contiguous arrays of data store variable information for each of the domain types (continuous, discrete integer, and discrete real), but active and inactive views into them permit selecting subsets in a given context. This management is encapsulated into the Variables and SharedVariablesData classes. This page clarifies concepts of merged vs. mixed, fine-grained vs. aggregated types, domain types, and views into contiguous arrays.

We begin with an overview of the storage and management concept, for which the following two sections describe the storage of variable values and meta-data about their organization, used in part to manage views. They are intended to communicate rationale to maintainers of Variables and SharedVariablesData classes. The final section provides a discussion of active and inactive views.

Chapter 34

Storage in Variables

As described in the Main Page Variables, a Variables object manages variable types (design, aleatory uncertain, epistemic uncertain, and state) and domain types (continuous, discrete integer, and discrete real) and supports different approaches to either distinguishing among these types or aggregating them. Two techniques are used in cooperation to accomplish this management: (1) class specialization (MergedVariables or MixedVariables) and (2) views into contiguous variable arrays. The latter technique is used whenever it can satisfy the requirement, with fallback to class specialization when it cannot. In particular, aggregation or separation of variable types can be accomplished with views, but for aggregation or separation of variable domains, we must resort to class specialization in order to relax discrete domain types. In this class specialization, a MergedVariables object combines continuous and discrete types (relaxing integers to reals) whereas a MixedVariables object maintains the integer/real distinction throughout.

The core data for a Variables instance is stored in a set of three continguous arrays, corresponding to the domain types: allContinuousVars, allDiscreteIntVars, and allDiscreteRealVars, unique to each Variables instance.

Within the core variable data arrays, data corresponding to different aggregated variable types are stored in sequence for each domain type:

- continuous: [design, aleatory uncertain, epistemic uncertain, state]
- discrete integer: [design, aleatory uncertain, (epistemic uncertain), state]
- discrete real: [design, aleatory uncertain, (epistemic uncertain), state]

Note there are currently no epistemic discrete variables. This domain type ordering (continuous, discrete integer, discrete real) and aggregated variable type ordering (design, aleatory uncertain, epistemic uncertain, state) is preserved whenever distinct types are flattened into single contiguous arrays. Note that the aleatory and epistemic uncertain variables contain sub-types for different distributions (e.g., normal, uniform, histogram, poisson), and discrete integer types include both integer ranges and integer set sub-types. All sub-types are ordered according to their order of appearance in dakota.input.nspec.

When relaxing in MixedVariables, the allContinuousVars will also aggregate the discrete types, such that they contain ALL design, then ALL uncertain, then ALL state variables, each in aggregated type order; the allDiscreteIntVars and allDiscreteRealVars arrays are empty.

Chapter 35

Storage in SharedVariablesData

Each Variables instance contains a reference-counted SharedVariablesData object that stores information on the variables configuration. This configuration data includes counts, types, IDs, and labels, which are often the same across many Variables instances. Thus, SharedVariablesData is intended to reduce the memory footprint by allowing the sharing of a single copy of redundant information among different Variables instances.

One of the purposes of this shared information is to support mappings between variable types, IDs, and indices into the storage arrays. Variable "types" refer to the fine-grained variable types a user would specify in an input file, as enumerated in DataVariables.H, e.g, CONTINUOUS_DESIGN, WEIBULL_UNCERTAIN, DISCRETE_-STATE_RANGE, etc. variablesComponents is a map from these variable types to counts of how many are present.

In contrast, the variablesCompsTotals array stores total counts of each "aggregated type" (design, aleatory uncertain, epistemic uncertain, state) which might be selected to be active in a given view. Thus this array has length 12 to track the combinations of three domain type storage arrays with four possible aggregated variable types: {continuous, discrete integer, discrete real} x {design, aleatory uncertain, epistemic uncertain, state}. For example, the first entry of this array stores the number of continuous design variables, the second the number of discrete integer design (including both discrete design range and discrete design set integer types), and the last the number of discrete real state variables.

The arrays allContinuousTypes, allDiscreteIntTypes, and allDiscreteRealTypes are sized to match the corresponding core domain type storage arrays. They track the fine-grained variable type stored in that entry of the data array (since when relaxed, the continuous array may be storing data corresponding to discrete data).

Finally allContinuousIds stores the 1-based IDs of the variables stored in the allContinuousVars array, i.e., the variable number of all the problem variables considered as a single contiguous set, in aggregate type order. For merged (relaxed) views, mergedDiscreteIds stores the 1-based IDs of the variables which have been relaxed into the continuous array.

These counts, types, and IDs are most commonly used within the Model classes for mappings between variables objects at different levels of a model recursion. See, for example, the variable mappings in the NestedModel constructor.

Chapter 36

Active and inactive views

The pair SharedVariablesDataRep::variablesView tracks the active and inactive views of the data, with values taken from the enum in DataVariables.H. The valid values include EMPTY and the combinations {merged, mixed} x {all, design, aleatory uncertain, epistemic uncertain, uncertain, state}. The ALL cases indicate aggregation of the design, aleatory uncertain, epistemic uncertain, and state types, whereas the DISTINCT cases indicate either no aggregation (design, aleatory uncertain, epistemic uncertain, state) or reduced aggregation (aleatory+epistemic uncertain). The active view is determined by the algorithm in use, managed in Variables::get_view(). Any inactive view is set based on higher level iteration within a model recursion (e.g., a NestedModel), which enables lower level iteration to return derivatives with respect to variables that are active at the higher level. In the case where there is no higher level iteration, then the inactive view will remain EMPTY. It is important to stress that "inactive" at one level corresponds to active at another, and therefore the inactive set of variables should not be interpreted as the strict complement of the active set of variables; rather, active and inactive are both subsets whose union may still be a subset of the total container (more precise terminology might involve "primary" active and "secondary" active or similar). An active complement view could potentially be supported in the future, should the need arise, although this view would require management of non-contiguous portions of the aggregated arrays.

Given these groupings (views), the active and inactive subsets of the allContinuousVars, allDiscreteIntVars, and allDiscreteRealVars arrays are always contiguous, permitting vector views of the underlying data using either Teuchos::View (for numerical vectors) or Boost.MultiArray (for book-keeping arrays) views.

When a Variables envelope is constructed, its letter is initialized to either a MergedVariables or MixedVariables object depending on the active view. The derived classes size the contiguous storage arrays to accomodate all the problem variables, and then initialize active views into them, which could involve either subsets (DISTINCT active views) or views of the full arrays (ALL active views). Inactive views, on the other hand, are initialized during construction of a model recursion (e.g., a call to Model::inactive_view() in the NestedModel constructor). Thus, active variable subsets are always available but inactive variable subsets will be EMPTY prior to them being initialized within a Model recursion.

Accessors for continuous variables include:

- continuous_variables(): returns the active view which might return all (ALL views) or a subset (DISTINCT views) such as design, uncertain, only aleatory uncertain, etc.
- inactive_continuous_variables(): returns the inactive view which which is either a subset or empty
- all_continuous_variables(): returns the full vector allContinuousVars

and this pattern is followed for active/inactive/all access to discrete_int_variables() and discrete_real_variables() as well as for labels, IDs, and types in SharedVariablesData and variable bounds in Constraints.

Chapter 37

Todo List

Chapter 38

Namespace Index

38.1 Namespace List

Here is a list of all documented namespaces with brief descriptions:

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SIM (A sample namespace for derived classes that use assign_rep() to plug facilities into DAKOTA) . . 264

Chapter 39

Class Index

39.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

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- SurfpackApproximation . . . 889
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Chapter 42

Namespace Documentation

42.1 Dakota Namespace Reference

The primary namespace for DAKOTA.

Classes

- class AnalysisCode

  Base class providing common functionality for derived classes (SysCallAnalysisCode and ForkAnalysisCode) which spawn separate processes for managing simulations.

- class ApplicationInterface

  Derived class within the interface class hierarchy for supporting interfaces to simulation codes.

- class ApproximationInterface

  Derived class within the interface class hierarchy for supporting approximations to simulation-based results.

- class APPSEvalMgr

  Evaluation manager class for APPSPACK.

- class APPSOptimizer

  Wrapper class for APPSPACK.

- class COLINApplication
- class COLINOptimizer

  Wrapper class for optimizers defined using COLIN.

- class CollaborativeHybridStrategy

  Strategy for hybrid minimization using multiple collaborating optimization and nonlinear least squares methods.

- class GetLongOpt

GetLongOpt is a general command line utility from S. Manoharan (Advanced Computer Research Institute, Lyon, France).

- class CommandLineHandler

  Utility class for managing command line inputs to DAKOTA.

- class CommandShell

  Utility class which defines convenience operators for spawning processes with system calls.

- class ConcurrentStrategy

  Strategy for multi-start iteration or pareto set optimization.

- class CONMINOptimizer

  Wrapper class for the CONMIN optimization library.

- class ActiveSet

  Container class for active set tracking information. Contains the active set request vector and the derivative variables vector.

- class Analyzer

  Base class for NonD, DACE, and ParamStudy branches of the iterator hierarchy.

- class Approximation

  Base class for the approximation class hierarchy.

- class BiStream

  The binary input stream class. Overloads the >> operator for all data types.

- class BoStream

  The binary output stream class. Overloads the << operator for all data types.

- class Constraints

  Base class for the variable constraints class hierarchy.

- class Graphics

  The Graphics class provides a single interface to 2D (motif) and 3D (PLPLOT) graphics as well as tabular cataloguing of data for post-processing with Matlab, Tecplot, etc.

- class Interface

  Base class for the interface class hierarchy.

- class Iterator

  Base class for the iterator class hierarchy.

- class LeastSq

  Base class for the nonlinear least squares branch of the iterator hierarchy.

- class Minimizer

  Base class for the optimizer and least squares branches of the iterator hierarchy.

- class Model

  Base class for the model class hierarchy.

- class NonD

  Base class for all nondetermistic iterators (the DAKOTA/UQ branch).

- class Optimizer

  Base class for the optimizer branch of the iterator hierarchy.

- class PStudyDACE

  Base class for managing common aspects of parameter studies and design of experiments methods.

- class ResponseRep

  Container class for response functions and their derivatives. ResponseRep provides the body class.

- class Response

  Container class for response functions and their derivatives. Response provides the handle class.

- class Strategy

  Base class for the strategy class hierarchy.

- class String

  Dakota::String class, used as main string class for Dakota.

- class Variables

  Base class for the variables class hierarchy.

- class Verification

  Base class for managing common aspects of verification studies.

- class DataFitSurrModel

  Derived model class within the surrogate model branch for managing data fit surrogates (global and local).

- class DataInterface

  Handle class for interface specification data.

- class DataMethodRep

  Body class for method specification data.

- class DataMethod

  Handle class for method specification data.

- class DataModelRep

Body class for model specification data.

- class DataModel

  Handle class for model specification data.

- class DataResponsesRep

  Body class for responses specification data.

- class DataResponses

  Handle class for responses specification data.

- class DataStrategyRep

  Body class for strategy specification data.

- class DataStrategy

  Handle class for strategy specification data.

- class DataVariablesRep

  Body class for variables specification data.

- class DataVariables

  Handle class for variables specification data.

- class DDACEDesignCompExp

  Wrapper class for the DDACE design of experiments library.

- class DirectApplicInterface

  Derived application interface class which spawns simulation codes and testers using direct procedure calls.

- class DiscrepancyCorrection

  Base class for discrepancy corrections.

- class DOTOptimizer

  Wrapper class for the DOT optimization library.

- class EffGlobalMinimizer

  Implementation of Efficient Global Optimization/Least Squares algorithms.

- class EmbeddedHybridStrategy

  Strategy for closely-coupled hybrid minimization, typically involving the embedding of local search methods within global search methods.

- class ForkAnalysisCode

  Derived class in the AnalysisCode class hierarchy which spawns simulations using forks.

- class ForkApplicInterface

Derived application interface class which spawns simulation codes using forks.

- class FSUDesignCompExp

  Wrapper class for the FSUDace QMC/CVT library.

- class GaussProcApproximation

  Derived approximation class for Gaussian Process implementation.

- struct BaseConstructor

  Dummy struct for overloading letter-envelope constructors.

- struct NoDBBaseConstructor

  Dummy struct for overloading constructors used in on-the-fly instantiations.

- struct RecastBaseConstructor

  Dummy struct for overloading constructors used in on-the-fly Model instantiations.

- class GridApplicInterface

  Derived application interface class which spawns simulation codes using grid services such as Condor or Globus.

- class HierarchSurrModel

  Derived model class within the surrogate model branch for managing hierarchical surrogates (models of varying fidelity).

- class HybridStrategy

  Base class for hybrid minimization strategies.

- class JEGAOptimizer

  A version of Dakota::Optimizer for instantiation of John Eddy's Genetic Algorithms (JEGA).

- class MergedConstraints

  Derived class within the Constraints hierarchy which employs the merged data view.

- class MergedVariables

  Derived class within the Variables hierarchy which employs the merged data view.

- class MixedConstraints

  Derived class within the Constraints hierarchy which employs the default data view (no variable or domain type array merging).

- class MixedVariables

  Derived class within the Variables hierarchy which employs the default data view (no variable or domain type array merging).

- class MPIPackBuffer

  Class for packing MPI message buffers.

- class MPIUnpackBuffer

  Class for unpacking MPI message buffers.

- class NCSUOptimizer

  Wrapper class for the NCSU DIRECT optimization library.

- class NestedModel

  Derived model class which performs a complete sub-iterator execution within every evaluation of the model.

- class NIDRProblemDescDB

  The derived input file database utilizing the new IDR parser.

- struct NL2Res

  Auxiliary information passed to calcr and calcj via ur.

- class NL2SOLLeastSq

  Wrapper class for the NL2SOL nonlinear least squares library.

- class NLPQLPOptimizer

  Wrapper class for the NLPQLP optimization library, Version 2.0.

- class NLSSOLLeastSq

  Wrapper class for the NLSSOL nonlinear least squares library.

- class NonDAdaptImpSampling

  Class for the Adaptive Importance Sampling methods within DAKOTA.

- class NonDBayesCalibration

  Base class for Bayesian inference: generates posterior distribution on model parameters given experimental data.

- class NonDCalibration
- class NonDCubature

  Derived nondeterministic class that generates N-dimensional numerical cubature points for evaluation of expectation integrals.

- class NonDExpansion

  Base class for polynomial chaos expansions (PCE) and stochastic collocation (SC).

- class NonDGlobalEvidence

  Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ.

- class NonDGlobalInterval

  Class for using global nongradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification.

- class NonDGlobalReliability

Class for global reliability methods within DAKOTA/UQ.

- class NonDGlobalSingleInterval

  Class for using global nongradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification.

- class NonDGPImpSampling

  Class for the Gaussian Process-based Importance Sampling method.

- class NonDGPMSABayesCalibration

  Generates posterior distribution on model parameters given experiment data.

- class NonDIncremLHSSampling

  Performs icremental LHS sampling for uncertainty quantification.

- class NonDIntegration

  Derived nondeterministic class that generates N-dimensional numerical integration points for evaluation of expectation integrals.

- class NonDInterval

  Base class for interval-based methods within DAKOTA/UQ.

- class NonDLHSEvidence

  Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ.

- class NonDLHSInterval

  Class for the LHS-based interval methods within DAKOTA/UQ.

- class NonDLHSSampling

  Performs LHS and Monte Carlo sampling for uncertainty quantification.

- class NonDLHSSingleInterval

  Class for pure interval propagation using LHS.

- class NonDLocalEvidence

  Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ.

- class NonDLocalInterval

  Class for using local gradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification.

- class NonDLocalRefinement

  Derived nondeterministic class that generates locally refined grids.

- class NonDLocalReliability

  Class for the reliability methods within DAKOTA/UQ.

- class NonDLocalSingleInterval

  Class for using local gradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification.

- class NonDPolynomialChaos

  Nonintrusive polynomial chaos expansion approaches to uncertainty quantification.

- class NonDQuadrature

  Derived nondeterministic class that generates N-dimensional numerical quadrature points for evaluation of expectation integrals over uncorrelated standard normals/uniforms/exponentials/betas/gammas.

- class NonDQUESOBayesCalibration

  Bayesian inference using the QUESO library from UT Austin.

- class NonDReliability

  Base class for the reliability methods within DAKOTA/UQ.

- class NonDSampling

  Base class for common code between NonDLHSSampling, NonDIncremLHSSampling, and NonDAdaptImpSampling.

- class NonDSparseGrid

  Derived nondeterministic class that generates N-dimensional Smolyak sparse grids for numerical evaluation of expectation integrals over independent standard random variables.

- class NonDStochCollocation

  Nonintrusive stochastic collocation approaches to uncertainty quantification.

- class NPSOLOptimizer

  Wrapper class for the NPSOL optimization library.

- class ParallelLevel

  Container class for the data associated with a single level of communicator partitioning.

- class ParallelConfiguration

  Container class for a set of ParallelLevel list iterators that collectively identify a particular multilevel parallel configuration.

- class ParallelLibrary

  Class for partitioning multiple levels of parallelism and managing message passing within these levels.

- class ParamResponsePair

  Container class for a variables object, a response object, and an evaluation id.

- class ParamStudy

  Class for vector, list, centered, and multidimensional parameter studies.

- class PecosApproximation

  Derived approximation class for global basis polynomials.

- class ProblemDescDB

  The database containing information parsed from the DAKOTA input file.

- struct partial_prp_hash

  wrapper to delegate to the ParamResponsePair hash_value function

- struct partial_prp_equality

  predicate for comparing ONLY the interfaceId and Vars attributes of PRPair

- class PSUADEDesignCompExp

  Wrapper class for the PSUADE library.

- class RecastModel

  Derived model class which provides a thin wrapper around a sub-model in order to recast the form of its inputs and/or outputs.

- class RichExtrapVerification

  Class for Richardson extrapolation for code and solution verification.

- class SensAnalysisGlobal

  Class for a utility class containing correlation calculations and variance-based decomposition.

- class SequentialHybridStrategy

  Strategy for sequential hybrid minimization using multiple optimization and nonlinear least squares methods on multiple models of varying fidelity.

- class SharedVariablesDataRep

  The representation of a SharedVariablesData instance. This representation, or body, may be shared by multiple SharedVariablesData handle instances.

- class SharedVariablesData

  Container class encapsulating variables data that can be shared among a set of Variables instances.

- class SingleMethodStrategy

  Simple fall-through strategy for running a single iterator on a single model.

- class SingleModel

  Derived model class which utilizes a single interface to map variables into responses.

- class SNLLBase

  Base class for OPT++ optimization and least squares methods.

- class SNLLLeastSq

Wrapper class for the OPT++ optimization library.

- class SNLLOptimizer

  Wrapper class for the OPT++ optimization library.

- class SOLBase

  Base class for Stanford SOL software.

- class SurfpackApproximation

  Derived approximation class for Surfpack approximation classes. Interface between Surfpack and Dakota.

- class SurrBasedGlobalMinimizer

  The global surrogate-based minimizer which sequentially minimizes and updates a global surrogate model without trust region controls.

- class SurrBasedLocalMinimizer

  Class for provably-convergent local surrogate-based optimization and nonlinear least squares.

- class SurrBasedMinimizer

  Base class for local/global surrogate-based optimization/least squares.

- class SurrogateModel

  Base class for surrogate models (DataFitSurrModel and HierarchSurrModel).

- class SysCallAnalysisCode

  Derived class in the AnalysisCode class hierarchy which spawns simulations using system calls.

- class SysCallApplicInterface

  Derived application interface class which spawns simulation codes using system calls.

- class TANA3Approximation

  Derived approximation class for TANA-3 two-point exponential approximation (a multipoint approximation).

- class TaylorApproximation

  Derived approximation class for first- or second-order Taylor series (a local approximation).

- class TrackerHTTP

  TrackerHTTP: a usage tracking module that uses HTTP/HTTPS via the curl library.

Typedefs

- typedef double **Real**
- typedef Teuchos::SerialDenseVector< int, Real > **RealVector**
- typedef Teuchos::SerialDenseVector< int, int > **IntVector**
- typedef Teuchos::SerialDenseMatrix< int, Real > **RealMatrix**

- typedef Teuchos::SerialSymDenseMatrix< int, Real > **RealSymMatrix**
- typedef std::deque< bool > **BoolDeque**
- typedef std::vector< BoolDeque > **BoolDequeArray**
- typedef std::vector< Real > **RealArray**
- typedef std::vector< RealArray > **Real2DArray**
- typedef std::vector< int > **IntArray**
- typedef std::vector< IntArray > **Int2DArray**
- typedef std::vector< short > **ShortArray**
- typedef std::vector< unsigned short > **UShortArray**
- typedef std::vector< UShortArray > **UShort2DArray**
- typedef std::vector< UShort2DArray > **UShort3DArray**
- typedef std::vector< size_t > **SizetArray**
- typedef std::vector< SizetArray > **Sizet2DArray**
- typedef std::vector< String > **StringArray**
- typedef std::vector< StringArray > **String2DArray**
- typedef boost::multi_array_types::index_range **idx_range**
- typedef boost::multi_array< String, 1 > **StringMultiArray**
- typedef StringMultiArray::array_view< 1 >::type **StringMultiArrayView**
- typedef StringMultiArray::const_array_view< 1 >::type **StringMultiArrayConstView**
- typedef boost::multi_array< unsigned short, 1 > **UShortMultiArray**
- typedef UShortMultiArray::array_view< 1 >::type **UShortMultiArrayView**
- typedef UShortMultiArray::const_array_view< 1 >::type **UShortMultiArrayConstView**
- typedef boost::multi_array< size_t, 1 > **SizetMultiArray**
- typedef SizetMultiArray::array_view< 1 >::type **SizetMultiArrayView**
- typedef SizetMultiArray::const_array_view< 1 >::type **SizetMultiArrayConstView**
- typedef std::vector< RealVector > **RealVectorArray**
- typedef std::vector< RealVectorArray > **RealVector2DArray**
- typedef std::vector< RealMatrix > **RealMatrixArray**
- typedef std::vector< RealSymMatrix > **RealSymMatrixArray**
- typedef std::vector< IntVector > **IntVectorArray**
- typedef std::vector< Variables > **VariablesArray**
- typedef std::vector< Response > **ResponseArray**
- typedef std::vector< ParamResponsePair > **PRPArray**
- typedef std::vector< PRPArray > **PRP2DArray**
- typedef std::vector< Model > **ModelArray**
- typedef std::vector< Iterator > **IteratorArray**
- typedef std::list< bool > **BoolList**
- typedef std::list< int > **IntList**
- typedef std::list< size_t > **SizetList**
- typedef std::list< Real > **RealList**
- typedef std::list< String > **StringList**
- typedef std::list< Variables > **VariablesList**
- typedef std::list< Interface > **InterfaceList**
- typedef std::list< Response > **ResponseList**
- typedef std::list< Model > **ModelList**
- typedef std::list< Iterator > **IteratorList**

- typedef std::pair< int, String > **IntStringPair**
- typedef std::pair< Real, Real > **RealRealPair**
- typedef std::pair< int, Response > **IntResponsePair**
- typedef std::set< Real > **RealSet**
- typedef std::set< int > **IntSet**
- typedef std::set< size_t > **SizetSet**
- typedef std::vector< RealSet > **RealSetArray**
- typedef std::vector< IntSet > **IntSetArray**
- typedef std::map< int, int > **IntIntMap**
- typedef std::map< int, short > **IntShortMap**
- typedef std::map< int, RealVector > **IntRealVectorMap**
- typedef std::map< int, ActiveSet > **IntActiveSetMap**
- typedef std::map< int, Variables > **IntVariablesMap**
- typedef std::map< int, Response > **IntResponseMap**
- typedef std::map< IntArray, size_t > **IntArraySizetMap**
- typedef std::multimap< RealRealPair, ParamResponsePair > **RealPairPRPMultiMap**
- typedef IntList::iterator **ILIter**
- typedef IntList::const_iterator **ILCIter**
- typedef SizetList::iterator **StLIter**
- typedef SizetList::const_iterator **StLCIter**
- typedef RealList::iterator **RLIter**
- typedef RealList::const_iterator **RLCIter**
- typedef StringList::iterator **StringLIter**
- typedef StringList::const_iterator **StringLCIter**
- typedef VariablesList::iterator **VarsLIter**
- typedef InterfaceList::iterator **InterfLIter**
- typedef ResponseList::iterator **RespLIter**
- typedef ModelList::iterator **ModelLIter**
- typedef IteratorList::iterator **IterLIter**
- typedef std::list< ParallelLevel >::iterator **ParLevLIter**
- typedef std::list< ParallelConfiguration >::iterator **ParConfigLIter**
- typedef IntSet::iterator **ISIter**
- typedef IntSet::const_iterator **ISCIter**
- typedef IntIntMap::iterator **IntIntMIter**
- typedef IntIntMap::const_iterator **IntIntMCIter**
- typedef IntShortMap::iterator **IntShMIter**
- typedef IntRealVectorMap::iterator **IntRDVMIter**
- typedef IntRealVectorMap::const_iterator **IntRDVMCIter**
- typedef IntActiveSetMap::iterator **IntASMIter**
- typedef IntVariablesMap::iterator **IntVarsMIter**
- typedef IntVariablesMap::const_iterator **IntVarsMCIter**
- typedef IntResponseMap::iterator **IntRespMIter**
- typedef IntResponseMap::const_iterator **IntRespMCIter**
- typedef void(∗ **dl_find_optimum_t**)(void ∗, Optimizer1 ∗, char ∗)
- typedef void(∗ **dl_destructor_t**)(void ∗∗)
- typedef int(∗ **ftw_fn**)(const char ∗file, const struct stat ∗, int ftype, int depth, void ∗v)

- typedef struct dirent **dirent**
- typedef struct Dakota::Cbuf **Cbuf**
- typedef struct Dakota::Buf **Buf**
- typedef struct Dakota::Finfo **Finfo**
- typedef Teuchos::SerialDenseSolver< int, Real > **RealSolver**
- typedef Teuchos::SerialSpdDenseSolver< int, Real > **RealSpdSolver**
- typedef int(∗ start_grid_computing_t)(char ∗analysis_driver_script, char ∗params_file, char ∗results_file)

  definition of start grid computing type (function pointer)

- typedef int(∗ perform_analysis_t)(char ∗iteration_num)

  definition of perform analysis type (function pointer)

- typedef int ∗(∗ get_jobs_completed_t)()

  definition of get completed jobs type (function pointer)

- typedef int(∗ stop_grid_computing_t)()

  definition of stop grid computing type (function pointer)

- typedef unsigned char **u_char**
- typedef unsigned short **u_short**
- typedef unsigned int **u_int**
- typedef unsigned long **u_long**
- typedef long long **long_long**
- typedef unsigned long **UL**
- typedef void(∗ **Calcrj**)(int ∗n, int ∗p, Real ∗x, int ∗nf, Real ∗r, int ∗ui, void ∗ur, Vf vf)
- typedef void(∗ **Vf**)()
- typedef int **MPI_Comm**
- typedef void ∗ **MPI_Request**
- typedef bmi::multi_index_container< Dakota::ParamResponsePair, bmi::indexed_by< bmi::ordered_unique< bmi::tag< ordered >, bmi::const_mem_fun< Dakota::ParamResponsePair, const IntStringPair &,&Dakota::ParamResponsePair::eval_interface_ids > >, bmi::hashed_non_unique< bmi::tag< hashed >, bmi::identity< Dakota::ParamResponsePair >, partial_prp_hash, partial_prp_equality > > > PRPMultiIndexCache

  Boost Multi-Index Container for globally caching ParamResponsePairs.

- typedef PRPMultiIndexCache **PRPCache**
- typedef PRPCache::index_iterator< ordered >::type **PRPCacheOIter**
- typedef PRPCache::index_const_iterator< ordered >::type **PRPCacheOCIter**
- typedef PRPCache::index_iterator< hashed >::type **PRPCacheHIter**
- typedef PRPCache::index_const_iterator< hashed >::type **PRPCacheHCIter**
- typedef PRPCacheOIter **PRPCacheIter**
- typedef PRPCacheOCIter **PRPCacheCIter**
- typedef bmi::multi_index_container< Dakota::ParamResponsePair, bmi::indexed_by< bmi::ordered_unique< bmi::tag< ordered >, bmi::const_mem_fun< Dakota::ParamResponsePair, int,&Dakota::ParamResponsePair::eval_id > >, bmi::hashed_non_unique< bmi::tag< hashed >, bmi::identity< Dakota::ParamResponsePair >, partial_prp_hash, partial_prp_equality > > > PRPMultiIndexQueue

Boost Multi-Index Container for locally queueing ParamResponsePairs.

- typedef PRPMultiIndexQueue **PRPQueue**
- typedef PRPQueue::index_iterator< ordered >::type **PRPQueueOIter**
- typedef PRPQueue::index_const_iterator< ordered >::type **PRPQueueOCIter**
- typedef PRPQueue::index_iterator< hashed >::type **PRPQueueHIter**
- typedef PRPQueue::index_const_iterator< hashed >::type **PRPQueueHCIter**
- typedef PRPQueueOIter **PRPQueueIter**
- typedef PRPQueueOCIter **PRPQueueCIter**

Enumerations

- enum {
  COBYLA, **DIRECT**, **EA**, **MS**,
  PS, **SW** }
- enum { **OBJECTIVE**, **INEQUALITY_CONSTRAINT**, **EQUALITY_CONSTRAINT** }
  define algebraic function types
- enum {
  SILENT_OUTPUT, **QUIET_OUTPUT**, **NORMAL_OUTPUT**, **VERBOSE_OUTPUT**,
  DEBUG_OUTPUT }
- enum { **STD_NORMAL_U**, **STD_UNIFORM_U**, **ASKEY_U**, **EXTENDED_U** }
- enum { **NODAL_INTERPOLANT**, **HIERARCHICAL_INTERPOLANT** }
- enum { **NO_INT_REFINE**, **IS**, **AIS**, **MMAIS** }
- enum { **PROBABILITIES**, **RELIABILITIES**, **GEN_RELIABILITIES** }
- enum { **COMPONENT** = 0, **SYSTEM_SERIES**, **SYSTEM_PARALLEL** }
- enum { **CUMULATIVE**, **COMPLEMENTARY** }
- enum {
  NO_EMULATOR, **POLYNOMIAL_CHAOS**, **STOCHASTIC_COLLOCATION**, **GAUSSIAN_-PROCESS**,
  KRIGING }
- enum { **IGNORE_RANKS**, **SET_RANKS**, **GET_RANKS**, **SET_GET_RANKS** }
- enum {
  UNCERTAIN, **UNCERTAIN_UNIFORM**, **ACTIVE**, **ACTIVE_UNIFORM**,
  ALL, **ALL_UNIFORM** }
- enum {
  MV, **AMV_X**, **AMV_U**, **AMV_PLUS_X**,
  AMV_PLUS_U, **TANA_X**, **TANA_U**, **NO_APPROX** }
- enum { **BREITUNG**, **HOHENRACK**, **HONG** }
- enum { **EGRA_X**, **EGRA_U** }
- enum { **ORIGINAL_PRIMARY**, **SINGLE_OBJECTIVE**, **LAGRANGIAN_OBJECTIVE**, **AUGMENTED_LAGRANGIAN_OBJECTIVE** }
- enum { **NO_CONSTRAINTS**, **LINEARIZED_CONSTRAINTS**, **ORIGINAL_CONSTRAINTS** }
- enum { **NO_RELAX**, **HOMOTOPY**, **COMPOSITE_STEP** }

- enum { **PENALTY_MERIT**, **ADAPTIVE_PENALTY_MERIT**, **LAGRANGIAN_MERIT**, **AUGMENTED_LAGRANGIAN_MERIT** }
- enum { **FILTER**, **TR_RATIO** }
- enum { **SCALE_NONE**, **SCALE_VALUE**, **SCALE_LOG** }
- enum { **CDV**, **LINEAR**, **NONLIN**, **FN_LSQ** }
- enum { **DISALLOW**, **TARGET**, **BOUNDS** }
- enum { **DEFAULT_POINTS**, **MINIMUM_POINTS**, **RECOMMENDED_POINTS**, **TOTAL_POINTS** }

  define special values for pointsManagement

- enum {

  NO_SURROGATE = 0, **UNCORRECTED_SURROGATE**, **AUTO_CORRECTED_SURROGATE**, **BYPASS_SURROGATE**,

  MODEL_DISCREPANCY }

  define special values for SurrogateModel::responseMode

- enum { **NO_CORRECTION** = 0, **ADDITIVE_CORRECTION**, **MULTIPLICATIVE_CORRECTION**, **COMBINED_CORRECTION** }

  define special values for approxCorrectionType

- enum {

  EMPTY, **MERGED_ALL**, **MIXED_ALL**, **MERGED_DISTINCT_DESIGN**,

  MERGED_DISTINCT_UNCERTAIN, **MERGED_DISTINCT_ALEATORY_UNCERTAIN**, **MERGED_DISTINCT_EPISTEMIC_UNCERTAIN**, **MERGED_DISTINCT_STATE**,

  MIXED_DISTINCT_DESIGN, **MIXED_DISTINCT_UNCERTAIN**, **MIXED_DISTINCT_ALEATORY_UNCERTAIN**, **MIXED_DISTINCT_EPISTEMIC_UNCERTAIN**,

  MIXED_DISTINCT_STATE }
- enum {

  CONTINUOUS_DESIGN, **DISCRETE_DESIGN_RANGE**, **DISCRETE_DESIGN_SET_INT**, **DISCRETE_DESIGN_SET_REAL**,

  NORMAL_UNCERTAIN, **LOGNORMAL_UNCERTAIN**, **UNIFORM_UNCERTAIN**, **LOGUNIFORM_UNCERTAIN**,

  TRIANGULAR_UNCERTAIN, **EXPONENTIAL_UNCERTAIN**, **BETA_UNCERTAIN**, **GAMMA_UNCERTAIN**,

  GUMBEL_UNCERTAIN, **FRECHET_UNCERTAIN**, **WEIBULL_UNCERTAIN**, **HISTOGRAM_BIN_UNCERTAIN**,

  POISSON_UNCERTAIN, **BINOMIAL_UNCERTAIN**, **NEGATIVE_BINOMIAL_UNCERTAIN**, **GEOMETRIC_UNCERTAIN**,

  HYPERGEOMETRIC_UNCERTAIN, **HISTOGRAM_POINT_UNCERTAIN**, **INTERVAL_UNCERTAIN**, **CONTINUOUS_STATE**,

  DISCRETE_STATE_RANGE, **DISCRETE_STATE_SET_INT**, **DISCRETE_STATE_SET_REAL** }

- enum var_t {

  VAR_x1, **VAR_x2**, **VAR_x3**, **VAR_b**,

  VAR_h, **VAR_P**, **VAR_M**, **VAR_Y**,

  VAR_w, **VAR_t**, **VAR_R**, **VAR_E**,

  VAR_X, **VAR_Fs**, **VAR_P1**, **VAR_P2**,

  VAR_P3, **VAR_B**, **VAR_D**, **VAR_H**,

  VAR_F0, **VAR_d** }

  enumeration of possible variable types (to index to names)

- enum driver_t {

  NO_DRIVER = 0, **CANTILEVER_BEAM**, **MOD_CANTILEVER_BEAM**, **CYLINDER_HEAD**,

  EXTENDED_ROSENBROCK, **GENERALIZED_ROSENBROCK**, **LF_ROSENBROCK**, **ROSENBROCK**,

  GERSTNER, **SCALABLE_GERSTNER**, **LOGNORMAL_RATIO**, **MULTIMODAL**,

  PLUGIN_ROSENBROCK, **PLUGIN_TEXT_BOOK**, **SHORT_COLUMN**, **LF_SHORT_COLUMN**,

  SIDE_IMPACT_COST, **SIDE_IMPACT_PERFORMANCE**, **SOBOL_RATIONAL**, **SOBOL_G_FUNCTION**,

  SOBOL_ISHIGAMI, **STEEL_COLUMN_COST**, **STEEL_COLUMN_PERFORMANCE**, **TEXT_BOOK**,

  TEXT_BOOK1, **TEXT_BOOK2**, **TEXT_BOOK3**, **TEXT_BOOK_OUU**,

  SCALABLE_TEXT_BOOK, **SCALABLE_MONOMIALS**, **HERBIE**, **SMOOTH_HERBIE**,

  SHUBERT, **SALINAS**, **MODELCENTER**, **MATLAB**,

  PYTHON }

  enumeration of possible driver types (to index to names)

- enum local_data_t { **VARIABLES_MAP** = 1, **VARIABLES_VECTOR** = 2 }

  enumeration for how local variables are stored (values must employ a bit representation)

- enum {

  sFTW_F, **sFTW_SL**, **sFTW_D**, **sFTW_DP**,

  sFTW_DNR, **sFTW_O**, **sFTW_NS** }
- enum {

  sFTWret_OK, **sFTWret_quit**, **sFTWret_skipdir**, **sFTWret_Follow**,

  sFTWret_mallocfailure }
- enum { **SETUP_MODEL**, **SETUP_USERFUNC** }
- enum {

  CAUVar_normal = 0, **CAUVar_lognormal** = 1, **CAUVar_uniform** = 2, **CAUVar_loguniform** = 3,

  CAUVar_triangular = 4, **CAUVar_exponential** = 5, **CAUVar_beta** = 6, **CAUVar_gamma** = 7,

  CAUVar_gumbel = 8, **CAUVar_frechet** = 9, **CAUVar_weibull** = 10, **CAUVar_histogram_bin** = 11,

  CAUVar_Nkinds = 12 }

- enum {

  DAUIVar_poisson = 0, **DAUIVar_binomial** = 1, **DAUIVar_negative_binomial** = 2, **DAUIVar_-geometric** = 3,

  DAUIVar_hypergeometric = 4, **DAUIVar_Nkinds** = 5 }
- enum { **DAURVar_histogram_point** = 0, **DAURVar_Nkinds** = 1 }
- enum { **CEUVar_interval** = 0, **CEUVar_Nkinds** = 1 }
- enum {

  DiscSetVar_design_set_int = 0, **DiscSetVar_design_set_real** = 1, **DiscSetVar_state_set_int** = 2, **DiscSetVar_state_set_real** = 3,

  DiscSetVar_Nkinds = 4 }
- enum { **N_VLS** = 4 }
- enum CG_UPDATETYPE {

  CG_STEEPEST, **CG_FLETCHER_REEVES**, **CG_POLAK_RIBIERE**, **CG_POLAK_RIBIERE_-PLUS**,

  CG_HESTENES_STIEFEL }

  NonlinearCG update options.

- enum CG_LINESEARCHTYPE { **CG_FIXED_STEP**, **CG_LS_SIMPLE**, **CG_LS_BRENT**, **CG_LS_-WOLFE** }

  NonlinearCG linesearch options.

- enum {

  LIST = 1, **VECTOR_SV**, **VECTOR_FP**, **CENTERED**,

  MULTIDIM }
- enum { **ESTIMATE_ORDER** = 1, **CONVERGE_ORDER**, **CONVERGE_QOI** }
- enum EvalType { **NLFEvaluator**, **CONEvaluator** }

  enumeration for the type of evaluator function

- enum {

  TH_SILENT_OUTPUT, **TH_QUIET_OUTPUT**, **TH_NORMAL_OUTPUT**, **TH_VERBOSE_-OUTPUT**,

  TH_DEBUG_OUTPUT }

Functions

- static const char ∗ basename (const char ∗s)

  return name of s, stripped of any leading path information

- static void cleanup_and_abort (const std::string &resname)

  output error message about results file and call abort

- CommandShell & flush (CommandShell &shell)

  convenient shell manipulator function to "flush" the shell

- bool operator== (const ActiveSet &set1, const ActiveSet &set2)

  equality operator for ActiveSet

- std::istream & operator>> (std::istream &s, ActiveSet &set)

  std::istream extraction operator for ActiveSet. Calls read(std::istream&).

- std::ostream & operator<< (std::ostream &s, const ActiveSet &set)

  std::ostream insertion operator for ActiveSet. Calls write(std::istream&).

- BiStream & operator>> (BiStream &s, ActiveSet &set)

  BiStream extraction operator for ActiveSet. Calls read(BiStream&).

- BoStream & operator<< (BoStream &s, const ActiveSet &set)

  BoStream insertion operator for ActiveSet. Calls write(BoStream&).

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, ActiveSet &set)

  MPIUnpackBuffer extraction operator for ActiveSet. Calls read(MPIUnpackBuffer&).

- MPIPackBuffer & operator<< (MPIPackBuffer &s, const ActiveSet &set)

  MPIPackBuffer insertion operator for ActiveSet. Calls write(MPIPackBuffer&).

- bool operator!= (const ActiveSet &set1, const ActiveSet &set2)

  inequality operator for ActiveSet

- template<class ArrayT >
  void array_read (BiStream &s, ArrayT &v)

  Read an array from BiStream, s.

- template<class ArrayT >
  void array_write (BoStream &s, const ArrayT &v)

  Write an array to BoStream, s.

- template<class ArrayT >
  BiStream & operator>> (BiStream &s, ArrayT &data)

  global BiStream extraction operator for generic "array" container

- template<class ArrayT >
  BoStream & operator<< (BoStream &s, const ArrayT &data)

  global BoStream insertion operator for generic "array" container

- std::istream & operator>> (std::istream &s, Constraints &con)

  std::istream extraction operator for Constraints

- std::ostream & operator<< (std::ostream &s, const Constraints &con)

  std::ostream insertion operator for Constraints

- bool interface_id_compare (const Interface &interface, const void *id)
  global comparison function for Interface
- bool method_id_compare (const Iterator &iterator, const void *id)
  global comparison function for Iterator
- bool model_id_compare (const Model &model, const void *id)
  global comparison function for Model
- bool operator== (const ResponseRep &rep1, const ResponseRep &rep2)
  equality operator for ResponseRep
- bool responses_id_compare (const Response &resp, const void *id)
  global comparison function for Response
- std::istream & operator>> (std::istream &s, Response &response)
  std::istream extraction operator for Response. Calls read(std::istream&).
- std::ostream & operator<< (std::ostream &s, const Response &response)
  std::ostream insertion operator for Response. Calls write(std::ostream&).
- BiStream & operator>> (BiStream &s, Response &response)
  BiStream extraction operator for Response. Calls read(BiStream&).
- BoStream & operator<< (BoStream &s, const Response &response)
  BoStream insertion operator for Response. Calls write(BoStream&).
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, Response &response)
  MPIUnpackBuffer extraction operator for Response. Calls read(MPIUnpackBuffer&).
- MPIPackBuffer & operator<< (MPIPackBuffer &s, const Response &response)
  MPIPackBuffer insertion operator for Response. Calls write(MPIPackBuffer&).
- bool operator== (const Response &resp1, const Response &resp2)
  equality operator for Response
- bool operator!= (const Response &resp1, const Response &resp2)
  inequality operator for Response
- std::string re_match (const std::string &token, const boost::regex &re)
  Global utility function to ease migration from CtelRegExp to Boost.Regex.
- MPIPackBuffer & operator<< (MPIPackBuffer &s, const String &data)
  Reads String from buffer.
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, String &data)

Writes String to buffer.

- String operator+ (const String &s1, const String &s2)

  Concatenate two Strings and return the resulting String.

- String operator+ (const char *s1, const String &s2)

  Append a String to a char and return the resulting String.*

- String operator+ (const String &s1, const char *s2)

  Append a char to a String and return the resulting String.*

- String operator+ (const std::string &s1, const String &s2)

  Append a String to a std::string and return the resulting String.

- String operator+ (const String &s1, const std::string &s2)

  Append a std::string to a String and return the resulting String.

- String toUpper (const String &str)

  Returns a String converted to upper case. Calls String::upper().

- String toLower (const String &str)

  Returns a String converted to lower case. Calls String::lower().

- bool operator== (const Variables &vars1, const Variables &vars2)

  equality operator for Variables

- bool binary_equal_to (const Variables &vars1, const Variables &vars2)

  binary_equal_to (since 'operator==' is not suitable for boost/hashed lookup)

- std::size_t hash_value (const Variables &vars)

  hash_value for Variables - required by the new BMI hash_set of PRPairs

- bool variables_id_compare (const Variables &vars, const void *id)

  global comparison function for Variables

- std::istream & operator>> (std::istream &s, Variables &vars)

  std::istream extraction operator for Variables.

- std::ostream & operator<< (std::ostream &s, const Variables &vars)

  std::ostream insertion operator for Variables.

- BiStream & operator>> (BiStream &s, Variables &vars)

  BiStream extraction operator for Variables.

- BoStream & operator<< (BoStream &s, const Variables &vars)

  BoStream insertion operator for Variables.

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, Variables &vars)

  MPIUnpackBuffer extraction operator for Variables.

- MPIPackBuffer & operator<< (MPIPackBuffer &s, const Variables &vars)

  MPIPackBuffer insertion operator for Variables.

- bool operator!= (const Variables &vars1, const Variables &vars2)

  inequality operator for Variables

- template<class T >
  std::ostream & operator<< (std::ostream &s, const std::set< T > &data)

  global std::ostream insertion operator for std::set

- template<class T >
  MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, std::set< T > &data)

  global MPIUnpackBuffer extraction operator for std::set

- template<class T >
  MPIPackBuffer & operator<< (MPIPackBuffer &s, const std::set< T > &data)

  global MPIPackBuffer insertion operator for std::set

- template<typename OrdinalType , typename ScalarType >
  MPIPackBuffer & operator<< (MPIPackBuffer &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &data)

  global MPIPackBuffer insertion operator for Teuchos::SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  MPIPackBuffer & operator<< (MPIPackBuffer &s, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &data)

  global MPIPackBuffer insertion operator for Teuchos::SerialDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  MPIPackBuffer & operator<< (MPIPackBuffer &s, const Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &data)

  global MPIPackBuffer insertion operator for Teuchos::SerialSymDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &data)

  global MPIUnpackBuffer extraction operator for Teuchos::SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &data)

  global MPIUnpackBuffer extraction operator for Teuchos::SerialDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &data)

  global MPIUnpackBuffer extraction operator for Teuchos::SerialSymDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void read_data (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  standard istream extraction operator for full SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void read_data (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArray &label_array)

  standard istream extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArrayView label_array)

  standard istream extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data_partial (std::istream &s, size_t start_index, size_t num_items, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  standard istream extraction operator for partial SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void read_data_partial (std::istream &s, size_t start_index, size_t num_items, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArray &label_array)

  standard istream extraction operator for partial SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data_partial (std::istream &s, size_t start_index, size_t num_items, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArrayView label_array)

  standard istream extraction operator for partial SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data_tabular (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  tabular istream extraction operator for full SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void read_data_partial_tabular (std::istream &s, size_t start_index, size_t num_items, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  tabular istream extraction operator for partial SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void read_data_annotated (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArray &label_array)

annotated istream extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data_annotated (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArrayView label_array)

  annotated istream extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const ScalarType *v, OrdinalType len)

  standard ostream insertion operator for full SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  standard ostream insertion operator for full SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  standard ostream insertion operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArrayConstView label_array)

  standard ostream insertion operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringArray &label_array)

  standard ostream insertion operator for full SerialDenseVector with alternate labels

- template<typename OrdinalType , typename ScalarType >
  void write_data_aprepro (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  aprepro ostream insertion operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data_partial (std::ostream &s, size_t start_index, size_t num_items, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  standard ostream insertion operator for partial SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void write_data_partial (std::ostream &s, size_t start_index, size_t num_items, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  standard ostream insertion operator for partial SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data_partial_aprepro (std::ostream &s, size_t start_index, size_t num_items, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  aprepro ostream insertion operator for partial SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data_annotated (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  annotated ostream insertion operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data_tabular (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  tabular ostream insertion operator for full SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void write_data_tabular (std::ostream &s, const ScalarType *ptr, OrdinalType num_items)

  tabular ostream insertion operator for full SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void write_data_partial_tabular (std::ostream &s, size_t start_index, size_t num_items, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v)

  tabular ostream insertion operator for partial SerialDenseVector

- void write_data_tabular (std::ostream &s, const StringArray &sa)

  tabular ostream insertion operator for vector of strings

- void write_data_tabular (std::ostream &s, StringMultiArrayConstView ma)

  tabular ostream insertion operator for view of StringMultiArray

- template<typename OrdinalType , typename ScalarType >
  std::istream & operator>> (std::istream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &data)

  global std::istream extraction operator for SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  std::ostream & operator<< (std::ostream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &data)

  global std::ostream insertion operator for SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void read_data (BiStream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArray &label_array)

  standard binary stream extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data (BiStream &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArrayView label_array)

standard binary stream extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data (BoStream &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  standard binary stream insertion operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data (MPIUnpackBuffer &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArray &label_array)

  standard MPI buffer extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data (MPIUnpackBuffer &s, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, StringMultiArrayView label_array)

  standard MPI buffer extraction operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void write_data (MPIPackBuffer &s, const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &v, const StringMultiArray &label_array)

  standard MPI buffer insertion operator for full SerialDenseVector with labels

- template<typename OrdinalType , typename ScalarType >
  void read_data (std::istream &s, std::vector< Teuchos::SerialDenseVector< OrdinalType, ScalarType > > &va)

  standard istream extraction operator for std::vector of SerialDenseVectors

- template<typename OrdinalType , typename ScalarType >
  void read_data (std::istream &s, Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &m)

  standard istream extraction operator for SerialSymDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &m, bool brackets, bool row_rtn, bool final_rtn)

  formatted ostream insertion operator for SerialSymDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &m, bool brackets, bool row_rtn, bool final_rtn)

  formatted ostream insertion operator for SerialDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void write_data (std::ostream &s, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &m, const StringArray &row_labels, const StringArray &col_labels)

  ostream insertion operator for SerialDenseMatrix with row/col labels

- template<typename OrdinalType , typename ScalarType >
  void read_lower_triangle (std::istream &s, Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &sm)

  istream partial specialization for reading the lower triangle of a SerialSymDenseMatrix

- template<typename IStreamType , typename OrdinalType , typename ScalarType >
  void read_lower_triangle (IStreamType &s, Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &sm)

  generic input stream template for reading the lower triangle of a SerialSymDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void write_lower_triangle (std::ostream &s, const Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &sm, bool row_rtn)

  ostream version for writing the lower triangle of a SerialSymDenseMatrix

- template<typename OStreamType , typename OrdinalType , typename ScalarType >
  void write_lower_triangle (OStreamType &s, const Teuchos::SerialSymDenseMatrix< OrdinalType, ScalarType > &sm)

  generic output stream template for writing the lower triangle of a SerialSymDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void read_col_vector_trans (std::istream &s, OrdinalType col, Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm)

  istream partial specialization for reading a column vector of a SerialDenseMatrix

- template<typename IStreamType , typename OrdinalType , typename ScalarType >
  void read_col_vector_trans (IStreamType &s, OrdinalType col, Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm)

  generic input stream template for reading a column vector of a SerialDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void write_col_vector_trans (std::ostream &s, OrdinalType col, OrdinalType num_items, bool brackets, bool break_line, bool final_rtn, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm)

  ostream insertion operator for a column vector from a SerialDenseMatrix

- template<typename OrdinalType , typename ScalarType >
  void write_col_vector_trans (std::ostream &s, OrdinalType col, bool brackets, bool break_line, bool final_rtn, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm)

  ostream insertion operator for a column vector from a SerialDenseMatrix

- template<typename OStreamType , typename OrdinalType , typename ScalarType >
  void write_col_vector_trans (OStreamType &s, OrdinalType col, OrdinalType num_items, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm)

  ostream insertion operator for a column vector from a SerialDenseMatrix

- template<typename OStreamType , typename OrdinalType , typename ScalarType >
  void write_col_vector_trans (OStreamType &s, OrdinalType col, const Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm)

ostream insertion operator for a column vector from a SerialDenseMatrix

- template<class ArrayT >
  void array_read (std::istream &s, ArrayT &v)

  read array from std::istream

- template<class ArrayT >
  void array_write (std::ostream &s, const ArrayT &v)

  write array to std::ostream

- template<class ListT >
  void list_write (const ListT &l, std::ostream &s)

  write list to std::ostream

- template<class T >
  std::istream & operator>> (std::istream &s, std::vector< T > &data)

  global std::istream extraction operator for std::vector

- template<class T >
  std::ostream & operator<< (std::ostream &s, const std::vector< T > &data)

  global std::ostream insertion operator for std::vector

- template<class T >
  std::ostream & operator<< (std::ostream &s, const std::list< T > &data)

  global std::ostream insertion operator for std::list

- template<class ArrayT >
  void array_write (std::ostream &s, const ArrayT &v, const std::vector< String > &label_array)

  write array to std::ostream with labels

- template<class ArrayT >
  void array_write_aprepro (std::ostream &s, const ArrayT &v, const std::vector< String > &label_array)

  write array to std::ostream (APREPRO format)

- template<class ArrayT >
  void array_write_annotated (std::ostream &s, const ArrayT &v, bool write_len)

  Write array to ostream as a row vector; precede with length if write_len = true.

- bool operator== (const ShortArray &dsa1, const ShortArray &dsa2)

  equality operator for ShortArray

- bool operator== (const StringArray &dsa1, const StringArray &dsa2)

  equality operator for StringArray

- bool operator== (const SizetArray &sa, SizetMultiArrayConstView smav)

  equality operator for SizetArray and SizetMultiArrayConstView

- bool operator== (const IntArray &dia1, const IntArray &dia2)

  equality operator for IntArray

- bool operator!= (const IntArray &dia1, const IntArray &dia2)

  inequality operator for IntArray

- bool operator!= (const ShortArray &dsa1, const ShortArray &dsa2)

  inequality operator for ShortArray

- bool operator!= (const StringArray &dsa1, const StringArray &dsa2)

  inequality operator for StringArray

- bool operator!= (const SizetArray &sa, SizetMultiArrayConstView smav)

  inequality operator for StringArray

- void build_label (String &label, const String &root_label, size_t tag)

  create a label by appending a numerical tag to the root_label

- void build_labels (StringArray &label_array, const String &root_label)

  create an array of labels by tagging root_label for each entry in label_array. Uses build_label().

- void build_labels (StringMultiArray &label_array, const String &root_label)

  create an array of labels by tagging root_label for each entry in label_array. Uses build_label().

- void build_labels_partial (StringArray &label_array, const String &root_label, size_t start_index, size_t num_items)

  create a partial array of labels by tagging root_label for a subset of entries in label_array. Uses build_label().

- void copy_row_vector (const RealMatrix &m, RealMatrix::ordinalType i, std::vector< Real > &row)

  Copies a row of a Teuchos_SerialDenseMatrix<int,Real> to std::vector<Real>.

- template<class T >
  void copy_data (const std::vector< T > &dbv, T *ptr, const int ptr_len)

  *copy Array<T> to T**

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const std::vector< Teuchos::SerialDenseVector< OrdinalType, ScalarType > > &sdva, ScalarType *ptr, const OrdinalType ptr_len, const String &ptr_type)

  *copy Array<Teuchos::SerialDenseVector<OT,ST> > to ST**

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv, Teuchos::SerialDenseMatrix< OrdinalType, ScalarType > &sdm, OrdinalType nr, OrdinalType nc)

  copy Teuchos::SerialDenseVector<OT,ST> to Teuchos::SerialDenseMatrix<OT,ST>

- template<class T >
  void copy_data (const std::list< T > &dl, std::vector< T > &da)

  copy std::list<T> to std::vector<T>

- template<class T >
  void copy_data (const std::list< T > &dl, std::vector< std::vector< T > > &d2a, size_t num_a, size_t a_len)

  copy std::list<T> to std::vector<std::vector<T> >

- template<class T >
  void copy_data (const std::vector< std::vector< T > > &d2a, std::vector< T > &da)

  copy std::vector<vector<T> > to std::vector<T>(unroll vecOfvecs into vector)

- template<class T >
  void copy_data (const std::map< int, T > &im, std::vector< T > &da)

  copy map<int, T> to std::vector<T> (discard integer keys)

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv1, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv2)

  copy Teuchos::SerialDenseVector<OrdinalType, ScalarType> to same (used in place of operator= when a deep copy of a vector view is needed)

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv, std::vector< ScalarType > &da)

  copy Teuchos::SerialDenseVector<OrdinalType, ScalarType> to std::vector<ScalarType>

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const std::vector< ScalarType > &da, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv)

  copy Array<ScalarType> to Teuchos::SerialDenseVector<OrdinalType, ScalarType>

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const ScalarType *ptr, const OrdinalType ptr_len, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv)

  copy ScalarType to Teuchos::SerialDenseVector<OrdinalType, ScalarType>*

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv, ScalarType *ptr, const OrdinalType ptr_len)

  copy ScalarType to Teuchos::SerialDenseVector<OrdinalType, ScalarType>*

- template<typename OrdinalType , typename ScalarType >
  void copy_data (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv, std::vector< Teuchos::SerialDenseVector< OrdinalType, ScalarType > > &sdva, OrdinalType num_vec, OrdinalType vec_len)

copy SerialDenseVector<> to Array<SerialDenseVector<> >

- template<typename OrdinalType , typename ScalarType >
  void copy_data_partial (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv1, OrdinalType start_index1, OrdinalType num_items, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv2)

  copy portion of first SerialDenseVector to all of second SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void copy_data_partial (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv1, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv2, OrdinalType start_index2)

  copy all of first SerialDenseVector to portion of second SerialDenseVector

- template<typename OrdinalType , typename ScalarType >
  void copy_data_partial (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv1, OrdinalType start_index1, OrdinalType num_items, Teuchos::SerialDenseVector< OrdinalType, ScalarType > &sdv2, OrdinalType start_index2)

  copy portion of first SerialDenseVector to portion of second SerialDenseVector

- template<class T >
  void copy_data_partial (const std::vector< T > &da1, size_t start_index1, size_t num_items, std::vector< T > &da2)

  copy portion of first Array<T> to all of second Array<T>

- template<class T >
  void copy_data_partial (const std::vector< T > &da1, std::vector< T > &da2, size_t start_index2)

  copy all of first Array<T> to portion of second Array<T>

- template<class T >
  void copy_data_partial (const std::vector< T > &da, boost::multi_array< T, 1 > &bma, size_t start_index_bma)

  copy all of first Array<T> to portion of boost::multi_array<T, 1>

- template<class T >
  void copy_data_partial (const std::vector< T > &da1, size_t start_index1, size_t num_items, std::vector< T > &da2, size_t start_index2)

  copy portion of first Array<T> to portion of second Array<T>

- void merge_data_partial (const IntVector &d_array, RealVector &m_array, size_t start_index_ma)

  aggregate continuous and discrete arrays into a single merged array

- template<typename OrdinalType , typename ScalarType >
  const ScalarType & set_index_to_value (OrdinalType index, const std::set< ScalarType > &values)

  retrieve the set value corresponding to the passed index

- template<typename ScalarType >
  size_t set_value_to_index (const ScalarType &value, const std::set< ScalarType > &values)

calculate the set index corresponding to the passed value

- template<typename OrdinalType , typename ScalarType >
  void x_y_pairs_to_x_set (const Teuchos::SerialDenseVector< OrdinalType, ScalarType > &xy_pairs, std::set< ScalarType > &x_set)

  convert a SerialDenseVector of head-to-tail (x,y) pairs into a std::set of (x), discarding the y values

- template<class ContainerType >
  ContainerType::size_type find_index (const ContainerType &c, const typename ContainerType::value_type &search_data)

  generic find_index (inactive)

- template<typename MultiArrayType , typename DakArrayType >
  void copy_data (const MultiArrayType &ma, DakArrayType &da)

  generic copy (inactive)

- template<class T >
  size_t find_index (const boost::multi_array< T, 1 > &bma, const T &search_data)

  compute the index of an entry within a boost::multi_array

- size_t find_index (SizetMultiArrayConstView bmacv, size_t search_data)

  compute the index of an entry within a boost::multi_array view

- size_t find_index (StringMultiArrayConstView bmacv, const String &search_data)

  compute the index of an entry within a boost::multi_array view

- template<class ListT >
  ListT::size_type find_index (const ListT &l, const typename ListT::value_type &val)

  compute the index of an entry within a std::list

- void copy_data (SizetMultiArrayConstView ma, SizetArray &da)

  copy boost::multi_array view to Array

- void copy_data (StringMultiArrayConstView ma, StringArray &da)

  copy boost::multi_array view to Array

- template<class ListT >
  ListT::const_iterator find_if (const ListT &c, bool(*test_fn)(const typename ListT::value_type &, const std::string &), const std::string &test_fn_data)

  return an iterator to the first list element satisfying the predicate test_fn w.r.t. the passed test_fn_data; end if not found

- template<typename DakContainerType >
  bool contains (const DakContainerType &v, const typename DakContainerType::value_type &val)

  return true if the item val appears in container v

- Real rel_change_rv (const RealVector &curr_rv, const RealVector &prev_rv)

Computes relative change between successive RealVectors using Euclidean norm.

- MPIPackBuffer & operator<< (MPIPackBuffer &s, const DataInterface &data)
  MPIPackBuffer insertion operator for DataInterface.
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, DataInterface &data)
  MPIUnpackBuffer extraction operator for DataInterface.
- std::ostream & operator<< (std::ostream &s, const DataInterface &data)
  std::ostream insertion operator for DataInterface
- MPIPackBuffer & operator<< (MPIPackBuffer &s, const DataMethod &data)
  MPIPackBuffer insertion operator for DataMethod.
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, DataMethod &data)
  MPIUnpackBuffer extraction operator for DataMethod.
- std::ostream & operator<< (std::ostream &s, const DataMethod &data)
  std::ostream insertion operator for DataMethod
- MPIPackBuffer & operator<< (MPIPackBuffer &s, const DataModel &data)
  MPIPackBuffer insertion operator for DataModel.
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, DataModel &data)
  MPIUnpackBuffer extraction operator for DataModel.
- std::ostream & operator<< (std::ostream &s, const DataModel &data)
  std::ostream insertion operator for DataModel
- MPIPackBuffer & operator<< (MPIPackBuffer &s, const DataResponses &data)
  MPIPackBuffer insertion operator for DataResponses.
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, DataResponses &data)
  MPIUnpackBuffer extraction operator for DataResponses.
- std::ostream & operator<< (std::ostream &s, const DataResponses &data)
  std::ostream insertion operator for DataResponses
- MPIPackBuffer & operator<< (MPIPackBuffer &s, const DataStrategy &data)
  MPIPackBuffer insertion operator for DataStrategy.
- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, DataStrategy &data)
  MPIUnpackBuffer extraction operator for DataStrategy.
- std::ostream & operator<< (std::ostream &s, const DataStrategy &data)
  std::ostream insertion operator for DataStrategy

- MPIPackBuffer & operator<< (MPIPackBuffer &s, const DataVariables &data)

  MPIPackBuffer insertion operator for DataVariables.

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, DataVariables &data)

  MPIUnpackBuffer extraction operator for DataVariables.

- std::ostream & operator<< (std::ostream &s, const DataVariables &data)

  std::ostream insertion operator for DataVariables

- int salinas_main (int argc, char *argv[ ], MPI_Comm *comm)

  subroutine interface to SALINAS simulation code

- int **dlsolver_option** (Opt_Info *)
- void abort_handler (int code)

  global function which handles serial or parallel aborts

- RealVector const * **continuous_lower_bounds** (Optimizer1 *o)
- RealVector const * **continuous_upper_bounds** (Optimizer1 *o)
- RealVector const * **nonlinear_ineq_constraint_lower_bounds** (Optimizer1 *o)
- RealVector const * **nonlinear_ineq_constraint_upper_bounds** (Optimizer1 *o)
- RealVector const * **nonlinear_eq_constraint_targets** (Optimizer1 *o)
- RealVector const * **linear_ineq_constraint_lower_bounds** (Optimizer1 *o)
- RealVector const * **linear_ineq_constraint_upper_bounds** (Optimizer1 *o)
- RealVector const * **linear_eq_constraint_targets** (Optimizer1 *o)
- RealMatrix const * **linear_ineq_constraint_coeffs** (Optimizer1 *o)
- RealMatrix const * **linear_eq_constraint_coeffs** (Optimizer1 *o)
- void **ComputeResponses** (Optimizer1 *o, int mode, int n, double *x)
- void **GetFuncs** (Optimizer1 *o, int m0, int m1, double *f)
- void **GetGrads** (Optimizer1 *o, int m0, int m1, int n, int is, int js, double *g)
- void **GetContVars** (Optimizer1 *o, int n, double *x)
- void **SetBestContVars** (Optimizer1 *o, int n, double *x)
- void **SetBestRespFns** (Optimizer1 *o, int n, double *x)
- void * **dl_constructor** (Optimizer1 *, Dakota_funcs *, dl_find_optimum_t *, dl_destructor_t *)
- static RealVector const * **continuous_lower_bounds1** (Optimizer1 *o)
- static RealVector const * **continuous_upper_bounds1** (Optimizer1 *o)
- static RealVector const * **nonlinear_ineq_constraint_lower_bounds1** (Optimizer1 *o)
- static RealVector const * **nonlinear_ineq_constraint_upper_bounds1** (Optimizer1 *o)
- static RealVector const * **nonlinear_eq_constraint_targets1** (Optimizer1 *o)
- static RealVector const * **linear_ineq_constraint_lower_bounds1** (Optimizer1 *o)
- static RealVector const * **linear_ineq_constraint_upper_bounds1** (Optimizer1 *o)
- static RealVector const * **linear_eq_constraint_targets1** (Optimizer1 *o)
- static RealMatrix const * **linear_eq_constraint_coeffs1** (Optimizer1 *o)
- static RealMatrix const * **linear_ineq_constraint_coeffs1** (Optimizer1 *o)
- static void **ComputeResponses1** (Optimizer1 *o, int mode, int n, double *x)
- static void **GetFuncs1** (Optimizer1 *o, int m0, int m1, double *f)

- static void **GetGrads1** (Optimizer1 ∗o, int m0, int m1, int n, int is, int js, double ∗g)
- static void **GetContVars1** (Optimizer1 ∗o, int n, double ∗x)
- static void **SetBestContVars1** (Optimizer1 ∗o, int n, double ∗x)
- static void **SetBestDiscVars1** (Optimizer1 ∗o, int n, int ∗x)
- static void **SetBestRespFns1** (Optimizer1 ∗o, int n, double ∗x)
- static double **Get_Real1** (Optimizer1 ∗o, const char ∗name)
- static int **Get_Int1** (Optimizer1 ∗o, const char ∗name)
- static bool **Get_Bool1** (Optimizer1 ∗o, const char ∗name)
- DOTOptimizer ∗ **new_DOTOptimizer** (Model &model)
- DOTOptimizer ∗ **new_DOTOptimizer** (NoDBBaseConstructor, Model &model)
- void **dak_sigcatch** (int sig)
- void start_dakota_heartbeat (int seconds)
- int **sftw** (const char ∗name, int(∗fn)(const char ∗file, const struct stat ∗, int ftype, int depth, void ∗v), void ∗v)
- static int **ftw1** (char ∗name, size_t namelen, size_t namemaxlen, ftw_fn fn, int, void ∗v)
- static int **compar** (const void ∗a, const void ∗b)
- static int **dodir** (DIR ∗dir, char ∗name, size_t namelen, size_t namemaxlen, ftw_fn fn, int depth, void ∗v, struct stat ∗sb)
- int **sftw** (const char ∗name, ftw_fn fn, void ∗v)
- static int **Symlink** (const char ∗from, const char ∗to)
- static int **my_recrm** (const char ∗file, const struct stat ∗sb, int ftype, int depth, void ∗v)
- int **rec_rmdir** (const char ∗name)
- static void **buf_incr** (Buf ∗b, size_t Lt)
- int my_cp (const char ∗file, const struct stat ∗sb, int ftype, int depth, void ∗v)
- int **rec_cp** (const char ∗from, const char ∗todir, int copy, int flatten, int replace)
- static char ∗ **pathsimp** (char ∗t0)
- void get_npath (int appdrive, std::string ∗pnpath)
- void **workdir_adjust** (const std::string &workdir)
- std::string get_cwd ()

  Portability adapter for getcwd.

- void putenv_impl (const char ∗name_and_value)

  Utility function from boost/test, not available in the DAKOTA snapshot.

- static HANDLE ∗ **wait_setup** (std::map< pid_t, int > ∗M, size_t ∗pn)
- static int **wait_for_one** (size_t n, HANDLE ∗h, int req1, size_t ∗pi)
- static void **pid_botch** ()
- template<class ListT >
  void **removeAt** (ListT &l, typename ListT::size_type index)
- Real getdist (const RealVector &x1, const RealVector &x2)
- Real mindist (const RealVector &x, const RealMatrix &xset, int except)
- Real mindistindx (const RealVector &x, const RealMatrix &xset, const IntArray &indx)
- Real getRmax (const RealMatrix &xset)
- ParallelLibrary dummy_lib ("dummy")

  dummy ParallelLibrary object used for < mandatory reference initialization when < a real ParallelLibrary instance is < unavailable

- template<typename T >
  T abort_handler_t (int code)
- int start_grid_computing (char *analysis_driver_script, char *params_file, char *results_file)
- int stop_grid_computing ()
- int perform_analysis (char *iteration_num)
- template<typename T >
  string asstring (const T &val)

  Creates a string from the argument val using an ostringstream.

- void run_dakota_data ()

  Function to encapsulate the DAKOTA object instantiations for mode 2: direct Data class instantiation.

- **PACKBUF** (int, MPI_INT)
- **UNPACKBUF** (int, MPI_INT)
- **PACKSIZE** (int, MPI_INT)
- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const int &data)

  insert an int

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const u_int &data)

  insert a u_int

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const long &data)

  insert a long

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const u_long &data)

  insert a u_long

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const short &data)

  insert a short

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const u_short &data)

  insert a u_short

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const char &data)

  insert a char

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const u_char &data)

  insert a u_char

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const double &data)

  insert a double

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const float &data)

  insert a float

- MPIPackBuffer & operator<< (MPIPackBuffer &buff, const bool &data)

  insert a bool

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, int &data)

  extract an int

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, u_int &data)

  extract a u_int

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, long &data)

  extract a long

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, u_long &data)

  extract a u_long

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, short &data)

  extract a short

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, u_short &data)

  extract a u_short

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, char &data)

  extract a char

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, u_char &data)

  extract a u_char

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, double &data)

  extract a double

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, float &data)

  extract a float

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &buff, bool &data)

  extract a bool

- template<class ContainerT >
  void container_read (ContainerT &c, MPIUnpackBuffer &s)

  Read a generic container (vector<T>, list<T>) from MPIUnpackBuffer, s.

- template<class ContainerT >
  void container_write (const ContainerT &c, MPIPackBuffer &s)

  Write a generic container to MPIPackBuffer, s.

- template<class ContainerT >
  MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, ContainerT &data)

global MPIUnpackBuffer extraction operator for generic container

- template<class ContainerT >
  MPIPackBuffer & operator<< (MPIPackBuffer &s, const ContainerT &data)

  global MPIPackBuffer insertion operator for generic container

- int MPIPackSize (const int &data, const int num=1)

  return packed size of an int

- int MPIPackSize (const u_int &data, const int num=1)

  return packed size of a u_int

- int MPIPackSize (const long &data, const int num=1)

  return packed size of a long

- int MPIPackSize (const u_long &data, const int num=1)

  return packed size of a u_long

- int MPIPackSize (const short &data, const int num=1)

  return packed size of a short

- int MPIPackSize (const u_short &data, const int num=1)

  return packed size of a u_short

- int MPIPackSize (const char &data, const int num=1)

  return packed size of a char

- int MPIPackSize (const u_char &data, const int num=1)

  return packed size of a u_char

- int MPIPackSize (const double &data, const int num=1)

  return packed size of a double

- int MPIPackSize (const float &data, const int num=1)

  return packed size of a float

- int MPIPackSize (const bool &data, const int num=1)

  return packed size of a bool

- int **nidr_parse** (const char ∗, FILE ∗)
- int **not_executable** (const char ∗driver_name, const char ∗tdir)
- static void **scale_chk** (StringArray &ST, RealVector &S, const char ∗what, const char ∗∗univ)
- static void **BuildLabels** (StringArray ∗sa, size_t nsa, size_t n1, size_t n2, const char ∗stub)
- static int **flist_check** (IntList ∗L, int n, IntArray ∗iv, const char ∗what)
- static void **flist_check2** (size_t n, IntArray ∗iv, const char ∗what)
- static int **wronglen** (size_t n, RealVector ∗V, const char ∗what)

- static int **wronglen2** (size_t n, IntVector ∗V, const char ∗what)
- static void **Vcopyup** (RealVector ∗V, RealVector ∗M, size_t i, size_t n)
- static void **Set_rdv** (RealVector ∗V, double d, size_t n)
- static void **Vadj_Normal** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_normalUnc** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Lognormal** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_lognormalUnc** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Uniform** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_uniformUnc** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Loguniform** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_loguniformUnc** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Triangular** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_triangularUnc** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Exponential** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_Exponential** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Beta** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_betaUnc** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Gamma** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_Gamma** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Gumbel** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_Gumbel** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Frechet** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_Frechet** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Weibull** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_Weibull** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_HistogramBin** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_Poisson** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_Binomial** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_NegBinomial** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_Geometric** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_HyperGeom** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_HistogramPt** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_HistogramBin** (DataVariablesRep ∗dv, size_t i0)
- static void **Vbgen_HistogramPt** (DataVariablesRep ∗dv, size_t i0)
- static void **Vadj_Interval** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vbgen_Interval** (DataVariablesRep ∗dv, size_t i0)
- static void **Vbgen_Poisson** (DataVariablesRep ∗dv, size_t i0)
- static void **Vbgen_Binomial** (DataVariablesRep ∗dv, size_t i0)
- static void **Vbgen_NegBinomial** (DataVariablesRep ∗dv, size_t i0)
- static void **Vbgen_Geometric** (DataVariablesRep ∗dv, size_t i0)
- static void **Vbgen_HyperGeom** (DataVariablesRep ∗dv, size_t i0)
- static void **DIset** (size_t n, IntSetArray ∗a, IntVector ∗L, IntVector ∗U, IntVector ∗V)
- static void **DRset** (size_t n, RealSetArray ∗a, RealVector ∗L, RealVector ∗U, RealVector ∗V)
- static void **Vbgen_DDSI** (DataVariablesRep ∗dv, size_t n)
- static void **Vbgen_DDSR** (DataVariablesRep ∗dv, size_t n)
- static void **Vbgen_DSSI** (DataVariablesRep ∗dv, size_t n)

- static void **Vbgen_DSSR** (DataVariablesRep ∗dv, size_t n)
- static void **not_div** (const char ∗kind, size_t nsv, size_t m)
- static void **wrong_number** (const char ∗what, const char ∗kind, size_t nsv, size_t m)
- static void **too_small** (const char ∗kind)
- static void **suppressed** (const char ∗kind, int ndup, int ∗ip, Real ∗rp)
- static void **bad_initial_ivalue** (const char ∗kind, int val)
- static void **bad_initial_rvalue** (const char ∗kind, Real val)
- static void **Vadj_DiscreteDesSetReal** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_DiscreteDesSetInt** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_DiscreteStateSetReal** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Vadj_DiscreteStateSetInt** (DataVariablesRep ∗dv, size_t i0, Var_Info ∗vi)
- static void **Rdv_copy** (RealVector ∗∗prdv, RealVectorArray ∗rdva)
- static void **var_iulbl** (const char ∗keyname, Values ∗val, VarLabel ∗vl)
- static Iface_mp_Rlit **MP3** (failAction, recoveryFnVals, recover)
- static Iface_mp_ilit **MP3** (failAction, retryLimit, retry)
- static Iface_mp_lit **MP2** (analysisScheduling, self)
- static Iface_mp_lit **MP2** (analysisScheduling, static)
- static Iface_mp_lit **MP2** (evalScheduling, self)
- static Iface_mp_lit **MP2** (evalScheduling, static)
- static Iface_mp_lit **MP2** (failAction, abort)
- static Iface_mp_lit **MP2** (failAction, continuation)
- static Iface_mp_lit **MP2** (interfaceSynchronization, asynchronous)
- static Iface_mp_lit **MP2** (interfaceType, direct)
- static Iface_mp_lit **MP2** (interfaceType, fork)
- static Iface_mp_lit **MP2** (interfaceType, grid)
- static Iface_mp_lit **MP2** (interfaceType, system)
- static Iface_mp_lit **MP2** (asynchLocalEvalScheduling, self)
- static Iface_mp_lit **MP2** (asynchLocalEvalScheduling, static)
- static String **MP_** (idInterface)
- static String **MP_** (inputFilter)
- static String **MP_** (outputFilter)
- static String **MP_** (parametersFile)
- static String **MP_** (resultsFile)
- static String **MP_** (templateDir)
- static String **MP_** (workDir)
- static String2DArray **MP_** (analysisComponents)
- static StringArray **MP_** (analysisDrivers)
- static StringArray **MP_** (templateFiles)
- static bool **MP_** (activeSetVectorFlag)
- static bool **MP_** (allowExistingResultsFlag)
- static bool **MP_** (apreproFlag)
- static bool **MP_** (dirSave)
- static bool **MP_** (dirTag)
- static bool **MP_** (evalCacheFlag)
- static bool **MP_** (fileSaveFlag)
- static bool **MP_** (fileTagFlag)

- static bool **MP_** (restartFileFlag)
- static bool **MP_** (templateCopy)
- static bool **MP_** (templateReplace)
- static bool **MP_** (useWorkdir)
- static bool **MP_** (verbatimFlag)
- static int **MP_** (analysisServers)
- static int **MP_** (asynchLocalAnalysisConcurrency)
- static int **MP_** (asynchLocalEvalConcurrency)
- static int **MP_** (evalServers)
- static int **MP_** (procsPerAnalysis)
- static IntVector **MP_** (primeBase)
- static IntVector **MP_** (sequenceLeap)
- static IntVector **MP_** (sequenceStart)
- static IntVector **MP_** (stepsPerVariable)
- static Method_mp_ilit2 **MP3** (replacementType, numberRetained, chc)
- static Method_mp_ilit2 **MP3** (replacementType, numberRetained, elitist)
- static Method_mp_ilit2 **MP3** (replacementType, numberRetained, random)
- static Method_mp_ilit2z **MP3** (crossoverType, numCrossPoints, multi_point_binary)
- static Method_mp_ilit2z **MP3** (crossoverType, numCrossPoints, multi_point_parameterized_binary)
- static Method_mp_ilit2z **MP3** (crossoverType, numCrossPoints, multi_point_real)
- static Method_mp_lit **MP2** (boxDivision, all_dimensions)
- static Method_mp_lit **MP2** (boxDivision, major_dimension)
- static Method_mp_lit **MP2** (collocPtReuse, all)
- static Method_mp_lit **MP2** (convergenceType, average_fitness_tracker)
- static Method_mp_lit **MP2** (convergenceType, best_fitness_tracker)
- static Method_mp_lit **MP2** (convergenceType, metric_tracker)
- static Method_mp_lit **MP2** (crossoverType, blend)
- static Method_mp_lit **MP2** (crossoverType, two_point)
- static Method_mp_lit **MP2** (crossoverType, uniform)
- static Method_mp_lit **MP2** (evalSynchronization, blocking)
- static Method_mp_lit **MP2** (evalSynchronization, nonblocking)
- static Method_mp_lit **MP2** (evalSynchronize, blocking)
- static Method_mp_lit **MP2** (evalSynchronize, nonblocking)
- static Method_mp_lit **MP2** (expansionSampleType, incremental_lhs)
- static Method_mp_lit **MP2** (exploratoryMoves, adaptive)
- static Method_mp_lit **MP2** (exploratoryMoves, multi_step)
- static Method_mp_lit **MP2** (exploratoryMoves, simple)
- static Method_mp_lit **MP2** (fitnessType, domination_count)
- static Method_mp_lit **MP2** (fitnessType, layer_rank)
- static Method_mp_lit **MP2** (fitnessType, linear_rank)
- static Method_mp_lit **MP2** (fitnessType, merit_function)
- static Method_mp_lit **MP2** (fitnessType, proportional)
- static Method_mp_lit **MP2** (initializationType, random)
- static Method_mp_lit **MP2** (initializationType, unique_random)
- static Method_mp_lit **MP2** (integrationRefine, ais)
- static Method_mp_lit **MP2** (integrationRefine, is)

- static Method_mp_lit **MP2** (integrationRefine, mmais)
- static Method_mp_lit **MP2** (meritFunction, merit_max)
- static Method_mp_lit **MP2** (meritFunction, merit_max_smooth)
- static Method_mp_lit **MP2** (meritFunction, merit1)
- static Method_mp_lit **MP2** (meritFunction, merit1_smooth)
- static Method_mp_lit **MP2** (meritFunction, merit2)
- static Method_mp_lit **MP2** (meritFunction, merit2_smooth)
- static Method_mp_lit **MP2** (meritFunction, merit2_squared)
- static Method_mp_lit **MP2** (methodName, asynch_pattern_search)
- static Method_mp_lit **MP2** (methodName, coliny_cobyla)
- static Method_mp_lit **MP2** (methodName, coliny_direct)
- static Method_mp_lit **MP2** (methodName, coliny_pattern_search)
- static Method_mp_lit **MP2** (methodName, coliny_solis_wets)
- static Method_mp_lit **MP2** (methodName, conmin_frcg)
- static Method_mp_lit **MP2** (methodName, conmin_mfd)
- static Method_mp_lit **MP2** (methodName, dace)
- static Method_mp_lit **MP2** (methodName, dot_bfgs)
- static Method_mp_lit **MP2** (methodName, dot_frcg)
- static Method_mp_lit **MP2** (methodName, dot_mmfd)
- static Method_mp_lit **MP2** (methodName, dot_slp)
- static Method_mp_lit **MP2** (methodName, dot_sqp)
- static Method_mp_lit **MP2** (methodName, efficient_global)
- static Method_mp_lit **MP2** (methodName, fsu_cvt)
- static Method_mp_lit **MP2** (methodName, fsu_halton)
- static Method_mp_lit **MP2** (methodName, fsu_hammersley)
- static Method_mp_lit **MP2** (methodName, ncsu_direct)
- static Method_mp_lit **MP2** (methodName, nl2sol)
- static Method_mp_lit **MP2** (methodName, nlpql_sqp)
- static Method_mp_lit **MP2** (methodName, nlssol_sqp)
- static Method_mp_lit **MP2** (methodName, nond_bayes_calibration)
- static Method_mp_lit **MP2** (methodName, nond_global_evidence)
- static Method_mp_lit **MP2** (methodName, nond_global_interval_est)
- static Method_mp_lit **MP2** (methodName, nond_global_reliability)
- static Method_mp_lit **MP2** (methodName, nond_importance_sampling)
- static Method_mp_lit **MP2** (methodName, nond_local_evidence)
- static Method_mp_lit **MP2** (methodName, nond_local_interval_est)
- static Method_mp_lit **MP2** (methodName, nond_polynomial_chaos)
- static Method_mp_lit **MP2** (methodName, nond_sampling)
- static Method_mp_lit **MP2** (methodName, nond_stoch_collocation)
- static Method_mp_lit **MP2** (methodName, nonlinear_cg)
- static Method_mp_lit **MP2** (methodName, npsol_sqp)
- static Method_mp_lit **MP2** (methodName, optpp_cg)
- static Method_mp_lit **MP2** (methodName, optpp_fd_newton)
- static Method_mp_lit **MP2** (methodName, optpp_g_newton)
- static Method_mp_lit **MP2** (methodName, optpp_newton)
- static Method_mp_lit **MP2** (methodName, optpp_pds)

- static Method_mp_lit **MP2** (methodName, optpp_q_newton)
- static Method_mp_lit **MP2** (methodName, psuade_moat)
- static Method_mp_lit **MP2** (methodName, richardson_extrap)
- static Method_mp_lit **MP2** (methodName, surrogate_based_global)
- static Method_mp_lit **MP2** (methodName, surrogate_based_local)
- static Method_mp_lit **MP2** (methodName, vector_parameter_study)
- static Method_mp_lit **MP2** (methodName, list_parameter_study)
- static Method_mp_lit **MP2** (methodName, centered_parameter_study)
- static Method_mp_lit **MP2** (methodName, multidim_parameter_study)
- static Method_mp_lit **MP2** (metropolisType, adaptive)
- static Method_mp_lit **MP2** (metropolisType, hastings)
- static Method_mp_lit **MP2** (minMaxType, maximize)
- static Method_mp_lit **MP2** (minMaxType, minimize)
- static Method_mp_lit **MP2** (mutationType, bit_random)
- static Method_mp_lit **MP2** (mutationType, offset_cauchy)
- static Method_mp_lit **MP2** (mutationType, offset_normal)
- static Method_mp_lit **MP2** (mutationType, offset_uniform)
- static Method_mp_lit **MP2** (mutationType, replace_uniform)
- static Method_mp_lit **MP2** (nondOptAlgorithm, nip)
- static Method_mp_lit **MP2** (nondOptAlgorithm, sqp)
- static Method_mp_lit **MP2** (nondOptAlgorithm, lhs)
- static Method_mp_lit **MP2** (nondOptAlgorithm, ego)
- static Method_mp_lit **MP2** (patternBasis, coordinate)
- static Method_mp_lit **MP2** (patternBasis, simplex)
- static Method_mp_lit **MP2** (rejectionType, standard)
- static Method_mp_lit **MP2** (rejectionType, delayed)
- static Method_mp_lit **MP2** (reliabilityIntegration, first_order)
- static Method_mp_lit **MP2** (reliabilityIntegration, second_order)
- static Method_mp_lit **MP2** (reliabilitySearchType, amv_plus_u)
- static Method_mp_lit **MP2** (reliabilitySearchType, amv_plus_x)
- static Method_mp_lit **MP2** (reliabilitySearchType, amv_u)
- static Method_mp_lit **MP2** (reliabilitySearchType, amv_x)
- static Method_mp_lit **MP2** (reliabilitySearchType, egra_u)
- static Method_mp_lit **MP2** (reliabilitySearchType, egra_x)
- static Method_mp_lit **MP2** (reliabilitySearchType, no_approx)
- static Method_mp_lit **MP2** (reliabilitySearchType, tana_u)
- static Method_mp_lit **MP2** (reliabilitySearchType, tana_x)
- static Method_mp_lit **MP2** (replacementType, elitist)
- static Method_mp_lit **MP2** (replacementType, favor_feasible)
- static Method_mp_lit **MP2** (replacementType, roulette_wheel)
- static Method_mp_lit **MP2** (replacementType, unique_roulette_wheel)
- static Method_mp_lit **MP2** (rngName, mt19937)
- static Method_mp_lit **MP2** (rngName, rnum2)
- static Method_mp_lit **MP2** (sampleType, incremental_lhs)
- static Method_mp_lit **MP2** (sampleType, incremental_random)
- static Method_mp_lit **MP2** (sampleType, lhs)

- static Method_mp_lit **MP2** (sampleType, random)
- static Method_mp_lit **MP2** (searchMethod, gradient_based_line_search)
- static Method_mp_lit **MP2** (searchMethod, tr_pds)
- static Method_mp_lit **MP2** (searchMethod, trust_region)
- static Method_mp_lit **MP2** (searchMethod, value_based_line_search)
- static Method_mp_lit **MP2** (subMethodName, box_behnken)
- static Method_mp_lit **MP2** (subMethodName, central_composite)
- static Method_mp_lit **MP2** (subMethodName, gpmsa)
- static Method_mp_lit **MP2** (subMethodName, grid)
- static Method_mp_lit **MP2** (subMethodName, lhs)
- static Method_mp_lit **MP2** (subMethodName, oa_lhs)
- static Method_mp_lit **MP2** (subMethodName, oas)
- static Method_mp_lit **MP2** (subMethodName, queso)
- static Method_mp_lit **MP2** (subMethodName, random)
- static Method_mp_lit **MP2** (subMethodName, converge_order)
- static Method_mp_lit **MP2** (subMethodName, converge_qoi)
- static Method_mp_lit **MP2** (subMethodName, estimate_order)
- static Method_mp_lit **MP2** (trialType, grid)
- static Method_mp_lit **MP2** (trialType, halton)
- static Method_mp_lit **MP2** (trialType, random)
- static Method_mp_lit2 **MP4** (methodName, reliabilitySearchType, nond_local_reliability,"mv")
- static Method_mp_litc **MP3** (crossoverType, crossoverRate, shuffle_random)
- static Method_mp_litc **MP3** (crossoverType, crossoverRate, null_crossover)
- static Method_mp_litc **MP3** (mutationType, mutationRate, null_mutation)
- static Method_mp_litc **MP3** (mutationType, mutationRate, offset_cauchy)
- static Method_mp_litc **MP3** (mutationType, mutationRate, offset_normal)
- static Method_mp_litc **MP3** (mutationType, mutationRate, offset_uniform)
- static Method_mp_litc **MP3** (replacementType, fitnessLimit, below_limit)
- static Method_mp_litrv **MP3** (nichingType, nicheVector, distance)
- static Method_mp_litrv **MP3** (nichingType, nicheVector, radial)
- static Method_mp_litrv **MP3** (postProcessorType, distanceVector, distance_postprocessor)
- static Method_mp_slit2 **MP3** (initializationType, flatFile, flat_file)
- static Method_mp_slit2 **MP3** (methodName, dlDetails, dl_solver)
- static Real **MP_** (absConvTol)
- static Real **MP_** (centeringParam)
- static Real **MP_** (collocationRatio)
- static Real **MP_** (collocRatioTermsOrder)
- static Real **MP_** (constraintPenalty)
- static Real **MP_** (constrPenalty)
- static Real **MP_** (constraintTolerance)
- static Real **MP_** (contractFactor)
- static Real **MP_** (contractStepLength)
- static Real **MP_** (convergenceTolerance)
- static Real **MP_** (crossoverRate)
- static Real **MP_** (falseConvTol)
- static Real **MP_** (functionPrecision)

- static Real **MP_** (globalBalanceParam)
- static Real **MP_** (gradientTolerance)
- static Real **MP_** (initDelta)
- static Real **MP_** (initStepLength)
- static Real **MP_** (initTRRadius)
- static Real **MP_** (likelihoodScale)
- static Real **MP_** (lineSearchTolerance)
- static Real **MP_** (localBalanceParam)
- static Real **MP_** (maxBoxSize)
- static Real **MP_** (maxStep)
- static Real **MP_** (minBoxSize)
- static Real **MP_** (mutationRate)
- static Real **MP_** (mutationScale)
- static Real **MP_** (proposalCovScale)
- static Real **MP_** (refinementRate)
- static Real **MP_** (shrinkagePercent)
- static Real **MP_** (singConvTol)
- static Real **MP_** (singRadius)
- static Real **MP_** (smoothFactor)
- static Real **MP_** (solnTarget)
- static Real **MP_** (stepLenToBoundary)
- static Real **MP_** (surrBasedLocalTRContract)
- static Real **MP_** (surrBasedLocalTRContractTrigger)
- static Real **MP_** (surrBasedLocalTRExpand)
- static Real **MP_** (surrBasedLocalTRExpandTrigger)
- static Real **MP_** (surrBasedLocalTRInitSize)
- static Real **MP_** (surrBasedLocalTRMinSize)
- static Real **MP_** (threshDelta)
- static Real **MP_** (threshStepLength)
- static Real **MP_** (vbdDropTolerance)
- static Real **MP_** (volBoxSize)
- static Real **MP_** (xConvTol)
- static RealVector **MP_** (anisoGridDimPref)
- static RealVector **MP_** (finalPoint)
- static RealVector **MP_** (linearEqConstraintCoeffs)
- static RealVector **MP_** (linearEqScales)
- static RealVector **MP_** (linearEqTargets)
- static RealVector **MP_** (linearIneqConstraintCoeffs)
- static RealVector **MP_** (linearIneqLowerBnds)
- static RealVector **MP_** (linearIneqUpperBnds)
- static RealVector **MP_** (linearIneqScales)
- static RealVector **MP_** (listOfPoints)
- static RealVector **MP_** (stepVector)
- static RealVectorArray **MP_** (genReliabilityLevels)
- static RealVectorArray **MP_** (probabilityLevels)
- static RealVectorArray **MP_** (reliabilityLevels)

- static RealVectorArray **MP_** (responseLevels)
- static unsigned short **MP_** (cubIntOrder)
- static UShortArray **MP_** (expansionOrder)
- static UShortArray **MP_** (quadratureOrder)
- static UShortArray **MP_** (sparseGridLevel)
- static UShortArray **MP_** (varPartitions)
- static String **MP_** (centralPath)
- static String **MP_** (expansionImportFile)
- static String **MP_** (idMethod)
- static String **MP_** (logFile)
- static String **MP_** (meritFn)
- static String **MP_** (modelPointer)
- static String **MP_** (subMethodName)
- static String **MP_** (subMethodPointer)
- static StringArray **MP_** (linearEqScaleTypes)
- static StringArray **MP_** (linearIneqScaleTypes)
- static StringArray **MP_** (miscOptions)
- static bool **MP_** (allVarsFlag)
- static bool **MP_** (constantPenalty)
- static bool **MP_** (expansionFlag)
- static bool **MP_** (fixedSeedFlag)
- static bool **MP_** (fixedSequenceFlag)
- static bool **MP_** (latinizeFlag)
- static bool **MP_** (mainEffectsFlag)
- static bool **MP_** (methodScaling)
- static bool **MP_** (methodUseDerivsFlag)
- static bool **MP_** (mutationAdaptive)
- static bool **MP_** (printPopFlag)
- static bool **MP_** (probCollocFlag)
- static bool **MP_** (randomizeOrderFlag)
- static bool **MP_** (regressDiag)
- static bool **MP_** (showMiscOptions)
- static bool **MP_** (speculativeFlag)
- static bool **MP_** (surrBasedGlobalReplacePts)
- static bool **MP_** (surrBasedLocalLayerBypass)
- static bool **MP_** (vbdFlag)
- static bool **MP_** (volQualityFlag)
- static short **MP_** (expansionType)
- static short **MP_** (nestingOverride)
- static short **MP_** (refinementType)
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- static int **MP_** (contractAfterFail)
- static int **MP_** (covarianceType)
- static int **MP_** (emulatorSamples)
- static int **MP_** (expandAfterSuccess)
- static int **MP_** (expansionSamples)

- static int **MP_** (expansionTerms)
- static int **MP_** (maxFunctionEvaluations)
- static int **MP_** (maxIterations)
- static int **MP_** (mutationRange)
- static int **MP_** (newSolnsGenerated)
- static int **MP_** (numSamples)
- static int **MP_** (numSteps)
- static int **MP_** (numSymbols)
- static int **MP_** (numTrials)
- static int **MP_** (populationSize)
- static int **MP_** (previousSamples)
- static int **MP_** (randomSeed)
- static int **MP_** (searchSchemeSize)
- static int **MP_** (surrBasedLocalSoftConvLimit)
- static int **MP_** (totalPatternSize)
- static int **MP_** (verifyLevel)
- static size_t **MP_** (numFinalSolutions)
- static size_t **MP_** (numGenerations)
- static size_t **MP_** (numOffspring)
- static size_t **MP_** (numParents)
- static Method_mp_type **MP2s** (distributionType, COMPLEMENTARY)
- static Method_mp_type **MP2s** (distributionType, CUMULATIVE)
- static Method_mp_type **MP2s** (emulatorType, GAUSSIAN_PROCESS)
- static Method_mp_type **MP2s** (emulatorType, KRIGING)
- static Method_mp_type **MP2s** (emulatorType, POLYNOMIAL_CHAOS)
- static Method_mp_type **MP2s** (emulatorType, STOCHASTIC_COLLOCATION)
- static Method_mp_type **MP2s** (expansionType, ASKEY_U)
- static Method_mp_type **MP2s** (expansionType, STD_NORMAL_U)
- static Method_mp_type **MP2p** (growthOverride, RESTRICTED)
- static Method_mp_type **MP2p** (growthOverride, UNRESTRICTED)
- static Method_mp_type **MP2s** (methodOutput, DEBUG_OUTPUT)
- static Method_mp_type **MP2s** (methodOutput, NORMAL_OUTPUT)
- static Method_mp_type **MP2s** (methodOutput, QUIET_OUTPUT)
- static Method_mp_type **MP2s** (methodOutput, SILENT_OUTPUT)
- static Method_mp_type **MP2s** (methodOutput, VERBOSE_OUTPUT)
- static Method_mp_type **MP2p** (nestingOverride, NESTED)
- static Method_mp_type **MP2p** (nestingOverride, NON_NESTED)
- static Method_mp_type **MP2s** (piecewiseBasisType, NODAL_INTERPOLANT)
- static Method_mp_type **MP2s** (piecewiseBasisType, HIERARCHICAL_INTERPOLANT)
- static Method_mp_type **MP2p** (refinementControl, DIMENSION_ADAPTIVE_CONTROL_-GENERALIZED)
- static Method_mp_type **MP2p** (refinementControl, DIMENSION_ADAPTIVE_CONTROL_DECAY)
- static Method_mp_type **MP2p** (refinementControl, DIMENSION_ADAPTIVE_CONTROL_SOBOL)
- static Method_mp_type **MP2p** (refinementControl, LOCAL_ADAPTIVE_CONTROL)
- static Method_mp_type **MP2p** (refinementControl, UNIFORM_CONTROL)
- static Method_mp_type **MP2p** (refinementType, P_REFINEMENT)

- static Method_mp_type **MP2p** (refinementType, H_REFINEMENT)
- static Method_mp_type **MP2s** (responseLevelTarget, GEN_RELIABILITIES)
- static Method_mp_type **MP2s** (responseLevelTarget, PROBABILITIES)
- static Method_mp_type **MP2s** (responseLevelTarget, RELIABILITIES)
- static Method_mp_type **MP2s** (responseLevelTargetReduce, SYSTEM_PARALLEL)
- static Method_mp_type **MP2s** (responseLevelTargetReduce, SYSTEM_SERIES)
- static Method_mp_type **MP2s** (surrBasedLocalAcceptLogic, FILTER)
- static Method_mp_type **MP2s** (surrBasedLocalAcceptLogic, TR_RATIO)
- static Method_mp_type **MP2s** (surrBasedLocalConstrRelax, HOMOTOPY)
- static Method_mp_type **MP2s** (surrBasedLocalMeritFn, ADAPTIVE_PENALTY_MERIT)
- static Method_mp_type **MP2s** (surrBasedLocalMeritFn, AUGMENTED_LAGRANGIAN_MERIT)
- static Method_mp_type **MP2s** (surrBasedLocalMeritFn, LAGRANGIAN_MERIT)
- static Method_mp_type **MP2s** (surrBasedLocalMeritFn, PENALTY_MERIT)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbCon, LINEARIZED_CONSTRAINTS)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbCon, NO_CONSTRAINTS)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbCon, ORIGINAL_CONSTRAINTS)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbObj, AUGMENTED_LAGRANGIAN_-OBJECTIVE)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbObj, LAGRANGIAN_OBJECTIVE)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbObj, ORIGINAL_PRIMARY)
- static Method_mp_type **MP2s** (surrBasedLocalSubProbObj, SINGLE_OBJECTIVE)
- static Method_mp_type **MP2p** (vbdControl, UNIVARIATE_VBD)
- static IntSet **MP_** (surrogateFnIndices)
- static Model_mp_lit **MP2** (approxPointReuse, all)
- static Model_mp_lit **MP2** (approxPointReuse, none)
- static Model_mp_lit **MP2** (approxPointReuse, region)
- static Model_mp_lit **MP2** (marsInterpolation, linear)
- static Model_mp_lit **MP2** (marsInterpolation, cubic)
- static Model_mp_lit **MP2** (modelType, nested)
- static Model_mp_lit **MP2** (modelType, single)
- static Model_mp_lit **MP2** (modelType, surrogate)
- static Model_mp_lit **MP2** (surrogateType, hierarchical)
- static Model_mp_lit **MP2** (surrogateType, global_gaussian)
- static Model_mp_lit **MP2** (surrogateType, global_kriging)
- static Model_mp_lit **MP2** (surrogateType, global_mars)
- static Model_mp_lit **MP2** (surrogateType, global_moving_least_squares)
- static Model_mp_lit **MP2** (surrogateType, global_neural_network)
- static Model_mp_lit **MP2** (surrogateType, global_polynomial)
- static Model_mp_lit **MP2** (surrogateType, global_radial_basis)
- static Model_mp_lit **MP2** (surrogateType, local_taylor)
- static Model_mp_lit **MP2** (surrogateType, multipoint_tana)
- static Model_mp_lit **MP2** (trendOrder, constant)
- static Model_mp_lit **MP2** (trendOrder, linear)
- static Model_mp_lit **MP2** (trendOrder, reduced_quadratic)
- static Model_mp_lit **MP2** (trendOrder, quadratic)
- static Model_mp_ord **MP2s** (approxCorrectionOrder, 0)

- static Model_mp_ord **MP2s** (approxCorrectionOrder, 1)
- static Model_mp_ord **MP2s** (approxCorrectionOrder, 2)
- static Model_mp_ord **MP2s** (polynomialOrder, 1)
- static Model_mp_ord **MP2s** (polynomialOrder, 2)
- static Model_mp_ord **MP2s** (polynomialOrder, 3)
- static Model_mp_type **MP2s** (approxCorrectionType, ADDITIVE_CORRECTION)
- static Model_mp_type **MP2s** (approxCorrectionType, COMBINED_CORRECTION)
- static Model_mp_type **MP2s** (approxCorrectionType, MULTIPLICATIVE_CORRECTION)
- static Model_mp_type **MP2s** (pointsManagement, MINIMUM_POINTS)
- static Model_mp_type **MP2s** (pointsManagement, RECOMMENDED_POINTS)
- static Real **MP_** (annRange)
- static RealVector **MP_** (krigingCorrelations)
- static RealVector **MP_** (primaryRespCoeffs)
- static RealVector **MP_** (secondaryRespCoeffs)
- static String **MP_** (approxPointReuseFile)
- static String **MP_** (idModel)
- static String **MP_** (interfacePointer)
- static String **MP_** (krigingOptMethod)
- static String **MP_** (lowFidelityModelPointer)
- static String **MP_** (optionalInterfRespPointer)
- static String **MP_** (responsesPointer)
- static String **MP_** (truthModelPointer)
- static String **MP_** (variablesPointer)
- static StringArray **MP_** (primaryVarMaps)
- static StringArray **MP_** (secondaryVarMaps)
- static StringArray **MP_** (diagMetrics)
- static bool **MP_** (approxPointFileAnnotated)
- static bool **MP_** (modelUseDerivsFlag)
- static bool **MP_** (pointSelection)
- static short **MP_** (annNodes)
- static short **MP_** (annRandomWeight)
- static short **MP_** (krigingMaxTrials)
- static short **MP_** (marsMaxBases)
- static short **MP_** (mlsPolyOrder)
- static short **MP_** (mlsWeightFunction)
- static short **MP_** (rbfBases)
- static short **MP_** (rbfMaxPts)
- static short **MP_** (rbfMaxSubsets)
- static short **MP_** (rbfMinPartition)
- static int **MP_** (pointsTotal)
- static IntList **MP_** (idAnalyticGrads)
- static IntList **MP_** (idAnalyticHessians)
- static IntList **MP_** (idNumericalGrads)
- static IntList **MP_** (idNumericalHessians)
- static IntList **MP_** (idQuasiHessians)
- static RealVector **MP_** (expConfigVars)

- static RealVector **MP_** (expObservations)
- static RealVector **MP_** (expStdDeviations)
- static RealVector **MP_** (primaryRespFnWeights)
- static RealVector **MP_** (nonlinearEqTargets)
- static RealVector **MP_** (nonlinearIneqLowerBnds)
- static RealVector **MP_** (nonlinearIneqUpperBnds)
- static RealVector **MP_** (fdGradStepSize)
- static RealVector **MP_** (fdHessStepSize)
- static RealVector **MP_** (primaryRespFnScales)
- static RealVector **MP_** (nonlinearEqScales)
- static RealVector **MP_** (nonlinearIneqScales)
- static Resp_mp_lit **MP2** (gradientType, analytic)
- static Resp_mp_lit **MP2** (gradientType, mixed)
- static Resp_mp_lit **MP2** (gradientType, none)
- static Resp_mp_lit **MP2** (gradientType, numerical)
- static Resp_mp_lit **MP2** (hessianType, analytic)
- static Resp_mp_lit **MP2** (hessianType, mixed)
- static Resp_mp_lit **MP2** (hessianType, none)
- static Resp_mp_lit **MP2** (hessianType, numerical)
- static Resp_mp_lit **MP2** (hessianType, quasi)
- static Resp_mp_lit **MP2** (intervalType, central)
- static Resp_mp_lit **MP2** (intervalType, forward)
- static Resp_mp_lit **MP2** (methodSource, dakota)
- static Resp_mp_lit **MP2** (methodSource, vendor)
- static Resp_mp_lit **MP2** (quasiHessianType, bfgs)
- static Resp_mp_lit **MP2** (quasiHessianType, damped_bfgs)
- static Resp_mp_lit **MP2** (quasiHessianType, sr1)
- static String **MP_** (expDataFileName)
- static String **MP_** (idResponses)
- static StringArray **MP_** (primaryRespFnScaleTypes)
- static StringArray **MP_** (nonlinearEqScaleTypes)
- static StringArray **MP_** (nonlinearIneqScaleTypes)
- static StringArray **MP_** (responseLabels)
- static bool **MP_** (centralHess)
- static bool **MP_** (expDataFileAnnotated)
- static bool **MP_** (ignoreBounds)
- static size_t **MP_** (numExpStdDeviations)
- static size_t **MP_** (numExpConfigVars)
- static size_t **MP_** (numExperiments)
- static size_t **MP_** (numLeastSqTerms)
- static size_t **MP_** (numNonlinearEqConstraints)
- static size_t **MP_** (numNonlinearIneqConstraints)
- static size_t **MP_** (numObjectiveFunctions)
- static size_t **MP_** (numResponseFunctions)
- static Real **MP_** (hybridLSProb)
- static RealVector **MP_** (concurrentParameterSets)

- static Strategy_mp_lit **MP2** (hybridType, collaborative)
- static Strategy_mp_lit **MP2** (hybridType, embedded)
- static Strategy_mp_lit **MP2** (hybridType, sequential)
- static Strategy_mp_lit **MP2** (iteratorScheduling, self)
- static Strategy_mp_lit **MP2** (iteratorScheduling, static)
- static Strategy_mp_lit **MP2** (strategyType, hybrid)
- static Strategy_mp_lit **MP2** (strategyType, multi_start)
- static Strategy_mp_lit **MP2** (strategyType, pareto_set)
- static Strategy_mp_lit **MP2** (strategyType, single_method)
- static String **MP_** (hybridGlobalMethodPointer)
- static String **MP_** (hybridLocalMethodPointer)
- static String **MP_** (methodPointer)
- static String **MP_** (tabularDataFile)
- static StringArray **MP_** (hybridMethodList)
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- static bool **MP_** (tabularDataFlag)
- static int **MP_** (concurrentRandomJobs)
- static int **MP_** (concurrentSeed)
- static int **MP_** (iteratorServers)
- static int **MP_** (outputPrecision)
- static size_t **MP_** (numBetaUncVars)
- static size_t **MP_** (numBinomialUncVars)
- static size_t **MP_** (numContinuousDesVars)
- static size_t **MP_** (numContinuousStateVars)
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- static size_t **MP_** (numDiscreteDesSetIntVars)
- static size_t **MP_** (numDiscreteDesSetRealVars)
- static size_t **MP_** (numDiscreteStateRangeVars)
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- static size_t **MP_** (numDiscreteStateSetRealVars)
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- static size_t **MP_** (numFrechetUncVars)
- static size_t **MP_** (numGammaUncVars)
- static size_t **MP_** (numGeometricUncVars)
- static size_t **MP_** (numGumbelUncVars)
- static size_t **MP_** (numHistogramBinUncVars)
- static size_t **MP_** (numHistogramPtUncVars)
- static size_t **MP_** (numHyperGeomUncVars)
- static size_t **MP_** (numIntervalUncVars)
- static size_t **MP_** (numLognormalUncVars)
- static size_t **MP_** (numLoguniformUncVars)
- static size_t **MP_** (numNegBinomialUncVars)
- static size_t **MP_** (numNormalUncVars)
- static size_t **MP_** (numPoissonUncVars)
- static size_t **MP_** (numTriangularUncVars)
- static size_t **MP_** (numUniformUncVars)

- static size_t **MP_** (numWeibullUncVars)
- static IntVector **MP_** (binomialUncNumTrials)
- static IntVector **MP_** (hyperGeomUncTotalPop)
- static IntVector **MP_** (hyperGeomUncSelectedPop)
- static IntVector **MP_** (hyperGeomUncNumDrawn)
- static IntVector **MP_** (negBinomialUncNumTrials)
- static IntVector **MP_** (discreteDesignRangeLowerBnds)
- static IntVector **MP_** (discreteDesignRangeUpperBnds)
- static IntVector **MP_** (discreteDesignRangeVars)
- static IntVector **MP_** (discreteDesignSetIntVars)
- static IntVector **MP_** (discreteStateRangeLowerBnds)
- static IntVector **MP_** (discreteStateRangeUpperBnds)
- static IntVector **MP_** (discreteStateRangeVars)
- static IntVector **MP_** (discreteStateSetIntVars)
- static IntArray **VP_** (dsvi)
- static IntArray **VP_** (ndsvi)
- static IntArray **VP_** (ndsvr)
- static IntArray **VP_** (nIv)
- static IntArray **VP_** (nbp)
- static IntArray **VP_** (npp)
- static IntArray **VP_** (nssvi)
- static IntArray **VP_** (nssvr)
- static IntArray **VP_** (ssvi)
- static RealVector **MP_** (betaUncLowerBnds)
- static RealVector **MP_** (betaUncUpperBnds)
- static RealVector **MP_** (binomialUncProbPerTrial)
- static RealVector **MP_** (continuousDesignLowerBnds)
- static RealVector **MP_** (continuousDesignUpperBnds)
- static RealVector **MP_** (continuousDesignVars)
- static RealVector **MP_** (continuousDesignScales)
- static RealVector **MP_** (continuousStateLowerBnds)
- static RealVector **MP_** (continuousStateUpperBnds)
- static RealVector **MP_** (continuousStateVars)
- static RealVector **MP_** (discreteDesignSetRealVars)
- static RealVector **MP_** (discreteStateSetRealVars)
- static RealVector **MP_** (frechetUncBetas)
- static RealVector **MP_** (geometricUncProbPerTrial)
- static RealVector **MP_** (gumbelUncBetas)
- static RealVector **MP_** (negBinomialUncProbPerTrial)
- static RealVector **MP_** (normalUncLowerBnds)
- static RealVector **MP_** (normalUncMeans)
- static RealVector **MP_** (normalUncUpperBnds)
- static RealVector **MP_** (poissonUncLambdas)
- static RealVector **MP_** (triangularUncModes)
- static RealVector **VP_** (dsvr)
- static RealVector **VP_** (Ivb)

- static RealVector **VP_** (Ivp)
- static RealVector **VP_** (ba)
- static RealVector **VP_** (bo)
- static RealVector **VP_** (bc)
- static RealVector **VP_** (pa)
- static RealVector **VP_** (pc)
- static RealVector **VP_** (ucm)
- static RealVector **VP_** (ssvr)
- static String **MP_** (idVariables)
- static StringArray **MP_** (continuousDesignLabels)
- static StringArray **MP_** (continuousDesignScaleTypes)
- static StringArray **MP_** (continuousStateLabels)
- static StringArray **MP_** (discreteDesignRangeLabels)
- static StringArray **MP_** (discreteDesignSetIntLabels)
- static StringArray **MP_** (discreteDesignSetRealLabels)
- static StringArray **MP_** (discreteStateRangeLabels)
- static StringArray **MP_** (discreteStateSetIntLabels)
- static StringArray **MP_** (discreteStateSetRealLabels)
- static Var_brv **MP2s** (betaUncAlphas, 0.)
- static Var_brv **MP2s** (betaUncBetas, 0.)
- static Var_brv **MP2s** (exponentialUncBetas, 0.)
- static Var_brv **MP2s** (frechetUncAlphas, 2.)
- static Var_brv **MP2s** (gammaUncAlphas, 0.)
- static Var_brv **MP2s** (gammaUncBetas, 0.)
- static Var_brv **MP2s** (gumbelUncAlphas, 0.)
- static Var_brv **MP2s** (lognormalUncErrFacts, 1.)
- static Var_brv **MP2s** (lognormalUncLambdas, 0.)
- static Var_brv **MP2s** (lognormalUncLowerBnds, 0.)
- static Var_brv **MP2s** (lognormalUncMeans, 0.)
- static Var_brv **MP2s** (lognormalUncStdDevs, 0.)
- static Var_brv **MP2s** (lognormalUncUpperBnds, DBL_MAX)
- static Var_brv **MP2s** (lognormalUncZetas, 0.)
- static Var_brv **MP2s** (loguniformUncLowerBnds, 0.)
- static Var_brv **MP2s** (loguniformUncUpperBnds, DBL_MAX)
- static Var_brv **MP2s** (normalUncStdDevs, 0.)
- static Var_brv **MP2s** (triangularUncLowerBnds,-DBL_MAX)
- static Var_brv **MP2s** (triangularUncUpperBnds, DBL_MAX)
- static Var_brv **MP2s** (uniformUncLowerBnds,-DBL_MAX)
- static Var_brv **MP2s** (uniformUncUpperBnds, DBL_MAX)
- static Var_brv **MP2s** (weibullUncAlphas, 0.)
- static Var_brv **MP2s** (weibullUncBetas, 0.)
- static const char * **Var_Name** (StringArray *sa, char *buf, size_t i)
- void **dn2f_** (int *n, int *p, Real *x, Calcrj, int *iv, int *liv, int *lv, Real *v, int *ui, void *ur, Vf)
- void **dn2fb_** (int *n, int *p, Real *x, Real *b, Calcrj, int *iv, int *liv, int *lv, Real *v, int *ui, void *ur, Vf)
- void **dn2g_** (int *n, int *p, Real *x, Calcrj, Calcrj, int *iv, int *liv, int *lv, Real *v, int *ui, void *ur, Vf)

- void **dn2gb_** (int ∗n, int ∗p, Real ∗x, Real ∗b, Calcrj, Calcrj, int ∗iv, int ∗liv, int ∗lv, Real ∗v, int ∗ui, void ∗ur, Vf)
- void **divset_** (int ∗, int ∗, int ∗, int ∗, Real ∗)
- double **dr7mdc_** (int ∗)
- static void **Rswapchk** (Nl2Misc ∗q)
- static int **hasnaninf** (const double ∗d, int n)
- NLPQLPOptimizer ∗ **new_NLPQLPOptimizer** (Model &model)
- NLPQLPOptimizer ∗ **new_NLPQLPOptimizer** (NoDBBaseConstructor, Model &model)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer** (Model &model)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer1** (NoDBBaseConstructor, Model &model)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer2** (Model &model, const int &derivative_level, const Real &conv_tol)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer3** (const RealVector &initial_point, const RealVector &var_lower_bnds, const RealVector &var_upper_bnds, const RealMatrix &lin_ineq_coeffs, const RealVector &lin_ineq_lower_bnds, const RealVector &lin_ineq_upper_bnds, const RealMatrix &lin_eq_coeffs, const RealVector &lin_eq_targets, const RealVector &nonlin_ineq_lower_bnds, const RealVector &nonlin_ineq_upper_bnds, const RealVector &nonlin_eq_targets, void(∗user_obj_eval)(int &, int &, double ∗, double &, double ∗, int &), void(∗user_con_eval)(int &, int &, int &, int &, int ∗, double ∗, double ∗, double ∗, int &), const int &derivative_level, const Real &conv_tol)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer** (NoDBBaseConstructor dummy, Model &model)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer** (Model &model, const int &, const Real &)
- NPSOLOptimizer ∗ **new_NPSOLOptimizer** (const RealVector &initial_point, const RealVector &var_lower_bnds, const RealVector &var_upper_bnds, const RealMatrix &lin_ineq_coeffs, const RealVector &lin_ineq_lower_bnds, const RealVector &lin_ineq_upper_bnds, const RealMatrix &lin_eq_coeffs, const RealVector &lin_eq_targets, const RealVector &nonlin_ineq_lower_bnds, const RealVector &nonlin_ineq_upper_bnds, const RealVector &nonlin_eq_targets, void(∗user_obj_eval)(int &, int &, double ∗, double &, double ∗, int &), void(∗user_con_eval)(int &, int &, int &, int &, int ∗, double ∗, double ∗, double ∗, int &), const int &derivative_level, const Real &conv_tol)
- std::istream & operator>> (std::istream &s, ParamResponsePair &pair)

  std::istream extraction operator for ParamResponsePair

- std::ostream & operator<< (std::ostream &s, const ParamResponsePair &pair)

  std::ostream insertion operator for ParamResponsePair

- BiStream & operator>> (BiStream &s, ParamResponsePair &pair)

  BiStream extraction operator for ParamResponsePair.

- BoStream & operator<< (BoStream &s, const ParamResponsePair &pair)

  BoStream insertion operator for ParamResponsePair.

- MPIUnpackBuffer & operator>> (MPIUnpackBuffer &s, ParamResponsePair &pair)

  MPIUnpackBuffer extraction operator for ParamResponsePair.

- MPIPackBuffer & operator<< (MPIPackBuffer &s, const ParamResponsePair &pair)

  MPIPackBuffer insertion operator for ParamResponsePair.

- bool operator== (const ParamResponsePair &pair1, const ParamResponsePair &pair2)

equality operator for ParamResponsePair

- bool operator!= (const ParamResponsePair &pair1, const ParamResponsePair &pair2)

  inequality operator for ParamResponsePair

- static void ∗ **binsearch** (void ∗kw, size_t kwsize, size_t n, const char ∗key)
- static const char ∗ **Begins** (const String &entry_name, const char ∗s)
- static void **Bad_name** (String entry_name, const char ∗where)
- static void **Locked_db** ()
- static void **Null_rep** (const char ∗who)
- static void **Null_rep1** (const char ∗who)
- bool set_compare (const ParamResponsePair &database_pr, const ActiveSet &search_set)

  search function for a particular ParamResponsePair within a PRPList based on ActiveSet content (request vector and derivative variables vector)

- bool id_vars_exact_compare (const ParamResponsePair &database_pr, const ParamResponsePair &search_pr)

  search function for a particular ParamResponsePair within a PRPMultiIndex

- std::size_t hash_value (const ParamResponsePair &prp)

  hash_value for ParamResponsePairs stored in a PRPMultiIndex

- PRPCacheHIter hashedCacheBegin (PRPCache &prp_cache)

  hashed definition of cache begin

- PRPCacheHIter hashedCacheEnd (PRPCache &prp_cache)

  hashed definition of cache end

- PRPQueueHIter hashedQueueBegin (PRPQueue &prp_queue)

  hashed definition of queue begin

- PRPQueueHIter hashedQueueEnd (PRPQueue &prp_queue)

  hashed definition of queue end

- PRPCacheHIter lookup_by_val (PRPMultiIndexCache &prp_cache, const ParamResponsePair &search_pr)

  find a ParamResponsePair based on the interface id, variables, and ActiveSet search data within search_pr.

- bool lookup_by_val (PRPMultiIndexCache &prp_cache, const ParamResponsePair &search_pr, ParamResponsePair &found_pr)

  alternate overloaded form returns bool and sets found_pr by wrapping lookup_by_val(PRPMultiIndexCache&, ParamResponsePair&)

- PRPCacheHIter lookup_by_val (PRPMultiIndexCache &prp_cache, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set)

  find the evaluation id of a ParamResponsePair within a PRPMultiIndexCache based on interface id, variables, and ActiveSet search data

- bool lookup_by_val (PRPMultiIndexCache &prp_cache, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set, ParamResponsePair &found_pr)

  find a ParamResponsePair within a PRPMultiIndexCache based on interface id, variables, and ActiveSet search data

- bool lookup_by_val (PRPMultiIndexCache &prp_cache, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set, int &found_eval_id)

  find the evaluation id of a ParamResponsePair within a PRPMultiIndexCache based on interface id, variables, and ActiveSet search data

- bool lookup_by_val (PRPMultiIndexCache &prp_cache, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set, Response &found_resp)

  find the response of a ParamResponsePair within a PRPMultiIndexCache based on interface id, variables, and ActiveSet search data

- PRPCacheOIter lookup_by_ids (PRPMultiIndexCache &prp_cache, const IntStringPair &search_ids)

  find a ParamResponsePair within a PRPMultiIndexCache based on search_ids (i.e. std::pair<eval_id,interface_id>) search data

- bool lookup_by_ids (PRPMultiIndexCache &prp_cache, const IntStringPair &search_eval_interface_ids, ParamResponsePair &found_pr)

  find a ParamResponsePair within a PRPMultiIndexCache based on eval_interface_ids

- bool lookup_by_ids (PRPMultiIndexCache &prp_cache, const ParamResponsePair &search_pr, ParamResponsePair &found_pr)

  find a ParamResponsePair within a PRPMultiIndexCache based on eval_interface_ids from the ParamResponsePair search data

- PRPQueueHIter lookup_by_val (PRPMultiIndexQueue &prp_queue, const ParamResponsePair &search_pr)

  find a ParamResponsePair based on the interface id, variables, and ActiveSet search data within search_pr.

- bool lookup_by_val (PRPMultiIndexQueue &prp_queue, const ParamResponsePair &search_pr, ParamResponsePair &found_pr)

  alternate overloaded form returns bool and sets found_pr by wrapping lookup_by_val(PRPMultiIndexQueue&, ParamResponsePair&)

- PRPQueueHIter lookup_by_val (PRPMultiIndexQueue &prp_queue, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set)

  find the evaluation id of a ParamResponsePair within a PRPMultiIndexQueue based on interface id, variables, and ActiveSet search data

- bool lookup_by_val (PRPMultiIndexQueue &prp_queue, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set, ParamResponsePair &found_pr)

  find a ParamResponsePair within a PRPMultiIndexQueue based on interface id, variables, and ActiveSet search data

- bool lookup_by_val (PRPMultiIndexQueue &prp_queue, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set, int &found_eval_id)

  find the evaluation id of a ParamResponsePair within a PRPMultiIndexQueue based on interface id, variables, and ActiveSet search data

- bool lookup_by_val (PRPMultiIndexQueue &prp_queue, const String &search_interface_id, const Variables &search_vars, const ActiveSet &search_set, Response &found_resp)

  find the response of a ParamResponsePair within a PRPMultiIndexQueue based on interface id, variables, and ActiveSet search data

- PRPQueueOIter lookup_by_eval_id (PRPMultiIndexQueue &prp_queue, const int &search_id)

  find a ParamResponsePair within a PRPMultiIndexQueue based on search_id (i.e. integer eval_id) search data

- bool lookup_by_eval_id (PRPMultiIndexQueue &prp_queue, const int &search_id, ParamResponsePair &found_pr)

  find a ParamResponsePair within a PRPMultiIndexQueue based on eval_id

- bool lookup_by_eval_id (PRPMultiIndexQueue &prp_queue, const ParamResponsePair &search_pr, ParamResponsePair &found_pr)

  find a ParamResponsePair within a PRPMultiIndexQueue based on eval_id from the ParamResponsePair search data

- void print_restart (int argc, char **argv, String print_dest)

  print a restart file

- void print_restart_tabular (int argc, char **argv, String print_dest)

  print a restart file (tabular format)

- void read_neutral (int argc, char **argv)

  read a restart file (neutral file format)

- void repair_restart (int argc, char **argv, String identifier_type)

  repair a restart file by removing corrupted evaluations

- void concatenate_restart (int argc, char **argv)

  concatenate multiple restart files

- void **find_env_token** (const char *s0, const char **s1, const char **s2, const char **s3)
- const char ** arg_list_adjust (const char **, void **)

  Utility function from legacy, "not_executable" module -- DO NOT TOUCH!

- bool path_is_absolute (const bfs::path &p)

  Utilities to manage API differences in BFS_VERSION_2 vs BFS_VERSION_3.

- std::string filename (const bfs::path &file_path)

  Same as file_path.filename() in latest boost::filesystem.

- bfs::path parent_path (const bfs::path &fp)

  Should be same as fp.parent_path() in latest boost::filesystem.

- bool contains (const bfs::path &dir_path, const std::string &file_name, boost::filesystem::path &complete_-filepath)

  Helper for "which" - sets complete_filepath from dir_path/file_name combo.

Variables

- ParallelLibrary ∗ Dak_pl

  set by ParallelLibrary, for use in CLH

- ProblemDescDB dummy_db

  dummy ProblemDescDB object used for < mandatory reference initialization when a < real ProblemDescDB instance is unavailable

- ParallelLibrary dummy_lib

  dummy ParallelLibrary object used for < mandatory reference initialization when < a real ParallelLibrary instance is < unavailable

- Graphics dakota_graphics

  the global Dakota::Graphics object used by < strategies, models, and approximations

- Interface dummy_interface

  dummy Interface object used for mandatory < reference initialization or default virtual < function return by reference when a real < Interface instance is unavailable

- Model dummy_model

  dummy Model object used for mandatory reference < initialization or default virtual function < return by reference when a real Model instance < is unavailable

- Iterator dummy_iterator

  dummy Iterator object used for mandatory < reference initialization or default virtual < function return by reference when a real < Iterator instance is unavailable

- const char ∗ FIELD_NAMES [ ]
- const int NUMBER_OF_FIELDS = 25
- PRPCache data_pairs

  contains all parameter/response pairs.

- Dakota_funcs ∗ **DF**
- Dakota_funcs **DakFuncs0**
- static time_t **start_time**
- static int **dakdrive**
- static char **slmap** [256]

- std::ostream ∗ dakota_cout = &cout

  DAKOTA stdout initially points to cout, < but may be redirected to a tagged ofstream if < there are concurrent iterators.

- std::ostream ∗ dakota_cerr = &cerr

  DAKOTA stderr initially points to cerr, < but may be redirected to a tagged ofstream if < there are concurrent iterators.

- BoStream write_restart

  the restart binary output stream (doesn't < really need to be global anymore except for < abort_handler()).

- int write_precision = 10

  used in ostream data output functions < (restart_util.C overrides this default value)

- int mc_ptr_int = 0

  global pointer for ModelCenter API

- int dc_ptr_int = 0

  global pointer for ModelCenter eval DB

- ProblemDescDB ∗ Dak_pddb

  set by ProblemDescDB, for use in parsing

- const size_t _NPOS = ∼(size_t)0

  special value returned by index() when entry not found

- static GuiKeyWord kw_1 [3]
- static GuiKeyWord **kw_2** [1]
- static GuiKeyWord **kw_3** [4]
- static GuiKeyWord **kw_4** [2]
- static GuiKeyWord **kw_5** [7]
- static GuiKeyWord **kw_6** [8]
- static GuiKeyWord **kw_7** [9]
- static GuiKeyWord **kw_8** [4]
- static GuiKeyWord **kw_9** [10]
- static GuiKeyWord **kw_10** [7]
- static GuiKeyWord **kw_11** [2]
- static GuiKeyWord **kw_12** [18]
- static GuiKeyWord **kw_13** [1]
- static GuiKeyWord **kw_14** [2]
- static GuiKeyWord **kw_15** [1]
- static GuiKeyWord **kw_16** [1]
- static GuiKeyWord **kw_17** [1]
- static GuiKeyWord **kw_18** [4]
- static GuiKeyWord **kw_19** [1]
- static GuiKeyWord **kw_20** [2]

- static GuiKeyWord **kw_21** [2]
- static GuiKeyWord **kw_22** [10]
- static GuiKeyWord **kw_23** [3]
- static GuiKeyWord **kw_24** [7]
- static GuiKeyWord **kw_25** [2]
- static GuiKeyWord **kw_26** [11]
- static GuiKeyWord **kw_27** [3]
- static GuiKeyWord **kw_28** [2]
- static GuiKeyWord **kw_29** [3]
- static GuiKeyWord **kw_30** [2]
- static GuiKeyWord **kw_31** [5]
- static GuiKeyWord **kw_32** [4]
- static GuiKeyWord **kw_33** [14]
- static GuiKeyWord **kw_34** [3]
- static GuiKeyWord **kw_35** [2]
- static GuiKeyWord **kw_36** [2]
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- static GuiKeyWord **kw_47** [3]
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- static GuiKeyWord **kw_49** [8]
- static GuiKeyWord **kw_50** [1]
- static GuiKeyWord **kw_51** [10]
- static GuiKeyWord **kw_52** [2]
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- static GuiKeyWord **kw_54** [1]
- static GuiKeyWord **kw_55** [2]
- static GuiKeyWord **kw_56** [2]
- static GuiKeyWord **kw_57** [3]
- static GuiKeyWord **kw_58** [2]
- static GuiKeyWord **kw_59** [3]
- static GuiKeyWord **kw_60** [2]
- static GuiKeyWord **kw_61** [9]
- static GuiKeyWord **kw_62** [2]
- static GuiKeyWord **kw_63** [3]
- static GuiKeyWord **kw_64** [2]
- static GuiKeyWord **kw_65** [5]
- static GuiKeyWord **kw_66** [2]

- static GuiKeyWord **kw_67** [1]
- static GuiKeyWord **kw_68** [1]
- static GuiKeyWord **kw_69** [2]
- static GuiKeyWord **kw_70** [3]
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- static GuiKeyWord **kw_72** [2]
- static GuiKeyWord **kw_73** [2]
- static GuiKeyWord **kw_74** [12]
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- static GuiKeyWord **kw_78** [7]
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- static GuiKeyWord **kw_109** [4]
- static GuiKeyWord **kw_110** [9]
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- static GuiKeyWord **kw_112** [2]

- static GuiKeyWord **kw_113** [4]
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- static GuiKeyWord **kw_115** [7]
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- static GuiKeyWord **kw_117** [3]
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- static GuiKeyWord **kw_191** [3]
- static GuiKeyWord **kw_192** [4]
- static GuiKeyWord **kw_193** [12]
- static GuiKeyWord **kw_194** [1]
- static GuiKeyWord **kw_195** [10]
- static GuiKeyWord **kw_196** [2]
- static GuiKeyWord **kw_197** [1]
- static GuiKeyWord **kw_198** [2]
- static GuiKeyWord **kw_199** [5]
- static GuiKeyWord **kw_200** [3]
- static GuiKeyWord **kw_201** [4]
- static GuiKeyWord **kw_202** [7]
- static GuiKeyWord **kw_203** [8]
- static GuiKeyWord **kw_204** [4]

- static GuiKeyWord **kw_205** [1]
- static GuiKeyWord **kw_206** [2]
- static GuiKeyWord **kw_207** [18]
- static GuiKeyWord **kw_208** [1]
- static GuiKeyWord **kw_209** [3]
- static GuiKeyWord **kw_210** [1]
- static GuiKeyWord **kw_211** [5]
- static GuiKeyWord **kw_212** [1]
- static GuiKeyWord **kw_213** [3]
- static GuiKeyWord **kw_214** [1]
- static GuiKeyWord **kw_215** [5]
- static GuiKeyWord **kw_216** [1]
- static GuiKeyWord **kw_217** [1]
- static GuiKeyWord **kw_218** [10]
- static GuiKeyWord **kw_219** [10]
- static GuiKeyWord **kw_220** [3]
- static GuiKeyWord **kw_221** [12]
- static GuiKeyWord **kw_222** [8]
- static GuiKeyWord **kw_223** [8]
- static GuiKeyWord **kw_224** [4]
- static GuiKeyWord **kw_225** [4]
- static GuiKeyWord **kw_226** [8]
- static GuiKeyWord **kw_227** [4]
- static GuiKeyWord **kw_228** [4]
- static GuiKeyWord **kw_229** [4]
- static GuiKeyWord **kw_230** [6]
- static GuiKeyWord **kw_231** [6]
- static GuiKeyWord **kw_232** [2]
- static GuiKeyWord **kw_233** [6]
- static GuiKeyWord **kw_234** [10]
- static GuiKeyWord **kw_235** [8]
- static GuiKeyWord **kw_236** [4]
- static GuiKeyWord **kw_237** [8]
- static GuiKeyWord **kw_238** [2]
- static GuiKeyWord **kw_239** [4]
- static GuiKeyWord **kw_240** [10]
- static GuiKeyWord **kw_241** [6]
- static GuiKeyWord **kw_242** [3]
- static GuiKeyWord **kw_243** [10]
- static GuiKeyWord **kw_244** [2]
- static GuiKeyWord **kw_245** [8]
- static GuiKeyWord **kw_246** [6]
- static GuiKeyWord **kw_247** [6]
- static GuiKeyWord **kw_248** [29]
- static GuiKeyWord **kw_249** [6]
- static KeyWord **kw_250** [4]

- static KeyWord **kw_251** [8]
- static KeyWord **kw_252** [2]
- static KeyWord **kw_253** [4]
- static KeyWord **kw_254** [10]
- static KeyWord **kw_255** [6]
- static KeyWord **kw_256** [3]
- static KeyWord **kw_257** [10]
- static KeyWord **kw_258** [2]
- static KeyWord **kw_259** [8]
- static KeyWord **kw_260** [6]
- static KeyWord **kw_261** [6]
- static KeyWord **kw_262** [29]
- static KeyWord **kw_263** [6]
- FILE ∗ **nidrin**
- static const char ∗ **aln_scaletypes** [ ] = { "auto", "log", "none", 0 }
- static Var_uinfo **CAUVLbl** [CAUVar_Nkinds]
- static Var_uinfo **DAUIVLbl** [DAUIVar_Nkinds]
- static Var_uinfo **DAURVLbl** [DAURVar_Nkinds]
- static Var_uinfo **CEUVLbl** [CEUVar_Nkinds]
- static Var_uinfo **DiscSetLbl** [DiscSetVar_Nkinds]
- static VarLabelChk **Vlch** [ ]
- static VLstuff **VLS** [N_VLS]
- static int **VL_aleatory** [N_VLS] = { 1, 0, 1, 1 }
- static String **MP_** (algebraicMappings)
- static Var_bgen **var_mp_bgen** [ ]
- static Var_bgen **var_mp_bgen_audr** [ ]
- static Var_bgen **var_mp_bgen_audi** [ ]
- static Var_bgen **var_mp_bgen_eu** [ ]
- static Var_bgen **var_mp_bgen_dis** [ ]
- static VarBgen **Bgen** [ ]
- static Var_bchk **var_mp_bndchk** [ ]
- static Var_ibchk **var_mp_ibndchk** [ ]
- const int LARGE_SCALE = 100

  a (perhaps arbitrary) definition of large scale; choose a large-scale algorithm if numVars >= LARGE_SCALE

42.1.1 Detailed Description

The primary namespace for DAKOTA. Utility functions for reading and writing tabular data files.

The COLINOptimizer class wraps COLIN, a Sandia-developed C++ optimization interface library. A variety of COLIN optimizers are defined in COLIN and its associated libraries, including SCOLIB which contains the optimization components from the old COLINY (formerly SGOPT) library. COLIN contains optimizers such as genetic algorithms, pattern search methods, and other nongradient-based techniques. COLINOptimizer uses a COLINApplication object to perform the function evaluations.

The user input mappings are as follows: `max_iterations`, `max_function_evaluations`, `convergence_tolerance`, and `solution_accuracy` are mapped into COLIN's `max_iterations`,

max_function_evaluations_this_trial, function_value_tolerance, sufficient_-objective_value properties. An outputLevel is mapped to COLIN's output_level property and a setting of debug activates output of method initialization and sets the COLIN debug attribute to 10000 for the DEBUG output level. Refer to [Hart, W.E., 2006] for additional information on COLIN objects and controls.

The Dakota namespace encapsulates the core classes of the DAKOTA framework and prevents name clashes with third-party libraries from methods and packages. The C++ source files defining these core classes reside in Dakota/src as ∗.[CH].

Emerging utilities for tabular file I/O. For now, just extraction of capability from separate contexts to faciliate rework. These augment (and leverage) those in data_util.h

Design/capability goals: Ability to read / write data with row/col headers or in free-form Detect premature end of file, report if extra data More consistent and reliable checks for file open errors Require right number of cols in header mode; only total data checking in free-form (likely) Allow comment character for header rows or even in data? variables vs. variables/responses for both read and write Should we support CSV? delimiter = ',’; other? Verify treatment of trailing newline without reading a zero Allow reading into the transpose of the data structure

42.1.2 Typedef Documentation

42.1.2.1 typedef bmi::multi_index_container<Dakota::ParamResponsePair, bmi::indexed_by< bmi::ordered_unique<bmi::tag<ordered>, bmi::const_mem_fun<Dakota::ParamResponsePair, const IntStringPair&, &Dakota::ParamResponsePair::eval_interface_ids> >, bmi::hashed_non_-unique<bmi::tag<hashed>, bmi::identity<Dakota::ParamResponsePair>, partial_prp_hash, partial_prp_equality> > > PRPMultiIndexCache

Boost Multi-Index Container for globally caching ParamResponsePairs. For a global cache, both evaluation and interface id's are used for tagging ParamResponsePair records.

42.1.2.2 typedef bmi::multi_index_container<Dakota::ParamResponsePair, bmi::indexed_by< bmi::ordered_unique<bmi::tag<ordered>, bmi::const_mem_-fun<Dakota::ParamResponsePair, int, &Dakota::ParamResponsePair::eval_id> >, bmi::hashed_non_unique<bmi::tag<hashed>, bmi::identity<Dakota::ParamResponsePair>, partial_prp_hash, partial_prp_equality> > > PRPMultiIndexQueue

Boost Multi-Index Container for locally queueing ParamResponsePairs. For a local queue, interface id's are expected to be consistent, such that evaluation id's are sufficient for tracking particular evaluations.

42.1.3 Function Documentation

42.1.3.1 CommandShell & flush (CommandShell & *shell*)

convenient shell manipulator function to "flush" the shell global convenience function for manipulating the shell; invokes the class member flush function.

Referenced by SysCallAnalysisCode::spawn_analysis(), SysCallAnalysisCode::spawn_evaluation(), SysCallAnalysisCode::spawn_input_filter(), and SysCallAnalysisCode::spawn_output_filter().

42.1.3.2 void start_dakota_heartbeat (int)

Heartbeat function provided by not_executable.C; pass output interval in seconds, or -1 to use $DAKOTA_-HEARTBEAT

Referenced by ParallelLibrary::init_mpi_comm(), and ParallelLibrary::ParallelLibrary().

42.1.3.3 int Dakota::my_cp (const char ∗ *file*, const struct stat ∗ *sb*, int *ftype*, int *depth*, void ∗ *v*)

my_cp is a wrapper around 'cp -r'. The extra layer allows for symlink to be used instead of file copy.

42.1.3.4 void Dakota::get_npath (int *appdrive*, std::string ∗ *pnpath*)

get_npath "shuffles" the string representing the current $PATH variable definition so that '.' is first in the $PATH. It then returns the new string as the result (last arg in the call).

References get_cwd().

42.1.3.5 std::string get_cwd ()

Portability adapter for getcwd. Portability adapter for getcwd

Referenced by get_npath().

42.1.3.6 Real Dakota::getdist (const RealVector & *x1*, const RealVector & *x2*)

Gets the Euclidean distance between x1 and x2

Referenced by mindist(), and mindistindx().

42.1.3.7 Real Dakota::mindist (const RealVector & *x*, const RealMatrix & *xset*, int *except*)

Returns the minimum distance between the point x and the points in the set xset (compares against all points in xset except point "except"): if except is not needed, pass 0.

References getdist().

Referenced by getRmax().

42.1.3.8 Real Dakota::mindistindx (const RealVector & *x*, const RealMatrix & *xset*, const IntArray & *indx*)

Gets the min distance between x and points in the set xset defined by the nindx values in indx.

References getdist().

Referenced by GaussProcApproximation::pointsel_add_sel().

42.1.3.9 Real Dakota::getRmax (const RealMatrix & *xset*)

Gets the maximum of the min distance between each point and the rest of the set.

References mindist().

Referenced by GaussProcApproximation::pointsel_add_sel().

42.1.3.10 T Dakota::abort_handler_t (int *code*) `[inline]`

Templatized abort_handler_t method that allows for convenient return from methods that otherwise have no sensible return from error clauses. Usage: MyType& method() { return abort_handler<MyType&>(-1); }

References abort_handler().

42.1.3.11 int Dakota::start_grid_computing (char * *analysis_driver_script*, char * *params_file*, char * *results_file*)

sample function prototype for launching grid computing

42.1.3.12 int Dakota::stop_grid_computing ()

sample function prototype for terminating grid computing

42.1.3.13 int Dakota::perform_analysis (char * *iteration_num*)

sample function prototype for submitting a grid evaluation

References SysCallAnalysisCode::spawn_evaluation().

42.1.3.14 string Dakota::asstring (const T & *val*) `[inline]`

Creates a string from the argument *val* using an ostringstream. This only gets used in this file and is only ever called with ints so no error checking is in place.

Parameters:

val The value of type T to convert to a string.

Returns:

The string representation of *val* created using an ostringstream.

Referenced by JEGAOptimizer::LoadTheConstraints(), and JEGAOptimizer::LoadTheObjectiveFunctions().

42.1.3.15 void run_dakota_data ()

Function to encapsulate the DAKOTA object instantiations for mode 2: direct Data class instantiation. Rather than parsing from an input file, this function populates Data class objects directly using a minimal specification and relies on constructor defaults and post-processing in post_process() to fill in the rest.

References ProblemDescDB::broadcast(), ProblemDescDB::check_input(), DataInterface::dataIfaceRep, DataMethod::dataMethodRep, DataResponses::dataRespRep, DataVariables::dataVarsRep, DataResponsesRep::gradientType, DataResponsesRep::hessianType, ProblemDescDB::insert_node(), ProblemDescDB::lock(), DataMethodRep::methodName, model_interface_plugins(), ParallelLibrary::mpirun_flag(), DataVariablesRep::numContinuousDesVars, DataResponsesRep::numNonlinearIneqConstraints, DataResponsesRep::numObjectiveFunctions, ProblemDescDB::post_process(), Strategy::run_strategy(), and ParallelLibrary::world_rank().

Referenced by main().

42.1.3.16 bool Dakota::set_compare (const ParamResponsePair & *database_pr*, const ActiveSet & *search_set*) [inline]

search function for a particular ParamResponsePair within a PRPList based on ActiveSet content (request vector and derivative variables vector) a global function to compare the ActiveSet of a particular database_pr (presumed to be in the global history list) with a passed in ActiveSet (search_set).

References ParamResponsePair::active_set(), ActiveSet::derivative_vector(), and ActiveSet::request_vector().

Referenced by lookup_by_val().

42.1.3.17 bool Dakota::id_vars_exact_compare (const ParamResponsePair & *database_pr*, const ParamResponsePair & *search_pr*) [inline]

search function for a particular ParamResponsePair within a PRPMultiIndex a global function to compare the interface id and variables of a particular database_pr (presumed to be in the global history list) with a passed in key of interface id and variables provided by search_pr.

References binary_equal_to(), ParamResponsePair::interface_id(), and ParamResponsePair::prp_parameters().

Referenced by partial_prp_equality::operator()().

42.1.3.18 PRPCacheHIter Dakota::lookup_by_val (PRPMultiIndexCache & *prp_cache*, const ParamResponsePair & *search_pr*) [inline]

find a ParamResponsePair based on the interface id, variables, and ActiveSet search data within search_pr. Lookup occurs in two steps: (1) PRPMultiIndexCache lookup based on strict equality in interface id and variables, and (2) set_compare() post-processing based on ActiveSet subset logic.

References ParamResponsePair::active_set(), and set_compare().

Referenced by ApplicationInterface::duplication_detect(), Model::estimate_derivatives(), SurrBasedLocalMinimizer::find_center_approx(), Optimizer::local_objective_recast_retrieve(), lookup_by_val(), SNLLLeastSq::post_run(), COLINOptimizer::post_run(), SurrBasedMinimizer::print_results(), Optimizer::print_results(), LeastSq::print_results(), DiscrepancyCorrection::search_db(), and NonDLocalReliability::update_mpp_search_data().

42.1.3.19 PRPQueueHIter Dakota::lookup_by_val (PRPMultiIndexQueue & *prp_queue*, const ParamResponsePair & *search_pr*) [inline]

find a ParamResponsePair based on the interface id, variables, and ActiveSet search data within search_pr. Lookup occurs in two steps: (1) PRPMultiIndexQueue lookup based on strict equality in interface id and variables, and (2) set_compare() post-processing based on ActiveSet subset logic.

References ParamResponsePair::active_set(), and set_compare().

42.1.3.20 void print_restart (int *argc*, char ** *argv*, String *print_dest*)

print a restart file **Usage:** "dakota_restart_util print dakota.rst"

"dakota_restart_util to_neutral dakota.rst dakota.neu"

Prints all evals. in full precision to either stdout or a neutral file. The former is useful for ensuring that duplicate detection is successful in a restarted run (e.g., starting a new method from the previous best), and the latter is used for translating binary files between platforms.

References ParamResponsePair::eval_id(), ParamResponsePair::write_annotated(), and write_precision.

Referenced by main().

42.1.3.21 void print_restart_tabular (int *argc*, char ** *argv*, String *print_dest*)

print a restart file (tabular format) **Usage:** "dakota_restart_util to_pdb dakota.rst dakota.pdb"

"dakota_restart_util to_tabular dakota.rst dakota.txt"

Unrolls all data associated with a particular tag for all evaluations and then writes this data in a tabular format (e.g., to a PDB database or MATLAB/TECPLOT data file).

References Variables::continuous_variables(), String::data(), data_pairs, Variables::discrete_int_variables(), Variables::discrete_real_variables(), and Response::function_values().

Referenced by main().

42.1.3.22 void read_neutral (int *argc*, char ** *argv*)

read a restart file (neutral file format) **Usage:** "dakota_restart_util from_neutral dakota.neu dakota.rst"

Reads evaluations from a neutral file. This is used for translating binary files between platforms.

References ParamResponsePair::read_annotated(), and write_restart.

Referenced by main().

42.1.3.23 void repair_restart (int *argc*, char ** *argv*, String *identifier_type*)

repair a restart file by removing corrupted evaluations **Usage:** "dakota_restart_util remove 0.0 dakota_old.rst dakota_new.rst"

"dakota_restart_util remove_ids 2 7 13 dakota_old.rst dakota_new.rst"

Repairs a restart file by removing corrupted evaluations. The identifier for evaluation removal can be either a double precision number (all evaluations having a matching response function value are removed) or a list of integers (all evaluations with matching evaluation ids are removed).

References Response::active_set_request_vector(), contains(), ParamResponsePair::eval_id(), Response::function_values(), ParamResponsePair::prp_response(), and write_restart.

Referenced by main().

42.1.3.24 void concatenate_restart (int *argc*, char ** *argv*)

concatenate multiple restart files **Usage:** "dakota_restart_util cat dakota_1.rst ... dakota_n.rst dakota_new.rst"

Combines multiple restart files into a single restart database.

References write_restart.

Referenced by main().

42.1.3.25 bool Dakota::path_is_absolute (const bfs::path & *p*) `[inline]`

Utilities to manage API differences in BFS_VERSION_2 vs BFS_VERSION_3. Same as path.is_absolute() in latest boost::filesystem

42.1.4 Variable Documentation

42.1.4.1 const char* FIELD_NAMES[ ]

Initial value:

```
{ "numFns", "numVars", "numACV", "numADIV",
                            "numADRV", "numDerivVars", "xC", "xDI",
                            "xDR", "xCLabels", "xDILabels",
                            "xDRLabels", "directFnASV", "directFnASM",
                            "directFnDVV", "directFnDVV_bool",
                            "fnFlag", "gradFlag", "hessFlag",
                            "fnVals",  "fnGrads",  "fnHessians",
                            "fnLabels", "failure", "currEvalId" }
```

fields to pass to Matlab in Dakota structure

Referenced by DirectApplicInterface::DirectApplicInterface(), and DirectApplicInterface::matlab_engine_run().

42.1.4.2 const int NUMBER_OF_FIELDS = 25

number of fields in above structure

Referenced by DirectApplicInterface::DirectApplicInterface(), and DirectApplicInterface::matlab_engine_run().

42.1.4.3 Dakota_funcs DakFuncs0

Initial value:

```
{
        fprintf,
        abort_handler,
        dlsolver_option,
        continuous_lower_bounds1,
        continuous_upper_bounds1,
        nonlinear_ineq_constraint_lower_bounds1,
        nonlinear_ineq_constraint_upper_bounds1,
        nonlinear_eq_constraint_targets1,
        linear_ineq_constraint_lower_bounds1,
        linear_ineq_constraint_upper_bounds1,
        linear_eq_constraint_targets1,
        linear_ineq_constraint_coeffs1,
        linear_eq_constraint_coeffs1,
        ComputeResponses1,
        GetFuncs1,
        GetGrads1,
        GetContVars1,
        SetBestContVars1,
        SetBestDiscVars1,
        SetBestRespFns1,
        Get_Real1,
        Get_Int1,
        Get_Bool1
        }
```

42.1.4.4 char slmap[256] [static]

Initial value:

```
{


0x0, 0x1, 0x2, 0x3, 0x4, 0x5, 0x6, 0x7, 0x8, 0x9, 0xa, 0xb, 0xc, 0xd, 0xe, 0xf,
0x10, 0x11, 0x12, 0x13, 0x14, 0x15, 0x16, 0x17, 0x18, 0x19, 0x1a, 0x1b, 0x1c, 0x
     1d, 0x1e, 0x1f,
0x20, 0x21, 0x22, 0x23, 0x24, 0x25, 0x26, 0x27, 0x28, 0x29, 0x2a, 0x2b, 0x2c, 0x
     2d, 0x2e, 0x2f,
0x30, 0x31, 0x32, 0x33, 0x34, 0x35, 0x36, 0x37, 0x38, 0x39, 0x3a, 0x3b, 0x3c, 0x
     3d, 0x3e, 0x3f,
0x40, 0x41, 0x42, 0x43, 0x44, 0x45, 0x46, 0x47, 0x48, 0x49, 0x4a, 0x4b, 0x4c, 0x
     4d, 0x4e, 0x4f,
0x50, 0x51, 0x52, 0x53, 0x54, 0x55, 0x56, 0x57, 0x58, 0x59, 0x5a, 0x5b, '/',  0x
     5d, 0x5e, 0x5f,
0x60, 'A',  'B',  'C',  'D',  'E',  'F',  'G',  'H',  'I',  'J',  'K',  'L',  'M
     ',  'N',  'O',
'P',  'Q',  'R',  'S',  'T',  'U',  'V',  'W',  'X',  'Y',  'Z',  0x7b, 0x7c, 0x
     7d, 0x7e, 0x7f,
0x80, 0x81, 0x82, 0x83, 0x84, 0x85, 0x86, 0x87, 0x88, 0x89, 0x8a, 0x8b, 0x8c, 0x
     8d, 0x8e, 0x8f,
0x90, 0x91, 0x92, 0x93, 0x94, 0x95, 0x96, 0x97, 0x98, 0x99, 0x9a, 0x9b, 0x9c, 0x
     9d, 0x9e, 0x9f,
0xa0, 0xa1, 0xa2, 0xa3, 0xa4, 0xa5, 0xa6, 0xa7, 0xa8, 0xa9, 0xaa, 0xab, 0xac, 0x
     ad, 0xae, 0xaf,
0xb0, 0xb1, 0xb2, 0xb3, 0xb4, 0xb5, 0xb6, 0xb7, 0xb8, 0xb9, 0xba, 0xbb, 0xbc, 0x
     bd, 0xbe, 0xbf,
0xc0, 0xc1, 0xc2, 0xc3, 0xc4, 0xc5, 0xc6, 0xc7, 0xc8, 0xc9, 0xca, 0xcb, 0xcc, 0x
     cd, 0xce, 0xcf,
0xd0, 0xd1, 0xd2, 0xd3, 0xd4, 0xd5, 0xd6, 0xd7, 0xd8, 0xd9, 0xda, 0xdb, 0xdc, 0x
     dd, 0xde, 0xdf,
```

```
0xe0, 0xe1, 0xe2, 0xe3, 0xe4, 0xe5, 0xe6, 0xe7, 0xe8, 0xe9, 0xea, 0xeb, 0xec, 0x
     ed, 0xee, 0xef,
0xf0, 0xf1, 0xf2, 0xf3, 0xf4, 0xf5, 0xf6, 0xf7, 0xf8, 0xf9, 0xfa, 0xfb, 0xfc, 0x
     fd, 0xfe, 0xff}
```

42.1.4.5 static KeyWord kw_1 [static]

Initial value:

```
{
                {"active_set_vector",8,0,1,0,1701},
                {"evaluation_cache",8,0,2,0,1703},
                {"restart_file",8,0,3,0,1705}
                }
```

934 distinct keywords (plus 121 aliases)

42.1.4.6 static KeyWord kw_2 () [static]

Initial value:

```
{
                {"processors_per_analysis",9,0,1,0,1685,0,0.,0.,0.,0,"{Number of
     processors per analysis} http://dakota.sandia.gov/licensing/votd/html-ref/InterfC
     ommands.html#InterfApplicDF"}
                }
```

42.1.4.7 static KeyWord kw_3 [static]

Initial value:

```
{
                {"abort",8,0,1,1,1691,0,0.,0.,0.,0,"@[CHOOSE failure mitigation]"
     },
                {"continuation",8,0,1,1,1697},
                {"recover",14,0,1,1,1695},
                {"retry",9,0,1,1,1693}
                }
```

42.1.4.8 static KeyWord kw_4 () [static]

Initial value:

```
{
                {"copy",8,0,1,0,1679,0,0.,0.,0.,0,"{Copy template files} http://d
     akota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplicSC"},
                {"replace",8,0,2,0,1681,0,0.,0.,0.,0,"{Replace existing files} ht
     tp://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplicSC
     "}
                }
```

42.1.4.9 static KeyWord kw_5 [static]

Initial value:

```
{
                {"dir_save",0,0,3,0,1672},
                {"dir_tag",0,0,2,0,1670},
                {"directory_save",8,0,3,0,1673,0,0.,0.,0.,0,"{Save work directory
     } http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfAppl
     icSC"},
                {"directory_tag",8,0,2,0,1671,0,0.,0.,0.,0,"{Tag work directory}
     http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplic
     SC"},
                {"named",11,0,1,0,1669,0,0.,0.,0.,0,"{Name of work directory} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplicSC"
     },
                {"template_directory",11,2,4,0,1675,kw_4,0.,0.,0.,0,"{Template di
     rectory} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#Int
     erfApplicSC"},
                {"template_files",15,2,4,0,1677,kw_4,0.,0.,0.,0,"{Template files}
      http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfAppli
     cSC"}
                }
```

42.1.4.10 static KeyWord kw_6 [static]

Initial value:

```
{
                {"allow_existing_results",8,0,3,0,1657,0,0.,0.,0.,0,"{Allow exist
     ing results files} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommand
     s.html#InterfApplicSC"},
                {"aprepro",8,0,5,0,1661,0,0.,0.,0.,0,"{Aprepro parameters file fo
     rmat} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#Interf
     ApplicSC"},
                {"file_save",8,0,7,0,1665,0,0.,0.,0.,0,"{Parameters and results f
     ile saving} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#
     InterfApplicSC"},
                {"file_tag",8,0,6,0,1663,0,0.,0.,0.,0,"{Parameters and results fi
     le tagging} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#
     InterfApplicSC"},
                {"parameters_file",11,0,1,0,1653,0,0.,0.,0.,0,"{Parameters file n
     ame} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfA
     pplicSC"},
                {"results_file",11,0,2,0,1655,0,0.,0.,0.,0,"{Results file name} h
     ttp://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplicS
     C"},
                {"verbatim",8,0,4,0,1659,0,0.,0.,0.,0,"{Verbatim driver/filter in
     vocation syntax} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.
     html#InterfApplicSC"},
                {"work_directory",8,7,8,0,1667,kw_5,0.,0.,0.,0,"{Create work dire
     ctory} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#Inter
     fApplicSC"}
                }
```

42.1.4.11 static KeyWord kw_7 [static]

Initial value:

```
{
            {"analysis_components",15,0,1,0,1643,0,0.,0.,0.,0,"{Additional id
entifiers for use by the analysis_drivers} http://dakota.sandia.gov/licensing/vot
d/html-ref/InterfCommands.html#InterfApplic"},
            {"deactivate",8,3,6,0,1699,kw_1,0.,0.,0.,0,"{Feature deactivation
} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfAppl
ic"},
            {"direct",8,1,4,1,1683,kw_2,0.,0.,0.,0,"[CHOOSE interface type]{D
irect function interface } http://dakota.sandia.gov/licensing/votd/html-ref/Inter
fCommands.html#InterfApplicDF"},
            {"failure_capture",8,4,5,0,1689,kw_3,0.,0.,0.,0,"{Failure capturi
ng} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfAp
plic"},
            {"fork",8,8,4,1,1651,kw_6,0.,0.,0.,0,"@"},
            {"grid",8,0,4,1,1687,0,0.,0.,0.,0,"{Grid interface } http://dakot
a.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplicG"},
            {"input_filter",11,0,2,0,1645,0,0.,0.,0.,0,"{Input filter} http:/
/dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplic"},
            {"output_filter",11,0,3,0,1647,0,0.,0.,0.,0,"{Output filter} http
://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplic"},
            {"system",8,8,4,1,1649,kw_6,0.,0.,0.,0,"{System call interface }
http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfApplic
SC"}
            }
```

42.1.4.12 static KeyWord kw_8 [static]

Initial value:

```
{
            {"analysis_concurrency",9,0,3,0,1715,0,0.,0.,0.,0,"{Asynchronous
analysis concurrency} http://dakota.sandia.gov/licensing/votd/html-ref/InterfComm
ands.html#InterfIndControl"},
            {"evaluation_concurrency",9,0,1,0,1709,0,0.,0.,0.,0,"{Asynchronou
s evaluation concurrency} http://dakota.sandia.gov/licensing/votd/html-ref/Interf
Commands.html#InterfIndControl"},
            {"local_evaluation_self_scheduling",8,0,2,0,1711,0,0.,0.,0.,0,"{S
elf-schedule local evals} http://dakota.sandia.gov/licensing/votd/html-ref/Interf
Commands.html#InterfIndControl"},
            {"local_evaluation_static_scheduling",8,0,2,0,1713,0,0.,0.,0.,0,"
{Static-schedule local evals} http://dakota.sandia.gov/licensing/votd/html-ref/In
terfCommands.html#InterfIndControl"}
            }
```

42.1.4.13 static KeyWord kw_9 () [static]

Initial value:

```
{
            {"algebraic_mappings",11,0,2,0,1639,0,0.,0.,0.,0,"{Algebraic mapp
ings file} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#I
nterfAlgebraic"},
            {"analysis_drivers",15,9,3,0,1641,kw_7,0.,0.,0.,0,"{Analysis driv
ers} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#InterfA
pplic"},
            {"analysis_self_scheduling",8,0,8,0,1725,0,0.,0.,0.,0,"[CHOOSE an
alysis sched.]{Self scheduling of analyses} http://dakota.sandia.gov/licensing/vo
```

```
td/html-ref/InterfCommands.html#InterfIndControl"},
          {"analysis_servers",9,0,7,0,1723,0,0.,0.,0.,0,"{Number of analysi
s servers} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#I
nterfIndControl"},
          {"analysis_static_scheduling",8,0,8,0,1727,0,0.,0.,0.,0,"{Static
scheduling of analyses} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCo
mmands.html#InterfIndControl"},
          {"asynchronous",8,4,4,0,1707,kw_8,0.,0.,0.,0,"{Asynchronous inter
face usage} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#
InterfIndControl"},
          {"evaluation_self_scheduling",8,0,6,0,1719,0,0.,0.,0.,0,"[CHOOSE
evaluation sched.]{Self scheduling of evaluations} http://dakota.sandia.gov/licen
sing/votd/html-ref/InterfCommands.html#InterfIndControl"},
          {"evaluation_servers",9,0,5,0,1717,0,0.,0.,0.,0,"{Number of evalu
ation servers} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.ht
ml#InterfIndControl"},
          {"evaluation_static_scheduling",8,0,6,0,1721,0,0.,0.,0.,0,"{Stati
c scheduling of evaluations} http://dakota.sandia.gov/licensing/votd/html-ref/Int
erfCommands.html#InterfIndControl"},
          {"id_interface",11,0,1,0,1637,0,0.,0.,0.,0,"{Interface set identi
fier} http://dakota.sandia.gov/licensing/votd/html-ref/InterfCommands.html#Interf
IndControl"}
          }
```

42.1.4.14 static KeyWord kw_10 [static]

Initial value:

```
{
          {"merit1",8,0,1,1,261,0,0.,0.,0.,0,"[CHOOSE merit function]"},
          {"merit1_smooth",8,0,1,1,263},
          {"merit2",8,0,1,1,265},
          {"merit2_smooth",8,0,1,1,267,0,0.,0.,0.,0,"@"},
          {"merit2_squared",8,0,1,1,269},
          {"merit_max",8,0,1,1,257},
          {"merit_max_smooth",8,0,1,1,259}
          }
```

42.1.4.15 static KeyWord kw_11 () [static]

Initial value:

```
{
          {"blocking",8,0,1,1,251,0,0.,0.,0.,0,"[CHOOSE synchronization]"},

          {"nonblocking",8,0,1,1,253,0,0.,0.,0.,0,"@"}
          }
```

42.1.4.16 static KeyWord kw_12 () [static]

Initial value:

```
{
          {"constraint_penalty",10,0,7,0,271,0,0.,0.,0.,0,"{Constraint pena
```

```
lty} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodA
PPSDC"},
          {"contraction_factor",10,0,2,0,243,0,0.,0.,0.,0,"{Pattern contrac
tion factor} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodAPPSDC"},
          {"initial_delta",10,0,1,0,241,0,0.,0.,0.,0,"{Initial offset value
} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodAPPS
DC"},
          {"linear_equality_constraint_matrix",14,0,14,0,403,0,0.,0.,0.,0,"
{Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html
-ref/MethodCommands.html#MethodIndControl"},
          {"linear_equality_scale_types",15,0,16,0,407,0,0.,0.,0.,0,"{Linea
r equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Method
Commands.html#MethodIndControl"},
          {"linear_equality_scales",14,0,17,0,409,0,0.,0.,0.,0,"{Linear equ
ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodIndControl"},
          {"linear_equality_targets",14,0,15,0,405,0,0.,0.,0.,0,"{Linear eq
uality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
tml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,9,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,10,0,395,0,0.,0.,0.,0,"{Li
near inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,12,0,399,0,0.,0.,0.,0,"{Lin
ear inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,13,0,401,0,0.,0.,0.,0,"{Linear i
nequality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands
.html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,11,0,397,0,0.,0.,0.,0,"{Li
near inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"merit_function",8,7,6,0,255,kw_10,0.,0.,0.,0,"{Merit function}
http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodAPPSDC
"},
          {"smoothing_factor",10,0,8,0,273,0,0.,0.,0.,0,"{Smoothing factor}
 http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodAPPSD
C"},
          {"solution_accuracy",2,0,4,0,246},
          {"solution_target",10,0,4,0,247,0,0.,0.,0.,0,"{Solution target} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodAPPSDC"
},
          {"synchronization",8,2,5,0,249,kw_11,0.,0.,0.,0,"{Evaluation sync
hronization} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodAPPSDC"},
          {"threshold_delta",10,0,3,0,245,0,0.,0.,0.,0,"{Threshold for offs
et values} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodAPPSDC"}
          }
```

42.1.4.17 static KeyWord kw_13 [static]

Initial value:

```
{
          {"emulator_samples",9,0,1,1,887}
          }
```

42.1.4.18 static KeyWord kw_14 () [static]

Initial value:

```
{
                {"adaptive",8,0,1,1,899},
                {"hastings",8,0,1,1,897}
                }
```

42.1.4.19 static KeyWord kw_15 () [static]

Initial value:

```
{
                {"emulator_samples",9,0,1,0,875}
                }
```

42.1.4.20 static KeyWord kw_16 () [static]

Initial value:

```
{
                {"sparse_grid_level",13,0,1,0,879}
                }
```

42.1.4.21 static KeyWord kw_17 () [static]

Initial value:

```
{
                {"sparse_grid_level",13,0,1,0,883}
                }
```

42.1.4.22 static KeyWord kw_18 () [static]

Initial value:

```
{
                {"gaussian_process",8,1,1,1,873,kw_15},
                {"gp",0,1,1,1,872,kw_15},
                {"pce",8,1,1,1,877,kw_16},
                {"sc",8,1,1,1,881,kw_17}
                }
```

42.1.4.23 static KeyWord kw_19 () [static]

Initial value:

```
{
                {"emulator",8,4,1,0,871,kw_18}
                }
```

42.1.4.24 static KeyWord kw_20 [static]

Initial value:

```
{
                {"delayed",8,0,1,1,893},
                {"standard",8,0,1,1,891}
                }
```

42.1.4.25 static KeyWord kw_21 () [static]

Initial value:

```
{
                {"mt19937",8,0,1,1,905},
                {"rnum2",8,0,1,1,907}
                }
```

42.1.4.26 static KeyWord kw_22 () [static]

Initial value:

```
{
                {"gpmsa",8,1,1,1,885,kw_13},
                {"likelihood_scale",10,0,7,0,911},
                {"metropolis",8,2,3,0,895,kw_14},
                {"proposal_covariance_scale",10,0,6,0,909},
                {"queso",8,1,1,1,869,kw_19},
                {"rejection",8,2,2,0,889,kw_20},
                {"rng",8,2,5,0,903,kw_21},
                {"samples",9,0,9,0,967,0,0.,0.,0,"{Number of samples} http://d
     akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"seed",9,0,8,0,969,0,0.,0.,0,"{Random seed} http://dakota.san
     dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
                {"use_derivatives",8,0,4,0,901}
                }
```

42.1.4.27 static KeyWord kw_23 () [static]

Initial value:

```
{
                {"deltas_per_variable",5,0,2,2,1174},
                {"step_vector",14,0,1,1,1173,0,0.,0.,0.,0,"{Step vector} http://d
     akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodPSCPS"},
                {"steps_per_variable",13,0,2,2,1175,0,0.,0.,0.,0,"{Number of step
     s per variable} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
     tml#MethodPSCPS"}
                }
```

42.1.4.28 static KeyWord kw_24 () [static]

Initial value:

```
{
                {"initial_delta",10,0,5,1,459,0,0.,0.,0.,0,"{Initial offset value
     } http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOL
     IBPS"},
                {"misc_options",15,0,4,0,545,0,0.,0.,0.,0,"{Specify miscellaneous
      options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
     thodSCOLIBDC"},
                {"seed",9,0,2,0,541,0,0.,0.,0.,0,"{Random seed for stochastic pat
     tern search} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
     #MethodSCOLIBPS"},
                {"show_misc_options",8,0,3,0,543,0,0.,0.,0.,0,"{Show miscellaneou
     s options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
     ethodSCOLIBDC"},
                {"solution_accuracy",2,0,1,0,538},
                {"solution_target",10,0,1,0,539,0,0.,0.,0.,0,"{Desired solution t
     arget} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
     dSCOLIBDC"},
                {"threshold_delta",10,0,6,2,461,0,0.,0.,0.,0,"{Threshold for offs
     et values} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
     ethodSCOLIBPS"}
                }
```

42.1.4.29 static KeyWord kw_25 () [static]

Initial value:

```
{
                {"all_dimensions",8,0,1,1,469},
                {"major_dimension",8,0,1,1,467}
                }
```

42.1.4.30 static KeyWord kw_26 () [static]

Initial value:

```
{
                {"constraint_penalty",10,0,6,0,479,0,0.,0.,0.,0,"{Constraint pena
     lty} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodS
     COLIBDIR"},
                {"division",8,2,1,0,465,kw_25,0.,0.,0.,0,"{Box subdivision approa
     ch} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSC
     OLIBDIR"},
                {"global_balance_parameter",10,0,2,0,471,0,0.,0.,0.,0,"{Global se
     arch balancing parameter} http://dakota.sandia.gov/licensing/votd/html-ref/Method
     Commands.html#MethodSCOLIBDIR"},
                {"local_balance_parameter",10,0,3,0,473,0,0.,0.,0.,0,"{Local sear
     ch balancing parameter} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCo
     mmands.html#MethodSCOLIBDIR"},
                {"max_boxsize_limit",10,0,4,0,475,0,0.,0.,0.,0,"{Maximum boxsize
     limit} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
     dSCOLIBDIR"},
                {"min_boxsize_limit",10,0,5,0,477,0,0.,0.,0.,0,"{Minimum boxsize
```

```
limit} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
dSCOLIBDIR"},
          {"misc_options",15,0,10,0,545,0,0.,0.,0.,0,"{Specify miscellaneou
s options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodSCOLIBDC"},
          {"seed",9,0,8,0,541,0,0.,0.,0.,0,"{Random seed for stochastic pat
tern search} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodSCOLIBPS"},
          {"show_misc_options",8,0,9,0,543,0,0.,0.,0.,0,"{Show miscellaneou
s options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodSCOLIBDC"},
          {"solution_accuracy",2,0,7,0,538},
          {"solution_target",10,0,7,0,539,0,0.,0.,0.,0,"{Desired solution t
arget} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
dSCOLIBDC"}
          }
```

42.1.4.31 static KeyWord kw_27 () [static]

Initial value:

```
{
          {"blend",8,0,1,1,515},
          {"two_point",8,0,1,1,513},
          {"uniform",8,0,1,1,517}
          }
```

42.1.4.32 static KeyWord kw_28 () [static]

Initial value:

```
{
          {"linear_rank",8,0,1,1,495},
          {"merit_function",8,0,1,1,497}
          }
```

42.1.4.33 static KeyWord kw_29 () [static]

Initial value:

```
{
          {"flat_file",11,0,1,1,491},
          {"simple_random",8,0,1,1,487},
          {"unique_random",8,0,1,1,489}
          }
```

42.1.4.34 static KeyWord kw_30 () [static]

Initial value:

```
{
                {"mutation_range",9,0,2,0,533,0,0.,0.,0.,0,"{Mutation range} http
     ://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"}
     ,
                {"mutation_scale",10,0,1,0,531,0,0.,0.,0.,0,"{Mutation scale} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"
     }
                }
```

42.1.4.35 static KeyWord kw_31 () [static]

Initial value:

```
{
                {"non_adaptive",8,0,2,0,535,0,0.,0.,0.,0,"{Non-adaptive mutation
     flag} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
     SCOLIBEA"},
                {"offset_cauchy",8,2,1,1,527,kw_30},
                {"offset_normal",8,2,1,1,525,kw_30},
                {"offset_uniform",8,2,1,1,529,kw_30},
                {"replace_uniform",8,0,1,1,523}
                }
```

42.1.4.36 static KeyWord kw_32 [static]

Initial value:

```
{
                {"chc",9,0,1,1,503,0,0.,0.,0.,0,"{CHC replacement type} http://da
     kota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"},
                {"elitist",9,0,1,1,505,0,0.,0.,0.,0,"{Elitist replacement type} h
     ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBE
     A"},
                {"new_solutions_generated",9,0,2,0,507,0,0.,0.,0.,0,"{New solutio
     ns generated} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
     l#MethodSCOLIBEA"},
                {"random",9,0,1,1,501,0,0.,0.,0.,0,"{Random replacement type} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"
     }
                }
```

42.1.4.37 static KeyWord kw_33 () [static]

Initial value:

```
{
                {"constraint_penalty",10,0,9,0,537},
                {"crossover_rate",10,0,5,0,509,0,0.,0.,0.,0,"{Crossover rate} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"
     },
                {"crossover_type",8,3,6,0,511,kw_27,0.,0.,0.,0,"{Crossover type}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIB
     EA"},
                {"fitness_type",8,2,3,0,493,kw_28,0.,0.,0.,0,"{Fitness type} http
```

```
://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"}
,
          {"initialization_type",8,3,2,0,485,kw_29,0.,0.,0.,0,"{Initializat
ion type} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodSCOLIBEA"},
          {"misc_options",15,0,13,0,545,0,0.,0.,0.,0,"{Specify miscellaneou
s options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodSCOLIBDC"},
          {"mutation_rate",10,0,7,0,519,0,0.,0.,0.,0,"{Mutation rate} http:
//dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA"},

          {"mutation_type",8,5,8,0,521,kw_31,0.,0.,0.,0,"{Mutation type} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBEA
"},
          {"population_size",9,0,1,0,483,0,0.,0.,0.,0,"{Number of populatio
n members} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodSCOLIBEA"},
          {"replacement_type",8,4,4,0,499,kw_32,0.,0.,0.,0,"{Replacement ty
pe} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSC
OLIBEA"},
          {"seed",9,0,11,0,541,0,0.,0.,0.,0,"{Random seed for stochastic pa
ttern search} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodSCOLIBPS"},
          {"show_misc_options",8,0,12,0,543,0,0.,0.,0.,0,"{Show miscellaneo
us options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#
MethodSCOLIBDC"},
          {"solution_accuracy",2,0,10,0,538},
          {"solution_target",10,0,10,0,539,0,0.,0.,0.,0,"{Desired solution
target} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Meth
odSCOLIBDC"}
          }
```

42.1.4.38 static KeyWord kw_34 () [static]

Initial value:

```
{
          {"adaptive_pattern",8,0,1,1,433},
          {"basic_pattern",8,0,1,1,435},
          {"multi_step",8,0,1,1,431}
          }
```

42.1.4.39 static KeyWord kw_35 () [static]

Initial value:

```
{
          {"coordinate",8,0,1,1,421},
          {"simplex",8,0,1,1,423}
          }
```

42.1.4.40 static KeyWord kw_36 () [static]

Initial value:

```
{
                {"blocking",8,0,1,1,439},
                {"nonblocking",8,0,1,1,441}
                }
```

42.1.4.41 static KeyWord kw_37 () [static]

Initial value:

```
{
                {"constant_penalty",8,0,1,0,413,0,0.,0.,0.,0,"{Control of dynamic
 penalty} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodSCOLIBPS"},
                {"constraint_penalty",10,0,16,0,455,0,0.,0.,0.,0,"{Constraint pen
alty} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
SCOLIBPS"},
                {"contraction_factor",10,0,15,0,453,0,0.,0.,0.,0,"{Pattern contra
ction factor} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodSCOLIBPS"},
                {"expand_after_success",9,0,3,0,417,0,0.,0.,0.,0,"{Number of cons
ecutive improvements before expansion} http://dakota.sandia.gov/licensing/votd/ht
ml-ref/MethodCommands.html#MethodSCOLIBPS"},
                {"exploratory_moves",8,3,7,0,429,kw_34,0.,0.,0.,0,"{Exploratory m
oves selection} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
tml#MethodSCOLIBPS"},
                {"initial_delta",10,0,13,1,459,0,0.,0.,0.,0,"{Initial offset valu
e} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCO
LIBPS"},
                {"misc_options",15,0,12,0,545,0,0.,0.,0.,0,"{Specify miscellaneou
s options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodSCOLIBDC"},
                {"no_expansion",8,0,2,0,415,0,0.,0.,0.,0,"{No expansion flag} htt
p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBPS"
},
                {"pattern_basis",8,2,4,0,419,kw_35,0.,0.,0.,0,"{Pattern basis sel
ection} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Meth
odSCOLIBPS"},
                {"seed",9,0,10,0,541,0,0.,0.,0.,0,"{Random seed for stochastic pa
ttern search} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodSCOLIBPS"},
                {"show_misc_options",8,0,11,0,543,0,0.,0.,0.,0,"{Show miscellaneo
us options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#
MethodSCOLIBDC"},
                {"solution_accuracy",2,0,9,0,538},
                {"solution_target",10,0,9,0,539,0,0.,0.,0.,0,"{Desired solution t
arget} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
dSCOLIBDC"},
                {"stochastic",8,0,5,0,425,0,0.,0.,0.,0,"{Stochastic pattern searc
h} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCO
LIBPS"},
                {"synchronization",8,2,8,0,437,kw_36,0.,0.,0.,0,"{Evaluation sync
hronization} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodSCOLIBPS"},
                {"threshold_delta",10,0,14,2,461,0,0.,0.,0.,0,"{Threshold for off
set values} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#
MethodSCOLIBPS"},
                {"total_pattern_size",9,0,6,0,427,0,0.,0.,0.,0,"{Total number of
points in pattern} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommand
s.html#MethodSCOLIBPS"}
                }
```

42.1.4.42 static KeyWord kw_38 () [static]

Initial value:

```
{
                {"constant_penalty",8,0,4,0,451,0,0.,0.,0.,0,"{Control of dynamic
 penalty} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodSCOLIBSW"},
                {"constraint_penalty",10,0,12,0,455,0,0.,0.,0.,0,"{Constraint pen
alty} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
SCOLIBPS"},
                {"contract_after_failure",9,0,1,0,445,0,0.,0.,0.,0,"{Number of co
nsecutive failures before contraction} http://dakota.sandia.gov/licensing/votd/ht
ml-ref/MethodCommands.html#MethodSCOLIBSW"},
                {"contraction_factor",10,0,11,0,453,0,0.,0.,0.,0,"{Pattern contra
ction factor} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodSCOLIBPS"},
                {"expand_after_success",9,0,3,0,449,0,0.,0.,0.,0,"{Number of cons
ecutive improvements before expansion} http://dakota.sandia.gov/licensing/votd/ht
ml-ref/MethodCommands.html#MethodSCOLIBSW"},
                {"initial_delta",10,0,9,1,459,0,0.,0.,0.,0,"{Initial offset value
} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOL
IBPS"},
                {"misc_options",15,0,8,0,545,0,0.,0.,0.,0,"{Specify miscellaneous
 options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodSCOLIBDC"},
                {"no_expansion",8,0,2,0,447,0,0.,0.,0.,0,"{No expansion flag} htt
p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSCOLIBSW"
},
                {"seed",9,0,6,0,541,0,0.,0.,0.,0,"{Random seed for stochastic pat
tern search} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodSCOLIBPS"},
                {"show_misc_options",8,0,7,0,543,0,0.,0.,0.,0,"{Show miscellaneou
s options} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodSCOLIBDC"},
                {"solution_accuracy",2,0,5,0,538},
                {"solution_target",10,0,5,0,539,0,0.,0.,0.,0,"{Desired solution t
arget} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
dSCOLIBDC"},
                {"threshold_delta",10,0,10,2,461,0,0.,0.,0.,0,"{Threshold for off
set values} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#
MethodSCOLIBPS"}
                }
```

42.1.4.43 static KeyWord kw_39 () [static]

Initial value:

```
{
                {"linear_equality_constraint_matrix",14,0,14,0,403,0,0.,0.,0.,0,"
{Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html
-ref/MethodCommands.html#MethodIndControl"},
                {"linear_equality_scale_types",15,0,16,0,407,0,0.,0.,0.,0,"{Linea
r equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Method
Commands.html#MethodIndControl"},
                {"linear_equality_scales",14,0,17,0,409,0,0.,0.,0.,0,"{Linear equ
ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodIndControl"},
                {"linear_equality_targets",14,0,15,0,405,0,0.,0.,0.,0,"{Linear eq
```

```
uality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
tml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,9,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,10,0,395,0,0.,0.,0.,0,"{Li
near inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,12,0,399,0,0.,0.,0.,0,"{Lin
ear inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,13,0,401,0,0.,0.,0.,0,"{Linear i
nequality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands
.html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,11,0,397,0,0.,0.,0.,0,"{Li
near inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"}
          }
```

42.1.4.44 static KeyWord kw_40 () [static]

Initial value:

```
{
          {"drop_tolerance",10,0,1,0,935}
          }
```

42.1.4.45 static KeyWord kw_41 () [static]

Initial value:

```
{
          {"box_behnken",8,0,1,1,925,0,0.,0.,0.,0,"[CHOOSE DACE type]"},
          {"central_composite",8,0,1,1,927},
          {"fixed_seed",8,0,5,0,937,0,0.,0.,0.,0,"{Fixed seed flag} http://
dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodDDACE"},
          {"grid",8,0,1,1,915},
          {"lhs",8,0,1,1,921},
          {"main_effects",8,0,2,0,929,0,0.,0.,0.,0,"{Main effects} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodDDACE"},
          {"oa_lhs",8,0,1,1,923},
          {"oas",8,0,1,1,919},
          {"quality_metrics",8,0,3,0,931,0,0.,0.,0.,0,"{Quality metrics} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodDDACE"},

          {"random",8,0,1,1,917},
          {"samples",9,0,8,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
          {"seed",9,0,7,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
          {"symbols",9,0,6,0,939,0,0.,0.,0.,0,"{Number of symbols} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodDDACE"},
          {"variance_based_decomp",8,1,4,0,933,kw_40,0.,0.,0.,0,"{Variance
based decomposition} http://dakota.sandia.gov/licensing/votd/html-ref/MethodComma
nds.html#MethodDDACE"}
          }
```

42.1.4.46 static KeyWord kw_42 () [static]

Initial value:

```
{
                {"maximize",8,0,1,1,177},
                {"minimize",8,0,1,1,175}
                }
```

42.1.4.47 static KeyWord kw_43 () [static]

Initial value:

```
{
                {"bfgs",8,0,1,1,167},
                {"frcg",8,0,1,1,163},
                {"linear_equality_constraint_matrix",14,0,7,0,403,0,0.,0.,0.,0,"{
     Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
     ref/MethodCommands.html#MethodIndControl"},
                {"linear_equality_scale_types",15,0,9,0,407,0,0.,0.,0.,0,"{Linear
      equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
     ommands.html#MethodIndControl"},
                {"linear_equality_scales",14,0,10,0,409,0,0.,0.,0.,0,"{Linear equ
     ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
     l#MethodIndControl"},
                {"linear_equality_targets",14,0,8,0,405,0,0.,0.,0.,0,"{Linear equ
     ality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.ht
     ml#MethodIndControl"},
                {"linear_inequality_constraint_matrix",14,0,2,0,393,0,0.,0.,0.,0,
     "{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
     tml-ref/MethodCommands.html#MethodIndControl"},
                {"linear_inequality_lower_bounds",14,0,3,0,395,0,0.,0.,0.,0,"{Lin
     ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
     hodCommands.html#MethodIndControl"},
                {"linear_inequality_scale_types",15,0,5,0,399,0,0.,0.,0.,0,"{Line
     ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
     hodCommands.html#MethodIndControl"},
                {"linear_inequality_scales",14,0,6,0,401,0,0.,0.,0.,0,"{Linear in
     equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
     html#MethodIndControl"},
                {"linear_inequality_upper_bounds",14,0,4,0,397,0,0.,0.,0.,0,"{Lin
     ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
     hodCommands.html#MethodIndControl"},
                {"mmfd",8,0,1,1,165},
                {"optimization_type",8,2,11,0,173,kw_42,0.,0.,0.,0,"{Optimization
      type} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
     dDOTDC"},
                {"slp",8,0,1,1,169},
                {"sqp",8,0,1,1,171}
                }
```

42.1.4.48 static KeyWord kw_44 () [static]

Initial value:

```
{
```

```
          {"linear_equality_constraint_matrix",14,0,6,0,403,0,0.,0.,0.,0,"{
Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
ref/MethodCommands.html#MethodIndControl"},
          {"linear_equality_scale_types",15,0,8,0,407,0,0.,0.,0.,0,"{Linear
 equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
ommands.html#MethodIndControl"},
          {"linear_equality_scales",14,0,9,0,409,0,0.,0.,0.,0,"{Linear equa
lity scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodIndControl"},
          {"linear_equality_targets",14,0,7,0,405,0,0.,0.,0.,0,"{Linear equ
ality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.ht
ml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,1,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,2,0,395,0,0.,0.,0.,0,"{Lin
ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,4,0,399,0,0.,0.,0.,0,"{Line
ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,5,0,401,0,0.,0.,0.,0,"{Linear in
equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,3,0,397,0,0.,0.,0.,0,"{Lin
ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"optimization_type",8,2,10,0,173,kw_42,0.,0.,0.,0,"{Optimization
 type} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
dDOTDC"}
          }
```

42.1.4.49 static KeyWord kw_45 [static]

Initial value:

```
{
          {"dakota",8,0,1,1,585},
          {"surfpack",8,0,1,1,583}
          }
```

42.1.4.50 static KeyWord kw_46 () [static]

Initial value:

```
{
          {"gaussian_process",8,2,1,0,581,kw_45,0.,0.,0.,0,"{GP selection}
http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
          {"kriging",0,2,1,0,580,kw_45},
          {"seed",9,0,3,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
          {"use_derivatives",8,0,2,0,587,0,0.,0.,0.,0,"{Derivative usage} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"}
          }
```

42.1.4.51 static KeyWord kw_47 () [static]

Initial value:

```
{
                {"grid",8,0,1,1,955,0,0.,0.,0.,0,"[CHOOSE trial type]"},
                {"halton",8,0,1,1,957},
                {"random",8,0,1,1,959,0,0.,0.,0.,0,"@"}
                }
```

42.1.4.52 static KeyWord kw_48 () [static]

Initial value:

```
{
                {"drop_tolerance",10,0,1,0,949}
                }
```

42.1.4.53 static KeyWord kw_49 () [static]

Initial value:

```
{
                {"fixed_seed",8,0,4,0,951,0,0.,0.,0.,0,"{Fixed seed flag} http://
     dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE"},
                {"latinize",8,0,1,0,943,0,0.,0.,0.,0,"{Latinization of samples} h
     ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE
     "},
                {"num_trials",9,0,6,0,961,0,0.,0.,0.,0,"{Number of trials  } http
     ://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE"},

                {"quality_metrics",8,0,2,0,945,0,0.,0.,0.,0,"{Quality metrics} ht
     tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE"
     },
                {"samples",9,0,8,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
     akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"seed",9,0,7,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
     dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
                {"trial_type",8,3,5,0,953,kw_47,0.,0.,0.,0,"{Trial type} http://d
     akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE"},
                {"variance_based_decomp",8,1,3,0,947,kw_48,0.,0.,0.,0,"{Variance
     based decomposition} http://dakota.sandia.gov/licensing/votd/html-ref/MethodComma
     nds.html#MethodFSUDACE"}
                }
```

42.1.4.54 static KeyWord kw_50 () [static]

Initial value:

```
{
                {"drop_tolerance",10,0,1,0,1147}
                }
```

42.1.4.55 static KeyWord kw_51 () [static]

Initial value:

```
{
                {"fixed_sequence",8,0,6,0,1151,0,0.,0.,0.,0,"{Fixed sequence flag
     } http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUD
     ACE"},
                {"halton",8,0,1,1,1137,0,0.,0.,0.,0,"[CHOOSE sequence type]"},
                {"hammersley",8,0,1,1,1139},
                {"latinize",8,0,2,0,1141,0,0.,0.,0.,0,"{Latinization of samples}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDAC
     E"},
                {"prime_base",13,0,9,0,1157,0,0.,0.,0.,0,"{Prime bases for sequen
     ces} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodF
     SUDACE"},
                {"quality_metrics",8,0,3,0,1143,0,0.,0.,0.,0,"{Quality metrics} h
     ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE
     "},
                {"samples",9,0,5,0,1149,0,0.,0.,0.,0,"{Number of samples} http://
     dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodFSUDACE"},
                {"sequence_leap",13,0,8,0,1155,0,0.,0.,0.,0,"{Sequence leaping in
     dices} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Metho
     dFSUDACE"},
                {"sequence_start",13,0,7,0,1153,0,0.,0.,0.,0,"{Sequence starting
     indices} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Met
     hodFSUDACE"},
                {"variance_based_decomp",8,1,4,0,1145,kw_50,0.,0.,0.,0,"{Variance
      based decomposition} http://dakota.sandia.gov/licensing/votd/html-ref/MethodComm
     ands.html#MethodFSUDACE"}
                }
```

42.1.4.56 static KeyWord kw_52 () [static]

Initial value:

```
{
                {"complementary",8,0,1,1,831},
                {"cumulative",8,0,1,1,829}
                }
```

42.1.4.57 static KeyWord kw_53 () [static]

Initial value:

```
{
                {"num_gen_reliability_levels",13,0,1,0,839,0,0.,0.,0.,0,"{Number
     of generalized reliability levels} http://dakota.sandia.gov/licensing/votd/html-r
     ef/MethodCommands.html#MethodNonD"}
                }
```

42.1.4.58 static KeyWord kw_54 () [static]

Initial value:

```
{
                {"num_probability_levels",13,0,1,0,835,0,0.,0.,0.,0,"{Number of p
robability levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommand
s.html#MethodNonD"}
                }
```

42.1.4.59 static KeyWord kw_55 () [static]

Initial value:

```
{
                {"mt19937",8,0,1,1,843},
                {"rnum2",8,0,1,1,845}
                }
```

42.1.4.60 static KeyWord kw_56 () [static]

Initial value:

```
{
                {"dakota",8,0,1,1,805},
                {"surfpack",8,0,1,1,803}
                }
```

42.1.4.61 static KeyWord kw_57 () [static]

Initial value:

```
{
                {"gaussian_process",8,2,1,0,801,kw_56},
                {"kriging",0,2,1,0,800,kw_56},
                {"use_derivatives",8,0,2,0,807}
                }
```

42.1.4.62 static KeyWord kw_58 () [static]

Initial value:

```
{
                {"parallel",8,0,1,1,825},
                {"series",8,0,1,1,823}
                }
```

42.1.4.63 static KeyWord kw_59 () [static]

Initial value:

```
{
                {"gen_reliabilities",8,0,1,1,819},
                {"probabilities",8,0,1,1,817},
                {"system",8,2,2,0,821,kw_58}
                }
```

42.1.4.64 static KeyWord kw_60 () [static]

Initial value:

```
{
                {"compute",8,3,2,0,815,kw_59},
                {"num_response_levels",13,0,1,0,813}
                }
```

42.1.4.65 static KeyWord kw_61 () [static]

Initial value:

```
{
                {"distribution",8,2,5,0,827,kw_52,0.,0.,0.,0,"{Distribution type}
 http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonD"
},
                {"ego",8,3,1,0,799,kw_57},
                {"gen_reliability_levels",14,1,7,0,837,kw_53,0.,0.,0.,0,"{General
ized reliability levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
ommands.html#MethodNonD"},
                {"lhs",8,0,1,0,809},
                {"probability_levels",14,1,6,0,833,kw_54,0.,0.,0.,0,"{Probability
 levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Met
hodNonD"},
                {"response_levels",14,2,2,0,811,kw_60},
                {"rng",8,2,8,0,841,kw_55,0.,0.,0.,0,"{Random number generator} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"}
,
                {"samples",9,0,4,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"seed",9,0,3,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"}
                }
```

42.1.4.66 static KeyWord kw_62 () [static]

Initial value:

```
{
                {"dakota",8,0,1,1,855},
                {"surfpack",8,0,1,1,853}
                }
```

42.1.4.67 static KeyWord kw_63 () [static]

Initial value:

```
{
                {"gaussian_process",8,2,1,0,851,kw_62,0.,0.,0.,0,"{EGO GP selecti
     on} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNo
     nDGlobalIntervalEst"},
                {"kriging",0,2,1,0,850,kw_62},
                {"use_derivatives",8,0,2,0,857,0,0.,0.,0.,0,"{Derivative usage} h
     ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDGlo
     balIntervalEst"}
                }
```

42.1.4.68 static KeyWord kw_64 () [static]

Initial value:

```
{
                {"mt19937",8,0,1,1,863},
                {"rnum2",8,0,1,1,865}
                }
```

42.1.4.69 static KeyWord kw_65 () [static]

Initial value:

```
{
                {"ego",8,3,1,0,849,kw_63},
                {"lhs",8,0,1,0,859},
                {"rng",8,2,2,0,861,kw_64,0.,0.,0.,0,"{Random seed generator} http
     ://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDGlobal
     IntervalEst"},
                {"samples",9,0,4,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
     akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"seed",9,0,3,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
     dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"}
                }
```

42.1.4.70 static KeyWord kw_66 () [static]

Initial value:

```
{
                {"complementary",8,0,1,1,1125},
                {"cumulative",8,0,1,1,1123}
                }
```

42.1.4.71 static KeyWord kw_67 () [static]

Initial value:

```
{
                {"num_gen_reliability_levels",13,0,1,0,1133}
                }
```

42.1.4.72 static KeyWord kw_68 () [static]

Initial value:

```
{
                {"num_probability_levels",13,0,1,0,1129}
                }
```

42.1.4.73 static KeyWord kw_69 () [static]

Initial value:

```
{
                {"parallel",8,0,1,1,1119},
                {"series",8,0,1,1,1117}
                }
```

42.1.4.74 static KeyWord kw_70 () [static]

Initial value:

```
{
                {"gen_reliabilities",8,0,1,1,1113},
                {"probabilities",8,0,1,1,1111},
                {"system",8,2,2,0,1115,kw_69}
                }
```

42.1.4.75 static KeyWord kw_71 () [static]

Initial value:

```
{
                {"compute",8,3,2,0,1109,kw_70},
                {"num_response_levels",13,0,1,0,1107}
                }
```

42.1.4.76 static KeyWord kw_72 () [static]

Initial value:

```
{
                {"mt19937",8,0,1,1,1101},
                {"rnum2",8,0,1,1,1103}
                }
```

42.1.4.77 static KeyWord kw_73 () [static]

Initial value:

```
{
                {"dakota",8,0,1,0,1091},
                {"surfpack",8,0,1,0,1089}
                }
```

42.1.4.78 static KeyWord kw_74 () [static]

Initial value:

```
{
                {"all_variables",8,0,2,0,1093,0,0.,0.,0.,0,"{All variables flag}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDGl
     obalRel"},
                {"distribution",8,2,7,0,1121,kw_66},
                {"gen_reliability_levels",14,1,9,0,1131,kw_67},
                {"probability_levels",14,1,8,0,1127,kw_68},
                {"response_levels",14,2,6,0,1105,kw_71},
                {"rng",8,2,5,0,1099,kw_72},
                {"seed",9,0,4,0,1097,0,0.,0.,0.,0,"{Refinement seed} http://dakot
     a.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDLocalRel"},
                {"u_gaussian_process",8,2,1,1,1087,kw_73},
                {"u_kriging",0,0,1,1,1086},
                {"use_derivatives",8,0,3,0,1095,0,0.,0.,0.,0,"{Derivative usage}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDGl
     obalRel"},
                {"x_gaussian_process",8,2,1,1,1085,kw_73},
                {"x_kriging",0,2,1,1,1084,kw_73}
                }
```

42.1.4.79 static KeyWord kw_75 () [static]

Initial value:

```
{
                {"parallel",8,0,1,1,795},
                {"series",8,0,1,1,793}
                }
```

42.1.4.80 static KeyWord kw_76 () [static]

Initial value:

```
{
                {"gen_reliabilities",8,0,1,1,789},
                {"probabilities",8,0,1,1,787},
                {"system",8,2,2,0,791,kw_75}
                }
```

42.1.4.81 static KeyWord kw_77 () [static]

Initial value:

```
{
                {"compute",8,3,2,0,785,kw_76},
                {"num_response_levels",13,0,1,0,783}
                }
```

42.1.4.82 static KeyWord kw_78 () [static]

Initial value:

```
{
                {"distribution",8,2,4,0,827,kw_52,0.,0.,0.,0,"{Distribution type}
 http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonD"
},
                {"gen_reliability_levels",14,1,6,0,837,kw_53,0.,0.,0.,0,"{General
ized reliability levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
ommands.html#MethodNonD"},
                {"probability_levels",14,1,5,0,833,kw_54,0.,0.,0.,0,"{Probability
 levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Met
hodNonD"},
                {"response_levels",14,2,1,0,781,kw_77},
                {"rng",8,2,7,0,841,kw_55,0.,0.,0.,0,"{Random number generator} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"}
,
                {"samples",9,0,3,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"seed",9,0,2,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"}
                }
```

42.1.4.83 static KeyWord kw_79 () [static]

Initial value:

```
{
                {"list_of_points",14,0,1,1,1169,0,0.,0.,0.,0,"{List of points to
evaluate} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodPSLPS"}
                }
```

42.1.4.84 static KeyWord kw_80 () [static]

Initial value:

```
{
                {"complementary",8,0,1,1,1013},
                {"cumulative",8,0,1,1,1011}
                }
```

42.1.4.85 static KeyWord kw_81 () [static]

Initial value:

```
{
                {"num_gen_reliability_levels",13,0,1,0,1007}
                }
```

42.1.4.86 static KeyWord kw_82 () [static]

Initial value:

```
{
                {"num_probability_levels",13,0,1,0,1003}
                }
```

42.1.4.87 static KeyWord kw_83 () [static]

Initial value:

```
{
                {"parallel",8,0,1,1,999},
                {"series",8,0,1,1,997}
                }
```

42.1.4.88 static KeyWord kw_84 () [static]

Initial value:

```
{
                {"gen_reliabilities",8,0,1,1,993},
                {"probabilities",8,0,1,1,991},
                {"system",8,2,2,0,995,kw_83}
                }
```

42.1.4.89 static KeyWord kw_85 () [static]

Initial value:

```
{
                {"compute",8,3,2,0,989,kw_84},
                {"num_response_levels",13,0,1,0,987}
                }
```

42.1.4.90 static KeyWord kw_86 () [static]

Initial value:

```
{
                {"distribution",8,2,5,0,1009,kw_80},
                {"gen_reliability_levels",14,1,4,0,1005,kw_81},
                {"nip",8,0,1,0,983},
                {"probability_levels",14,1,3,0,1001,kw_82},
                {"response_levels",14,2,2,0,985,kw_85},
                {"sqp",8,0,1,0,981}
                }
```

42.1.4.91 static KeyWord kw_87 () [static]

Initial value:

```
{
                {"nip",8,0,1,0,1019},
                {"sqp",8,0,1,0,1017}
                }
```

42.1.4.92 static KeyWord kw_88 () [static]

Initial value:

```
{
                {"adapt_import",8,0,1,1,1053},
                {"import",8,0,1,1,1051},
                {"mm_adapt_import",8,0,1,1,1055},
                {"samples",9,0,2,0,1057,0,0.,0.,0,"{Refinement samples} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDLocalRel
     "},
                {"seed",9,0,3,0,1059,0,0.,0.,0,"{Random seed} http://dakota.sa
     ndia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"}
                }
```

42.1.4.93 static KeyWord kw_89 () [static]

Initial value:

```
{
                {"first_order",8,0,1,1,1045},
                {"sample_refinement",8,5,2,0,1049,kw_88},
                {"second_order",8,0,1,1,1047}
                }
```

42.1.4.94 static KeyWord kw_90 () [static]

Initial value:

```
{
                {"integration",8,3,3,0,1043,kw_89,0.,0.,0.,0,"{Integration method
     } http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonD
     LocalRel"},
                {"nip",8,0,2,0,1041},
                {"no_approx",8,0,1,1,1037},
                {"sqp",8,0,2,0,1039},
                {"u_taylor_mean",8,0,1,1,1027},
                {"u_taylor_mpp",8,0,1,1,1031},
                {"u_two_point",8,0,1,1,1035},
                {"x_taylor_mean",8,0,1,1,1025},
                {"x_taylor_mpp",8,0,1,1,1029},
                {"x_two_point",8,0,1,1,1033}
                }
```

42.1.4.95 static KeyWord kw_91 () [static]

Initial value:

```
{
                {"num_reliability_levels",13,0,1,0,1081}
                }
```

42.1.4.96 static KeyWord kw_92 () [static]

Initial value:

```
{
                {"parallel",8,0,1,1,1077},
                {"series",8,0,1,1,1075}
                }
```

42.1.4.97 static KeyWord kw_93 () [static]

Initial value:

```
{
                {"gen_reliabilities",8,0,1,1,1071},
                {"probabilities",8,0,1,1,1067},
                {"reliabilities",8,0,1,1,1069},
                {"system",8,2,2,0,1073,kw_92}
                }
```

42.1.4.98 static KeyWord kw_94 () [static]

Initial value:

```
{
                {"compute",8,4,2,0,1065,kw_93},
                {"num_response_levels",13,0,1,0,1063}
                }
```

42.1.4.99 static KeyWord kw_95 () [static]

Initial value:

```
{
                {"distribution",8,2,4,0,1121,kw_66},
                {"gen_reliability_levels",14,1,6,0,1131,kw_67},
                {"mpp_search",8,10,1,0,1023,kw_90,0.,0.,0.,0,"{MPP search type} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDLoc
alRel"},
                {"probability_levels",14,1,5,0,1127,kw_68},
                {"reliability_levels",14,1,3,0,1079,kw_91},
                {"response_levels",14,2,2,0,1061,kw_94}
                }
```

42.1.4.100 static KeyWord kw_96 () [static]

Initial value:

```
{
                {"num_offspring",0x19,0,2,0,371,0,0.,0.,0.,0,"{Number of offsprin
g in random shuffle crossover} http://dakota.sandia.gov/licensing/votd/html-ref/M
ethodCommands.html#MethodJEGADC"},
                {"num_parents",0x19,0,1,0,369,0,0.,0.,0.,0,"{Number of parents in
 random shuffle crossover} http://dakota.sandia.gov/licensing/votd/html-ref/Metho
dCommands.html#MethodJEGADC"}
                }
```

42.1.4.101 static KeyWord kw_97 () [static]

Initial value:

```
{
                {"crossover_rate",10,0,2,0,373,0,0.,0.,0.,0,"{Crossover rate} htt
p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"},

                {"multi_point_binary",9,0,1,1,361,0,0.,0.,0.,0,"{Multi point bina
ry crossover} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodJEGADC"},
                {"multi_point_parameterized_binary",9,0,1,1,363,0,0.,0.,0.,0,"{Mu
lti point parameterized binary crossover} http://dakota.sandia.gov/licensing/votd
/html-ref/MethodCommands.html#MethodJEGADC"},
                {"multi_point_real",9,0,1,1,365,0,0.,0.,0.,0,"{Multi point real c
rossover} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodJEGADC"},
                {"shuffle_random",8,2,1,1,367,kw_96,0.,0.,0.,0,"{Random shuffle c
rossover} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodJEGADC"}
                }
```

42.1.4.102 static KeyWord kw_98 () [static]

Initial value:

```
{
                {"flat_file",11,0,1,1,357},
                {"simple_random",8,0,1,1,353},
                {"unique_random",8,0,1,1,355}
                }
```

42.1.4.103 static KeyWord kw_99 () [static]

Initial value:

```
{
                {"mutation_scale",10,0,1,0,387,0,0.,0.,0.,0,"{Mutation scale} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"}
                }
```

42.1.4.104 static KeyWord kw_100 () [static]

Initial value:

```
{
                {"bit_random",8,0,1,1,377},
                {"mutation_rate",10,0,2,0,389,0,0.,0.,0.,0,"{Mutation rate} http:
     //dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"},
                {"offset_cauchy",8,1,1,1,383,kw_99},
                {"offset_normal",8,1,1,1,381,kw_99},
                {"offset_uniform",8,1,1,1,385,kw_99},
                {"replace_uniform",8,0,1,1,379}
                }
```

42.1.4.105 static KeyWord kw_101 () [static]

Initial value:

```
{
                {"metric_tracker",8,0,1,1,303,0,0.,0.,0.,0,"{Convergence type} ht
     tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGAMOGA
     "},
                {"num_generations",0x29,0,3,0,307,0,0.,0.,0.,0,"{Number generatio
     ns for metric_tracker converger} http://dakota.sandia.gov/licensing/votd/html-ref
     /MethodCommands.html#MethodJEGAMOGA"},
                {"percent_change",10,0,2,0,305,0,0.,0.,0.,0,"{Percent change limi
     t for metric_tracker converger} http://dakota.sandia.gov/licensing/votd/html-ref/
     MethodCommands.html#MethodJEGAMOGA"}
                }
```

42.1.4.106 static KeyWord kw_102 () [static]

Initial value:

```
{
                {"domination_count",8,0,1,1,281},
                {"layer_rank",8,0,1,1,279}
                }
```

42.1.4.107 static KeyWord kw_103 () [static]

Initial value:

```
{
                {"distance",14,0,1,1,299},
                {"radial",14,0,1,1,297}
                }
```

42.1.4.108 static KeyWord kw_104 () [static]

Initial value:

```
{
                {"orthogonal_distance",14,0,1,1,311,0,0.,0.,0.,0,"{Post_processor
 distance} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodJEGAMOGA"}
                }
```

42.1.4.109 static KeyWord kw_105 () [static]

Initial value:

```
{
                {"shrinkage_fraction",10,0,1,0,293},
                {"shrinkage_percentage",2,0,1,0,292}
                }
```

42.1.4.110 static KeyWord kw_106 () [static]

Initial value:

```
{
                {"below_limit",10,2,1,1,291,kw_105,0.,0.,0.,0,"{Below limit selec
tion} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
JEGADC"},
                {"elitist",8,0,1,1,285},
                {"roulette_wheel",8,0,1,1,287},
                {"unique_roulette_wheel",8,0,1,1,289}
                }
```

42.1.4.111 static KeyWord kw_107 () [static]

Initial value:

```
{
                {"convergence_type",8,3,4,0,301,kw_101},
                {"crossover_type",8,5,19,0,359,kw_97,0.,0.,0.,0,"{Crossover type}
 http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGAD
C"},
```

```
          {"fitness_type",8,2,1,0,277,kw_102,0.,0.,0.,0,"{Fitness type} htt
p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGAMOGA"
},
          {"initialization_type",8,3,18,0,351,kw_98,0.,0.,0.,0,"{Initializa
tion type} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodJEGADC"},
          {"linear_equality_constraint_matrix",14,0,11,0,403,0,0.,0.,0.,0,"
{Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html
-ref/MethodCommands.html#MethodIndControl"},
          {"linear_equality_scale_types",15,0,13,0,407,0,0.,0.,0.,0,"{Linea
r equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Method
Commands.html#MethodIndControl"},
          {"linear_equality_scales",14,0,14,0,409,0,0.,0.,0.,0,"{Linear equ
ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodIndControl"},
          {"linear_equality_targets",14,0,12,0,405,0,0.,0.,0.,0,"{Linear eq
uality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
tml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,6,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,7,0,395,0,0.,0.,0.,0,"{Lin
ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,9,0,399,0,0.,0.,0.,0,"{Line
ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,10,0,401,0,0.,0.,0.,0,"{Linear i
nequality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands
.html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,8,0,397,0,0.,0.,0.,0,"{Lin
ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"log_file",11,0,16,0,347,0,0.,0.,0.,0,"{Log file} http://dakota.
sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"},
          {"mutation_type",8,6,20,0,375,kw_100,0.,0.,0.,0,"{Mutation type}
http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC
"},
          {"niching_type",8,2,3,0,295,kw_103,0.,0.,0.,0,"{Niche pressure ty
pe} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJE
GAMOGA"},
          {"population_size",9,0,15,0,345,0,0.,0.,0.,0,"{Number of populati
on members} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#
MethodJEGADC"},
          {"postprocessor_type",8,1,5,0,309,kw_104,0.,0.,0.,0,"{Post_proces
sor type} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
thodJEGAMOGA"},
          {"print_each_pop",8,0,17,0,349,0,0.,0.,0.,0,"{Population output}
http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC
"},
          {"replacement_type",8,4,2,0,283,kw_106,0.,0.,0.,0,"{Replacement t
ype} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJ
EGADC"},
          {"seed",9,0,21,0,391,0,0.,0.,0.,0,"{Random seed} http://dakota.sa
ndia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"}
          }
```

42.1.4.112 static KeyWord kw_108 () [static]

Initial value:

```
{
                {"partitions",13,0,1,1,1179,0,0.,0.,0.,0,"{Partitions per variabl
     e} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodPSM
     PS"}
                }
```

42.1.4.113 static KeyWord kw_109 () [static]

Initial value:

```
{
                {"min_boxsize_limit",10,0,2,0,975,0,0.,0.,0.,0,"{Min boxsize limi
     t} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNCS
     UDC"},
                {"solution_accuracy",2,0,1,0,972},
                {"solution_target",10,0,1,0,973,0,0.,0.,0.,0,"{Solution Target }
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNCSUDC
     "},
                {"volume_boxsize_limit",10,0,3,0,977,0,0.,0.,0.,0,"{Volume boxsiz
     e limit} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Met
     hodNCSUDC"}
                }
```

42.1.4.114 static KeyWord kw_110 () [static]

Initial value:

```
{
                {"absolute_conv_tol",10,0,2,0,551,0,0.,0.,0.,0,"{Absolute functio
     n convergence tolerance} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
     ommands.html#MethodLSNL2SOL"},
                {"covariance",9,0,8,0,563,0,0.,0.,0.,0,"{Covariance post-processi
     ng} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodLS
     NL2SOL"},
                {"false_conv_tol",10,0,6,0,559,0,0.,0.,0.,0,"{False convergence t
     olerance} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
     thodLSNL2SOL"},
                {"function_precision",10,0,1,0,549,0,0.,0.,0.,0,"{Relative precis
     ion in least squares terms} http://dakota.sandia.gov/licensing/votd/html-ref/Meth
     odCommands.html#MethodLSNL2SOL"},
                {"initial_trust_radius",10,0,7,0,561,0,0.,0.,0.,0,"{Initial trust
      region radius} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
     tml#MethodLSNL2SOL"},
                {"regression_diagnostics",8,0,9,0,565,0,0.,0.,0.,0,"{Regression d
     iagnostics post-processing} http://dakota.sandia.gov/licensing/votd/html-ref/Meth
     odCommands.html#MethodLSNL2SOL"},
                {"singular_conv_tol",10,0,4,0,555,0,0.,0.,0.,0,"{Singular converg
     ence tolerance} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
     tml#MethodLSNL2SOL"},
                {"singular_radius",10,0,5,0,557,0,0.,0.,0.,0,"{Step limit for sct
     ol} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodLS
     NL2SOL"},
                {"x_conv_tol",10,0,3,0,553,0,0.,0.,0.,0,"{Convergence tolerance f
     or change in parameter vector} http://dakota.sandia.gov/licensing/votd/html-ref/M
     ethodCommands.html#MethodLSNL2SOL"}
                }
```

42.1.4.115 static KeyWord kw_111 () [static]

Initial value:

```
{
                {"num_reliability_levels",13,0,1,0,759,0,0.,0.,0.,0,"{Number of r
     eliability levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommand
     s.html#MethodNonD"}
                }
```

42.1.4.116 static KeyWord kw_112 () [static]

Initial value:

```
{
                {"parallel",8,0,1,1,777},
                {"series",8,0,1,1,775}
                }
```

42.1.4.117 static KeyWord kw_113 () [static]

Initial value:

```
{
                {"gen_reliabilities",8,0,1,1,771},
                {"probabilities",8,0,1,1,767},
                {"reliabilities",8,0,1,1,769},
                {"system",8,2,2,0,773,kw_112}
                }
```

42.1.4.118 static KeyWord kw_114 () [static]

Initial value:

```
{
                {"compute",8,4,2,0,765,kw_113,0.,0.,0.,0,"{Target statistics for
     response levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
     html#MethodNonD"},
                {"num_response_levels",13,0,1,0,763,0,0.,0.,0.,0,"{Number of resp
     onse levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
     #MethodNonD"}
                }
```

42.1.4.119 static KeyWord kw_115 () [static]

Initial value:

```
{
                {"expansion_order",13,0,5,1,641,0,0.,0.,0.,0,"{Expansion order} h
     ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDPCE
```

```
"},
          {"expansion_terms",9,0,5,1,643,0,0.,0.,0.,0,"{Expansion terms} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDPCE"
},
          {"ratio_order",10,0,1,0,627,0,0.,0.,0.,0,"{Order of collocation o
versampling relationship} http://dakota.sandia.gov/licensing/votd/html-ref/Method
Commands.html#MethodNonDPCE"},
          {"reuse_points",8,0,2,0,629},
          {"reuse_samples",0,0,2,0,628},
          {"tensor_grid",8,0,4,0,633},
          {"use_derivatives",8,0,3,0,631}
          }
```

42.1.4.120 static KeyWord kw_116 () [static]

Initial value:

```
{
          {"expansion_order",13,0,5,1,641,0,0.,0.,0.,0,"{Expansion order} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDPCE
"},
          {"expansion_terms",9,0,5,1,643,0,0.,0.,0.,0,"{Expansion terms} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDPCE"
}
          }
```

42.1.4.121 static KeyWord kw_117 () [static]

Initial value:

```
{
          {"expansion_order",13,0,2,1,641,0,0.,0.,0.,0,"{Expansion order} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDPCE
"},
          {"expansion_terms",9,0,2,1,643,0,0.,0.,0.,0,"{Expansion terms} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDPCE"
},
          {"incremental_lhs",8,0,1,0,637,0,0.,0.,0.,0,"{Use incremental LHS
 for expansion_samples} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCo
mmands.html#MethodNonDPCE"}
          }
```

42.1.4.122 static KeyWord kw_118 () [static]

Initial value:

```
{
          {"decay",8,0,1,1,599},
          {"generalized",8,0,1,1,601},
          {"sobol",8,0,1,1,597}
          }
```

42.1.4.123 static KeyWord kw_119 () [static]

Initial value:

```
{
                {"dimension_adaptive",8,3,1,1,595,kw_118},
                {"uniform",8,0,1,1,593}
                }
```

42.1.4.124 static KeyWord kw_120 () [static]

Initial value:

```
{
                {"dimension_preference",14,0,1,0,615,0,0.,0.,0.,0,"{Dimension pre
     ference for anisotropic tensor and sparse grids} http://dakota.sandia.gov/licensi
     ng/votd/html-ref/MethodCommands.html#MethodNonDPCE"},
                {"nested",8,0,2,0,617},
                {"non_nested",8,0,2,0,619}
                }
```

42.1.4.125 static KeyWord kw_121 () [static]

Initial value:

```
{
                {"adapt_import",8,0,1,1,655},
                {"import",8,0,1,1,653},
                {"mm_adapt_import",8,0,1,1,657}
                }
```

42.1.4.126 static KeyWord kw_122 () [static]

Initial value:

```
{
                {"lhs",8,0,1,1,661},
                {"random",8,0,1,1,663}
                }
```

42.1.4.127 static KeyWord kw_123 () [static]

Initial value:

```
{
                {"dimension_preference",14,0,2,0,615,0,0.,0.,0.,0,"{Dimension pre
     ference for anisotropic tensor and sparse grids} http://dakota.sandia.gov/licensi
     ng/votd/html-ref/MethodCommands.html#MethodNonDPCE"},
                {"nested",8,0,3,0,617},
                {"non_nested",8,0,3,0,619},
                {"restricted",8,0,1,0,611},
                {"unrestricted",8,0,1,0,613}
                }
```

42.1.4.128 static KeyWord kw_124 () [static]

Initial value:

```
{
                {"drop_tolerance",10,0,2,0,649,0,0.,0.,0.,0,"{VBD tolerance for o
     mitting small indices} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCom
     mands.html#MethodNonDMC"},
                {"univariate_effects",8,0,1,0,647,0,0.,0.,0.,0,"{Restriction of V
     BD indices to main/total} http://dakota.sandia.gov/licensing/votd/html-ref/Method
     Commands.html#MethodNonDPCE"}
                }
```

42.1.4.129 static KeyWord kw_125 () [static]

Initial value:

```
{
                {"all_variables",8,0,15,0,753,0,0.,0.,0.,0,"{All variables flag}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC
     "},
                {"askey",8,0,2,0,603},
                {"collocation_points",9,7,3,1,623,kw_115,0.,0.,0.,0,"{Number coll
     ocation points to estimate coeffs} http://dakota.sandia.gov/licensing/votd/html-r
     ef/MethodCommands.html#MethodNonDPCE"},
                {"collocation_ratio",10,7,3,1,625,kw_115,0.,0.,0.,0,"{Collocation
      point oversampling ratio to estimate coeffs} http://dakota.sandia.gov/licensing/
     votd/html-ref/MethodCommands.html#MethodNonDPCE"},
                {"cubature_integrand",9,0,3,1,621,0,0.,0.,0.,0,"{Cubature integra
     nd order for PCE coefficient estimation} http://dakota.sandia.gov/licensing/votd/
     html-ref/MethodCommands.html#MethodNonDPCE"},
                {"distribution",8,2,9,0,827,kw_52,0.,0.,0.,0,"{Distribution type}
      http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonD"
     },
                {"expansion_import_file",11,2,3,1,639,kw_116,0.,0.,0.,0,"{PCE coe
     ffs import file} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
     html#MethodNonDPCE"},
                {"expansion_samples",9,3,3,1,635,kw_117,0.,0.,0.,0,"{Number simul
     ation samples to estimate coeffs} http://dakota.sandia.gov/licensing/votd/html-re
     f/MethodCommands.html#MethodNonDPCE"},
                {"fixed_seed",8,0,16,0,755,0,0.,0.,0.,0,"{Fixed seed flag} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"gen_reliability_levels",14,1,11,0,837,kw_53,0.,0.,0.,0,"{Genera
     lized reliability levels} http://dakota.sandia.gov/licensing/votd/html-ref/Method
     Commands.html#MethodNonD"},
                {"p_refinement",8,2,1,0,591,kw_119,0.,0.,0.,0,"{Automated polynom
     ial order refinement} http://dakota.sandia.gov/licensing/votd/html-ref/MethodComm
     ands.html#MethodNonDPCE"},
                {"probability_levels",14,1,10,0,833,kw_54,0.,0.,0.,0,"{Probabilit
     y levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
     thodNonD"},
                {"quadrature_order",13,3,3,1,607,kw_120,0.,0.,0.,0,"{Quadrature o
     rder for PCE coefficient estimation} http://dakota.sandia.gov/licensing/votd/html
     -ref/MethodCommands.html#MethodNonDPCE"},
                {"reliability_levels",14,1,13,0,757,kw_111,0.,0.,0.,0,"{Reliabili
     ty levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
     ethodNonD"},
                {"response_levels",14,2,14,0,761,kw_114,0.,0.,0.,0,"{Response lev
     els} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodN
```

```
onD"},
          {"rng",8,2,12,0,841,kw_55,0.,0.,0.,0,"{Random number generator} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"
},
          {"sample_refinement",8,3,5,0,651,kw_121,0.,0.,0.,0,"{Importance s
ampling refinement} http://dakota.sandia.gov/licensing/votd/html-ref/MethodComman
ds.html#MethodNonDPCE"},
          {"sample_type",8,2,6,0,659,kw_122,0.,0.,0.,0,"{Sampling type} htt
p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},

          {"samples",9,0,8,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
          {"seed",9,0,7,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
          {"sparse_grid_level",13,5,3,1,609,kw_123,0.,0.,0.,0,"{Sparse grid
 level for PCE coefficient estimation} http://dakota.sandia.gov/licensing/votd/ht
ml-ref/MethodCommands.html#MethodNonDPCE"},
          {"variance_based_decomp",8,2,4,0,645,kw_124,0.,0.,0.,0,"{Variance
 based decomposition (VBD)} http://dakota.sandia.gov/licensing/votd/html-ref/Meth
odCommands.html#MethodNonDMC"},
          {"wiener",8,0,2,0,605}
          }
```

42.1.4.130 static KeyWord kw_126 () [static]

Initial value:

```
{
          {"previous_samples",9,0,1,1,747,0,0.,0.,0.,0,"{Previous samples f
or incremental approaches} http://dakota.sandia.gov/licensing/votd/html-ref/Metho
dCommands.html#MethodNonDMC"}
          }
```

42.1.4.131 static KeyWord kw_127 () [static]

Initial value:

```
{
          {"incremental_lhs",8,1,1,1,743,kw_126},
          {"incremental_random",8,1,1,1,745,kw_126},
          {"lhs",8,0,1,1,741},
          {"random",8,0,1,1,739}
          }
```

42.1.4.132 static KeyWord kw_128 () [static]

Initial value:

```
{
          {"drop_tolerance",10,0,1,0,751}
          }
```

42.1.4.133 static KeyWord kw_129 () [static]

Initial value:

```
{
                {"all_variables",8,0,11,0,753,0,0.,0.,0.,0,"{All variables flag}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC
     "},
                {"distribution",8,2,5,0,827,kw_52,0.,0.,0.,0,"{Distribution type}
      http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonD"
     },
                {"fixed_seed",8,0,12,0,755,0,0.,0.,0.,0,"{Fixed seed flag} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"gen_reliability_levels",14,1,7,0,837,kw_53,0.,0.,0.,0,"{General
     ized reliability levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
     ommands.html#MethodNonD"},
                {"probability_levels",14,1,6,0,833,kw_54,0.,0.,0.,0,"{Probability
      levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Met
     hodNonD"},
                {"reliability_levels",14,1,9,0,757,kw_111,0.,0.,0.,0,"{Reliabilit
     y levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
     thodNonD"},
                {"response_levels",14,2,10,0,761,kw_114,0.,0.,0.,0,"{Response lev
     els} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodN
     onD"},
                {"rng",8,2,8,0,841,kw_55,0.,0.,0.,0,"{Random number generator} ht
     tp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"}
     ,
                {"sample_type",8,4,1,0,737,kw_127},
                {"samples",9,0,4,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
     akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"seed",9,0,3,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
     dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
                {"variance_based_decomp",8,1,2,0,749,kw_128}
                }
```

42.1.4.134 static KeyWord kw_130 () [static]

Initial value:

```
{
                {"generalized",8,0,1,1,685},
                {"sobol",8,0,1,1,683}
                }
```

42.1.4.135 static KeyWord kw_131 () [static]

Initial value:

```
{
                {"dimension_adaptive",8,2,1,1,681,kw_130},
                {"local_adaptive",8,0,1,1,687},
                {"uniform",8,0,1,1,679}
                }
```

42.1.4.136 static KeyWord kw_132 [static]

Initial value:

```
{
                {"generalized",8,0,1,1,675},
                {"sobol",8,0,1,1,673}
                }
```

42.1.4.137 static KeyWord kw_133 () [static]

Initial value:

```
{
                {"dimension_adaptive",8,2,1,1,671,kw_132},
                {"uniform",8,0,1,1,669}
                }
```

42.1.4.138 static KeyWord kw_134 () [static]

Initial value:

```
{
                {"hierarchical",8,0,1,0,693},
                {"nodal",8,0,1,0,691}
                }
```

42.1.4.139 static KeyWord kw_135 () [static]

Initial value:

```
{
                {"adapt_import",8,0,1,1,725},
                {"import",8,0,1,1,723},
                {"mm_adapt_import",8,0,1,1,727}
                }
```

42.1.4.140 static KeyWord kw_136 () [static]

Initial value:

```
{
                {"lhs",8,0,1,1,731},
                {"random",8,0,1,1,733}
                }
```

42.1.4.141 static KeyWord kw_137 () [static]

Initial value:

```
{
                {"restricted",8,0,1,0,703},
                {"unrestricted",8,0,1,0,705}
                }
```

42.1.4.142 static KeyWord kw_138 () [static]

Initial value:

```
{
                {"drop_tolerance",10,0,2,0,719,0,0.,0.,0.,0,"{VBD tolerance for o
     mitting small indices} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCom
     mands.html#MethodNonDSC"},
                {"univariate_effects",8,0,1,0,717,0,0.,0.,0.,0,"{Restriction of V
     BD indices to main/total} http://dakota.sandia.gov/licensing/votd/html-ref/Method
     Commands.html#MethodNonDSC"}
                }
```

42.1.4.143 static KeyWord kw_139 () [static]

Initial value:

```
{
                {"all_variables",8,0,18,0,753,0,0.,0.,0.,0,"{All variables flag}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC
     "},
                {"askey",8,0,2,0,695},
                {"dimension_preference",14,0,4,0,707,0,0.,0.,0.,0,"{Dimension pre
     ference for anisotropic tensor and sparse grids} http://dakota.sandia.gov/licensi
     ng/votd/html-ref/MethodCommands.html#MethodNonDSC"},
                {"distribution",8,2,12,0,827,kw_52,0.,0.,0.,0,"{Distribution type
     } http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonD
     "},
                {"fixed_seed",8,0,19,0,755,0,0.,0.,0.,0,"{Fixed seed flag} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
                {"gen_reliability_levels",14,1,14,0,837,kw_53,0.,0.,0.,0,"{Genera
     lized reliability levels} http://dakota.sandia.gov/licensing/votd/html-ref/Method
     Commands.html#MethodNonD"},
                {"h_refinement",8,3,1,0,677,kw_131},
                {"nested",8,0,6,0,711},
                {"non_nested",8,0,6,0,713},
                {"p_refinement",8,2,1,0,667,kw_133},
                {"piecewise",8,2,2,0,689,kw_134},
                {"probability_levels",14,1,13,0,833,kw_54,0.,0.,0.,0,"{Probabilit
     y levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Me
     thodNonD"},
                {"quadrature_order",13,0,3,1,699,0,0.,0.,0.,0,"{Quadrature order
     for collocation points} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCo
     mmands.html#MethodNonDSC"},
                {"reliability_levels",14,1,16,0,757,kw_111,0.,0.,0.,0,"{Reliabili
     ty levels} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
     ethodNonD"},
```

```
            {"response_levels",14,2,17,0,761,kw_114,0.,0.,0.,0,"{Response lev
    els} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodN
    onD"},
            {"rng",8,2,15,0,841,kw_55,0.,0.,0.,0,"{Random number generator} h
    ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"
    },
            {"sample_refinement",8,3,8,0,721,kw_135},
            {"sample_type",8,2,9,0,729,kw_136},
            {"samples",9,0,11,0,967,0,0.,0.,0.,0,"{Number of samples} http://
    dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
            {"seed",9,0,10,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.sa
    ndia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"},
            {"sparse_grid_level",13,2,3,1,701,kw_137,0.,0.,0.,0,"{Sparse grid
     level for collocation points} http://dakota.sandia.gov/licensing/votd/html-ref/M
    ethodCommands.html#MethodNonDSC"},
            {"use_derivatives",8,0,5,0,709,0,0.,0.,0.,0,"{Derivative usage fl
    ag} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNo
    nDSC"},
            {"variance_based_decomp",8,2,7,0,715,kw_138,0.,0.,0.,0,"{Variance
    -based decomposition (VBD)} http://dakota.sandia.gov/licensing/votd/html-ref/Meth
    odCommands.html#MethodNonDSC"},
            {"wiener",8,0,2,0,697}
            }
```

42.1.4.144 static KeyWord kw_140 () [static]

Initial value:

```
{
            {"misc_options",15,0,1,0,569}
            }
```

42.1.4.145 static KeyWord kw_141 () [static]

Initial value:

```
{
            {"function_precision",10,0,11,0,197,0,0.,0.,0.,0,"{Function preci
    sion} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
    NPSOLDC"},
            {"linear_equality_constraint_matrix",14,0,6,0,403,0,0.,0.,0.,0,"{
    Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
    ref/MethodCommands.html#MethodIndControl"},
            {"linear_equality_scale_types",15,0,8,0,407,0,0.,0.,0.,0,"{Linear
     equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
    ommands.html#MethodIndControl"},
            {"linear_equality_scales",14,0,9,0,409,0,0.,0.,0.,0,"{Linear equa
    lity scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
    #MethodIndControl"},
            {"linear_equality_targets",14,0,7,0,405,0,0.,0.,0.,0,"{Linear equ
    ality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.ht
    ml#MethodIndControl"},
            {"linear_inequality_constraint_matrix",14,0,1,0,393,0,0.,0.,0.,0,
    "{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
    tml-ref/MethodCommands.html#MethodIndControl"},
            {"linear_inequality_lower_bounds",14,0,2,0,395,0,0.,0.,0.,0,"{Lin
    ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
```

```
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,4,0,399,0,0.,0.,0.,0,"{Line
ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,5,0,401,0,0.,0.,0.,0,"{Linear in
equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,3,0,397,0,0.,0.,0.,0,"{Lin
ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linesearch_tolerance",10,0,12,0,199,0,0.,0.,0.,0,"{Line search
tolerance} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodNPSOLDC"},
          {"verify_level",9,0,10,0,195,0,0.,0.,0.,0,"{Gradient verification
 level} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Meth
odNPSOLDC"}
          }
```

42.1.4.146 static KeyWord kw_142 () [static]

Initial value:

```
{
          {"gradient_tolerance",10,0,11,0,233},
          {"linear_equality_constraint_matrix",14,0,6,0,403,0,0.,0.,0.,0,"{
Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
ref/MethodCommands.html#MethodIndControl"},
          {"linear_equality_scale_types",15,0,8,0,407,0,0.,0.,0.,0,"{Linear
 equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
ommands.html#MethodIndControl"},
          {"linear_equality_scales",14,0,9,0,409,0,0.,0.,0.,0,"{Linear equa
lity scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html
#MethodIndControl"},
          {"linear_equality_targets",14,0,7,0,405,0,0.,0.,0.,0,"{Linear equ
ality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.ht
ml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,1,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,2,0,395,0,0.,0.,0.,0,"{Lin
ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,4,0,399,0,0.,0.,0.,0,"{Line
ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,5,0,401,0,0.,0.,0.,0,"{Linear in
equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,3,0,397,0,0.,0.,0.,0,"{Lin
ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"max_step",10,0,10,0,231}
          }
```

42.1.4.147 static KeyWord kw_143 () [static]

Initial value:

```
{
            {"linear_equality_constraint_matrix",14,0,7,0,403,0,0.,0.,0.,0,"{
    Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
    ref/MethodCommands.html#MethodIndControl"},
            {"linear_equality_scale_types",15,0,9,0,407,0,0.,0.,0.,0,"{Linear
     equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
    ommands.html#MethodIndControl"},
            {"linear_equality_scales",14,0,10,0,409,0,0.,0.,0.,0,"{Linear equ
    ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
    l#MethodIndControl"},
            {"linear_equality_targets",14,0,8,0,405,0,0.,0.,0.,0,"{Linear equ
    ality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.ht
    ml#MethodIndControl"},
            {"linear_inequality_constraint_matrix",14,0,2,0,393,0,0.,0.,0.,0,
    "{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
    tml-ref/MethodCommands.html#MethodIndControl"},
            {"linear_inequality_lower_bounds",14,0,3,0,395,0,0.,0.,0.,0,"{Lin
    ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
    hodCommands.html#MethodIndControl"},
            {"linear_inequality_scale_types",15,0,5,0,399,0,0.,0.,0.,0,"{Line
    ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
    hodCommands.html#MethodIndControl"},
            {"linear_inequality_scales",14,0,6,0,401,0,0.,0.,0.,0,"{Linear in
    equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
    html#MethodIndControl"},
            {"linear_inequality_upper_bounds",14,0,4,0,397,0,0.,0.,0.,0,"{Lin
    ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
    hodCommands.html#MethodIndControl"},
            {"search_scheme_size",9,0,1,0,237}
            }
```

42.1.4.148 static KeyWord kw_144 () [static]

Initial value:

```
{
            {"gradient_based_line_search",8,0,1,1,217,0,0.,0.,0.,0,"[CHOOSE l
    ine search type]"},
            {"tr_pds",8,0,1,1,221},
            {"trust_region",8,0,1,1,219},
            {"value_based_line_search",8,0,1,1,215}
            }
```

42.1.4.149 static KeyWord kw_145 () [static]

Initial value:

```
{
            {"centering_parameter",10,0,5,0,229},
            {"central_path",11,0,3,0,225},
            {"gradient_tolerance",10,0,16,0,233},
            {"linear_equality_constraint_matrix",14,0,11,0,403,0,0.,0.,0.,0,"
    {Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html
    -ref/MethodCommands.html#MethodIndControl"},
            {"linear_equality_scale_types",15,0,13,0,407,0,0.,0.,0.,0,"{Linea
    r equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Method
    Commands.html#MethodIndControl"},
```

```
          {"linear_equality_scales",14,0,14,0,409,0,0.,0.,0.,0,"{Linear equ
ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodIndControl"},
          {"linear_equality_targets",14,0,12,0,405,0,0.,0.,0.,0,"{Linear eq
uality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
tml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,6,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,7,0,395,0,0.,0.,0.,0,"{Lin
ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,9,0,399,0,0.,0.,0.,0,"{Line
ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,10,0,401,0,0.,0.,0.,0,"{Linear i
nequality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands
.html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,8,0,397,0,0.,0.,0.,0,"{Lin
ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"max_step",10,0,15,0,231},
          {"merit_function",11,0,2,0,223},
          {"search_method",8,4,1,0,213,kw_144},
          {"steplength_to_boundary",10,0,4,0,227}
          }
```

42.1.4.150 static KeyWord kw_146 () [static]

Initial value:

```
{
          {"debug",8,0,1,1,67,0,0.,0.,0.,0,"[CHOOSE output level]"},
          {"normal",8,0,1,1,71},
          {"quiet",8,0,1,1,73},
          {"silent",8,0,1,1,75},
          {"verbose",8,0,1,1,69}
          }
```

42.1.4.151 static KeyWord kw_147 () [static]

Initial value:

```
{
          {"partitions",13,0,1,0,965,0,0.,0.,0.,0,"{Number of partitions} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodPSUADE"
},
          {"samples",9,0,3,0,967,0,0.,0.,0.,0,"{Number of samples} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodNonDMC"},
          {"seed",9,0,2,0,969,0,0.,0.,0.,0,"{Random seed} http://dakota.san
dia.gov/licensing/votd/html-ref/MethodCommands.html#MethodEG"}
          }
```

42.1.4.152 static KeyWord kw_148 () [static]

Initial value:

```
{
                {"converge_order",8,0,1,1,1185},
                {"converge_qoi",8,0,1,1,1187},
                {"estimate_order",8,0,1,1,1183},
                {"refinement_rate",10,0,2,0,1189,0,0.,0.,0.,0,"{Refinement rate}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSolnRi
     chardson"}
                }
```

42.1.4.153 static KeyWord kw_149 () [static]

Initial value:

```
{
                {"num_generations",0x29,0,2,0,343},
                {"percent_change",10,0,1,0,341}
                }
```

42.1.4.154 static KeyWord kw_150 () [static]

Initial value:

```
{
                {"num_generations",0x29,0,2,0,337,0,0.,0.,0.,0,"{Number of genera
     tions (for convergence test) } http://dakota.sandia.gov/licensing/votd/html-ref/M
     ethodCommands.html#MethodJEGASOGA"},
                {"percent_change",10,0,1,0,335,0,0.,0.,0.,0,"{Percent change in f
     itness} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Meth
     odJEGASOGA"}
                }
```

42.1.4.155 static KeyWord kw_151 () [static]

Initial value:

```
{
                {"average_fitness_tracker",8,2,1,1,339,kw_149},
                {"best_fitness_tracker",8,2,1,1,333,kw_150}
                }
```

42.1.4.156 static KeyWord kw_152 () [static]

Initial value:

```
{
                {"constraint_penalty",10,0,2,0,319,0,0.,0.,0.,0,"{Constraint pena
     lty in merit function} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCom
     mands.html#MethodJEGASOGA"},
                {"merit_function",8,0,1,1,317}
                }
```

42.1.4.157 static KeyWord kw_153 () [static]

Initial value:

```
{
                {"elitist",8,0,1,1,323},
                {"favor_feasible",8,0,1,1,325},
                {"roulette_wheel",8,0,1,1,327},
                {"unique_roulette_wheel",8,0,1,1,329}
                }
```

42.1.4.158 static KeyWord kw_154 () [static]

Initial value:

```
{
                {"convergence_type",8,2,3,0,331,kw_151,0.,0.,0.,0,"{Convergence t
     ype} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJ
     EGASOGA"},
                {"crossover_type",8,5,17,0,359,kw_97,0.,0.,0.,0,"{Crossover type}
      http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGAD
     C"},
                {"fitness_type",8,2,1,0,315,kw_152,0.,0.,0.,0,"{Fitness type} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGASOGA"
     },
                {"initialization_type",8,3,16,0,351,kw_98,0.,0.,0.,0,"{Initializa
     tion type} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
     ethodJEGADC"},
                {"linear_equality_constraint_matrix",14,0,9,0,403,0,0.,0.,0.,0,"{
     Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
     ref/MethodCommands.html#MethodIndControl"},
                {"linear_equality_scale_types",15,0,11,0,407,0,0.,0.,0.,0,"{Linea
     r equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Method
     Commands.html#MethodIndControl"},
                {"linear_equality_scales",14,0,12,0,409,0,0.,0.,0.,0,"{Linear equ
     ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
     l#MethodIndControl"},
                {"linear_equality_targets",14,0,10,0,405,0,0.,0.,0.,0,"{Linear eq
     uality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
     tml#MethodIndControl"},
                {"linear_inequality_constraint_matrix",14,0,4,0,393,0,0.,0.,0.,0,
     "{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
     tml-ref/MethodCommands.html#MethodIndControl"},
                {"linear_inequality_lower_bounds",14,0,5,0,395,0,0.,0.,0.,0,"{Lin
     ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
     hodCommands.html#MethodIndControl"},
                {"linear_inequality_scale_types",15,0,7,0,399,0,0.,0.,0.,0,"{Line
     ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
     hodCommands.html#MethodIndControl"},
                {"linear_inequality_scales",14,0,8,0,401,0,0.,0.,0.,0,"{Linear in
     equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
     html#MethodIndControl"},
                {"linear_inequality_upper_bounds",14,0,6,0,397,0,0.,0.,0.,0,"{Lin
     ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
     hodCommands.html#MethodIndControl"},
                {"log_file",11,0,14,0,347,0,0.,0.,0.,0,"{Log file} http://dakota.
     sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"},
                {"mutation_type",8,6,18,0,375,kw_100,0.,0.,0.,0,"{Mutation type}
     http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC
```

```
"},
          {"population_size",9,0,13,0,345,0,0.,0.,0.,0,"{Number of populati
on members} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#
MethodJEGADC"},
          {"print_each_pop",8,0,15,0,349,0,0.,0.,0.,0,"{Population output}
http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC
"},
          {"replacement_type",8,4,2,0,321,kw_153,0.,0.,0.,0,"{Replacement t
ype} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJ
EGASOGA"},
          {"seed",9,0,19,0,391,0,0.,0.,0.,0,"{Random seed} http://dakota.sa
ndia.gov/licensing/votd/html-ref/MethodCommands.html#MethodJEGADC"}
          }
```

42.1.4.159 static KeyWord kw_155 () [static]

Initial value:

```
{
          {"function_precision",10,0,12,0,197,0,0.,0.,0.,0,"{Function preci
sion} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
NPSOLDC"},
          {"linear_equality_constraint_matrix",14,0,7,0,403,0,0.,0.,0.,0,"{
Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html-
ref/MethodCommands.html#MethodIndControl"},
          {"linear_equality_scale_types",15,0,9,0,407,0,0.,0.,0.,0,"{Linear
 equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/MethodC
ommands.html#MethodIndControl"},
          {"linear_equality_scales",14,0,10,0,409,0,0.,0.,0.,0,"{Linear equ
ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodIndControl"},
          {"linear_equality_targets",14,0,8,0,405,0,0.,0.,0.,0,"{Linear equ
ality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.ht
ml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,2,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,3,0,395,0,0.,0.,0.,0,"{Lin
ear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,5,0,399,0,0.,0.,0.,0,"{Line
ar inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,6,0,401,0,0.,0.,0.,0,"{Linear in
equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,4,0,397,0,0.,0.,0.,0,"{Lin
ear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Met
hodCommands.html#MethodIndControl"},
          {"linesearch_tolerance",10,0,13,0,199,0,0.,0.,0.,0,"{Line search
tolerance} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#M
ethodNPSOLDC"},
          {"nlssol",8,0,1,1,193},
          {"npsol",8,0,1,1,191},
          {"verify_level",9,0,11,0,195,0,0.,0.,0.,0,"{Gradient verification
 level} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Meth
odNPSOLDC"}
          }
```

42.1.4.160 static KeyWord kw_156 () [static]

Initial value:

```
{
                {"approx_method_name",11,0,1,1,573,0,0.,0.,0.,0,"[CHOOSE sub-meth
     od ref.]{Approximate sub-problem minimization method name} http://dakota.sandia.g
     ov/licensing/votd/html-ref/MethodCommands.html#MethodSBG"},
                {"approx_method_pointer",11,0,1,1,575,0,0.,0.,0.,0,"{Approximate
     sub-problem minimization method pointer} http://dakota.sandia.gov/licensing/votd/
     html-ref/MethodCommands.html#MethodSBG"},
                {"replace_points",8,0,2,0,577,0,0.,0.,0.,0,"{Replace points used
     in surrogate construction with best points from previous iteration} http://dakota
     .sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodSBG"}
                }
```

42.1.4.161 static KeyWord kw_157 () [static]

Initial value:

```
{
                {"filter",8,0,1,1,145,0,0.,0.,0.,0,"@[CHOOSE acceptance logic]"},

                {"tr_ratio",8,0,1,1,143}
                }
```

42.1.4.162 static KeyWord kw_158 () [static]

Initial value:

```
{
                {"augmented_lagrangian_objective",8,0,1,1,121,0,0.,0.,0.,0,"[CHOO
     SE objective formulation]"},
                {"lagrangian_objective",8,0,1,1,123},
                {"linearized_constraints",8,0,2,2,127,0,0.,0.,0.,0,"[CHOOSE const
     raint formulation]"},
                {"no_constraints",8,0,2,2,129},
                {"original_constraints",8,0,2,2,125,0,0.,0.,0.,0,"@"},
                {"original_primary",8,0,1,1,117,0,0.,0.,0.,0,"@"},
                {"single_objective",8,0,1,1,119}
                }
```

42.1.4.163 static KeyWord kw_159 () [static]

Initial value:

```
{
                {"homotopy",8,0,1,1,149}
                }
```

42.1.4.164 static KeyWord kw_160 () [static]

Initial value:

```
{
                {"adaptive_penalty_merit",8,0,1,1,135,0,0.,0.,0.,0,"[CHOOSE merit
      function]"},
                {"augmented_lagrangian_merit",8,0,1,1,139,0,0.,0.,0.,0,"@"},
                {"lagrangian_merit",8,0,1,1,137},
                {"penalty_merit",8,0,1,1,133}
                }
```

42.1.4.165 static KeyWord kw_161 () [static]

Initial value:

```
{
                {"contract_threshold",10,0,3,0,107,0,0.,0.,0.,0,"{Shrink trust re
     gion if trust region ratio is below this value} http://dakota.sandia.gov/licensin
     g/votd/html-ref/MethodCommands.html#MethodSBL"},
                {"contraction_factor",10,0,5,0,111,0,0.,0.,0.,0,"{Trust region co
     ntraction factor} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands
     .html#MethodSBL"},
                {"expand_threshold",10,0,4,0,109,0,0.,0.,0.,0,"{Expand trust regi
     on if trust region ratio is above this value} http://dakota.sandia.gov/licensing/
     votd/html-ref/MethodCommands.html#MethodSBL"},
                {"expansion_factor",10,0,6,0,113,0,0.,0.,0.,0,"{Trust region expa
     nsion factor} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
     l#MethodSBL"},
                {"initial_size",10,0,1,0,103,0,0.,0.,0.,0,"{Trust region initial
     size (relative to bounds)} http://dakota.sandia.gov/licensing/votd/html-ref/Metho
     dCommands.html#MethodSBL"},
                {"minimum_size",10,0,2,0,105,0,0.,0.,0.,0,"{Trust region minimum
     size} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
     SBL"}
                }
```

42.1.4.166 static KeyWord kw_162 () [static]

Initial value:

```
{
                {"acceptance_logic",8,2,7,0,141,kw_157,0.,0.,0.,0,"{SBL iterate a
     cceptance logic} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
     html#MethodSBL"},
                {"approx_method_name",11,0,1,1,93,0,0.,0.,0.,0,"[CHOOSE sub-metho
     d ref.]{Approximate sub-problem minimization method name} http://dakota.sandia.go
     v/licensing/votd/html-ref/MethodCommands.html#MethodSBL"},
                {"approx_method_pointer",11,0,1,1,95,0,0.,0.,0.,0,"{Approximate s
     ub-problem minimization method pointer} http://dakota.sandia.gov/licensing/votd/h
     tml-ref/MethodCommands.html#MethodSBL"},
                {"approx_subproblem",8,7,5,0,115,kw_158,0.,0.,0.,0,"{Approximate
     subproblem formulation} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCo
     mmands.html#MethodSBL"},
                {"constraint_relax",8,1,8,0,147,kw_159,0.,0.,0.,0,"{SBL constrain
     t relaxation method for infeasible iterates} http://dakota.sandia.gov/licensing/v
```

```
otd/html-ref/MethodCommands.html#MethodSBL"},
          {"linear_equality_constraint_matrix",14,0,14,0,403,0,0.,0.,0.,0,"
{Linear equality coefficient matrix} http://dakota.sandia.gov/licensing/votd/html
-ref/MethodCommands.html#MethodIndControl"},
          {"linear_equality_scale_types",15,0,16,0,407,0,0.,0.,0.,0,"{Linea
r equality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Method
Commands.html#MethodIndControl"},
          {"linear_equality_scales",14,0,17,0,409,0,0.,0.,0.,0,"{Linear equ
ality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.htm
l#MethodIndControl"},
          {"linear_equality_targets",14,0,15,0,405,0,0.,0.,0.,0,"{Linear eq
uality targets} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.h
tml#MethodIndControl"},
          {"linear_inequality_constraint_matrix",14,0,9,0,393,0,0.,0.,0.,0,
"{Linear inequality coefficient matrix} http://dakota.sandia.gov/licensing/votd/h
tml-ref/MethodCommands.html#MethodIndControl"},
          {"linear_inequality_lower_bounds",14,0,10,0,395,0,0.,0.,0.,0,"{Li
near inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"linear_inequality_scale_types",15,0,12,0,399,0,0.,0.,0.,0,"{Lin
ear inequality scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"linear_inequality_scales",14,0,13,0,401,0,0.,0.,0.,0,"{Linear i
nequality scales} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands
.html#MethodIndControl"},
          {"linear_inequality_upper_bounds",14,0,11,0,397,0,0.,0.,0.,0,"{Li
near inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodIndControl"},
          {"merit_function",8,4,6,0,131,kw_160,0.,0.,0.,0,"{SBL merit funct
ion} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodS
BL"},
          {"soft_convergence_limit",9,0,2,0,97,0,0.,0.,0.,0,"{Soft converge
nce limit for SBL iterations} http://dakota.sandia.gov/licensing/votd/html-ref/Me
thodCommands.html#MethodSBL"},
          {"trust_region",8,6,4,0,101,kw_161,0.,0.,0.,0,"{Trust region grou
p specification} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.
html#MethodSBL"},
          {"truth_surrogate_bypass",8,0,3,0,99,0,0.,0.,0.,0,"{Flag for bypa
ssing lower level surrogates in truth verifications} http://dakota.sandia.gov/lic
ensing/votd/html-ref/MethodCommands.html#MethodSBL"}
          }
```

42.1.4.167 static KeyWord kw_163 () [static]

Initial value:

```
{
          {"final_point",14,0,1,1,1161,0,0.,0.,0.,0,"[CHOOSE final pt or in
crement]{Termination point of vector} http://dakota.sandia.gov/licensing/votd/htm
l-ref/MethodCommands.html#MethodPSVPS"},
          {"num_steps",9,0,2,2,1165,0,0.,0.,0.,0,"{Number of steps along ve
ctor} http://dakota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#Method
PSVPS"},
          {"step_vector",14,0,1,1,1163,0,0.,0.,0.,0,"{Step vector} http://d
akota.sandia.gov/licensing/votd/html-ref/MethodCommands.html#MethodPSVPS"}
          }
```

42.1.4.168 static KeyWord kw_165 () [static]

Initial value:

```
{
                {"optional_interface_responses_pointer",11,0,1,0,1357,0,0.,0.,0.,
     0,"{Responses pointer for nested model optional interfaces} http://dakota.sandia.
     gov/licensing/votd/html-ref/ModelCommands.html#ModelNested"}
                }
```

42.1.4.169 static KeyWord kw_166 () [static]

Initial value:

```
{
                {"primary_response_mapping",14,0,3,0,1365,0,0.,0.,0.,0,"{Primary
     response mappings for nested models} http://dakota.sandia.gov/licensing/votd/html
     -ref/ModelCommands.html#ModelNested"},
                {"primary_variable_mapping",15,0,1,0,1361,0,0.,0.,0.,0,"{Primary
     variable mappings for nested models} http://dakota.sandia.gov/licensing/votd/html
     -ref/ModelCommands.html#ModelNested"},
                {"secondary_response_mapping",14,0,4,0,1367,0,0.,0.,0.,0,"{Second
     ary response mappings for nested models} http://dakota.sandia.gov/licensing/votd/
     html-ref/ModelCommands.html#ModelNested"},
                {"secondary_variable_mapping",15,0,2,0,1363,0,0.,0.,0.,0,"{Second
     ary variable mappings for nested models} http://dakota.sandia.gov/licensing/votd/
     html-ref/ModelCommands.html#ModelNested"}
                }
```

42.1.4.170 static KeyWord kw_167 () [static]

Initial value:

```
{
                {"optional_interface_pointer",11,1,1,0,1355,kw_165,0.,0.,0.,0,"{O
     ptional interface set pointer} http://dakota.sandia.gov/licensing/votd/html-ref/M
     odelCommands.html#ModelNested"},
                {"sub_method_pointer",11,4,2,1,1359,kw_166,0.,0.,0.,0,"{Sub-metho
     d pointer for nested models} http://dakota.sandia.gov/licensing/votd/html-ref/Mod
     elCommands.html#ModelNested"}
                }
```

42.1.4.171 static KeyWord kw_168 () [static]

Initial value:

```
{
                {"interface_pointer",11,0,1,0,1201,0,0.,0.,0.,0,"{Interface set p
     ointer} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#Model
     Single"}
                }
```

42.1.4.172 static KeyWord kw_169 () [static]

Initial value:

```
{
                {"additive",8,0,2,2,1315,0,0.,0.,0.,0,"[CHOOSE correction type]"}
     ,
                {"combined",8,0,2,2,1319},
                {"first_order",8,0,1,1,1311,0,0.,0.,0.,0,"[CHOOSE correction orde
     r]"},
                {"multiplicative",8,0,2,2,1317},
                {"second_order",8,0,1,1,1313},
                {"zeroth_order",8,0,1,1,1309}
                }
```

42.1.4.173 static KeyWord kw_170 () [static]

Initial value:

```
{
                {"constant",8,0,1,1,1217},
                {"linear",8,0,1,1,1219},
                {"reduced_quadratic",8,0,1,1,1221}
                }
```

42.1.4.174 static KeyWord kw_171 () [static]

Initial value:

```
{
                {"point_selection",8,0,1,0,1213,0,0.,0.,0.,0,"{GP point selection
     } http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"
     },
                {"trend",8,3,2,0,1215,kw_170,0.,0.,0.,0,"{GP trend function} http
     ://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"}
                }
```

42.1.4.175 static KeyWord kw_172 () [static]

Initial value:

```
{
                {"constant",8,0,1,1,1227},
                {"linear",8,0,1,1,1229},
                {"quadratic",8,0,1,1,1233},
                {"reduced_quadratic",8,0,1,1,1231}
                }
```

42.1.4.176 static KeyWord kw_173 () [static]

Initial value:

```
{
                {"correlation_lengths",14,0,4,0,1239,0,0.,0.,0.,0,"{Surfpack GP c
     orrelation lengths} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommand
     s.html#ModelSurrG"},
                {"max_trials",0x19,0,3,0,1237,0,0.,0.,0.,0,"{Surfpack GP maximum
     trials} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#Model
     SurrG"},
                {"optimization_method",11,0,2,0,1235,0,0.,0.,0.,0,"{Surfpack GP o
     ptimization method} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommand
     s.html#ModelSurrG"},
                {"trend",8,4,1,0,1225,kw_172,0.,0.,0.,0,"{Surfpack GP trend funct
     ion} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSur
     rG"}
                }
```

42.1.4.177 static KeyWord kw_174 () [static]

Initial value:

```
{
                {"dakota",8,2,1,1,1211,kw_171},
                {"surfpack",8,4,1,1,1223,kw_173}
                }
```

42.1.4.178 static KeyWord kw_175 () [static]

Initial value:

```
{
                {"cubic",8,0,1,1,1249},
                {"linear",8,0,1,1,1247}
                }
```

42.1.4.179 static KeyWord kw_176 () [static]

Initial value:

```
{
                {"interpolation",8,2,2,0,1245,kw_175,0.,0.,0.,0,"{MARS interpolat
     ion} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSur
     rG"},
                {"max_bases",9,0,1,0,1243,0,0.,0.,0.,0,"{MARS maximum bases} http
     ://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"}
                }
```

42.1.4.180 static KeyWord kw_177 () [static]

Initial value:

```
{
                {"poly_order",9,0,1,0,1253,0,0.,0.,0.,0,"{MLS polynomial order} h
```

```
ttp://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"},
          {"weight_function",9,0,2,0,1255,0,0.,0.,0.,0,"{MLS weight functio
n} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG
"}
          }
```

42.1.4.181 static KeyWord kw_178 () [static]

Initial value:

```
{
          {"nodes",9,0,1,0,1259,0,0.,0.,0.,0,"{ANN number nodes} http://dak
ota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"},
          {"random_weight",9,0,3,0,1263,0,0.,0.,0.,0,"{ANN random weight} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"},
          {"range",10,0,2,0,1261,0,0.,0.,0.,0,"{ANN range} http://dakota.sa
ndia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"}
          }
```

42.1.4.182 static KeyWord kw_179 () [static]

Initial value:

```
{
          {"annotated",8,0,1,0,1301,0,0.,0.,0.,0,"{Data file in annotated f
ormat} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelS
urrG"},
          {"freeform",8,0,1,0,1303,0,0.,0.,0.,0,"{Data file in freeform for
mat} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSur
rG"}
          }
```

42.1.4.183 static KeyWord kw_180 () [static]

Initial value:

```
{
          {"cubic",8,0,1,1,1281,0,0.,0.,0.,0,"[CHOOSE polynomial order]"},
          {"linear",8,0,1,1,1277},
          {"quadratic",8,0,1,1,1279}
          }
```

42.1.4.184 static KeyWord kw_181 () [static]

Initial value:

```
{
          {"bases",9,0,1,0,1267,0,0.,0.,0.,0,"{RBF number of bases} http://
dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"},
          {"max_pts",9,0,2,0,1269,0,0.,0.,0.,0,"{RBF maximum points} http:/
/dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"},
```

```
                {"max_subsets",9,0,4,0,1273},
                {"min_partition",9,0,3,0,1271,0,0.,0.,0.,0,"{RBF minimum partitio
ns} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurr
G"}
                }
```

42.1.4.185 static KeyWord kw_182 () [static]

Initial value:

```
{
                {"all",8,0,1,1,1293},
                {"none",8,0,1,1,1297},
                {"region",8,0,1,1,1295}
                }
```

42.1.4.186 static KeyWord kw_183 () [static]

Initial value:

```
{
                {"correction",8,6,7,0,1307,kw_169,0.,0.,0.,0,"{Surrogate correcti
on approach} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#
ModelSurrG"},
                {"dace_method_pointer",11,0,3,0,1289,0,0.,0.,0.,0,"{Design of exp
eriments method pointer} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCo
mmands.html#ModelSurrG"},
                {"diagnostics",15,0,8,0,1321,0,0.,0.,0.,0,"{Print diagnostic metr
ics about the surrogate goodness of fit} http://dakota.sandia.gov/licensing/votd/
html-ref/ModelCommands.html#ModelSurrG"},
                {"gaussian_process",8,2,1,1,1209,kw_174,0.,0.,0.,0,"[CHOOSE surro
gate type]{DAKOTA Gaussian process} http://dakota.sandia.gov/licensing/votd/html-
ref/ModelCommands.html#ModelSurrG"},
                {"kriging",0,2,1,1,1208,kw_174},
                {"mars",8,2,1,1,1241,kw_176,0.,0.,0.,0,"{Multivariate adaptive re
gression splines} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.
html#ModelSurrG"},
                {"minimum_points",8,0,2,0,1285},
                {"moving_least_squares",8,2,1,1,1251,kw_177,0.,0.,0.,0,"{Moving l
east squares} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html
#ModelSurrG"},
                {"neural_network",8,3,1,1,1257,kw_178,0.,0.,0.,0,"{Artificial neu
ral network} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#
ModelSurrG"},
                {"points_file",11,2,5,0,1299,kw_179,0.,0.,0.,0,"{File import of s
amples for global approximation builds} http://dakota.sandia.gov/licensing/votd/h
tml-ref/ModelCommands.html#ModelSurrG"},
                {"polynomial",8,3,1,1,1275,kw_180,0.,0.,0.,0,"{Polynomial} http:/
/dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrG"},
                {"radial_basis",8,4,1,1,1265,kw_181},
                {"recommended_points",8,0,2,0,1287},
                {"reuse_points",8,3,4,0,1291,kw_182},
                {"reuse_samples",0,3,4,0,1290,kw_182},
                {"samples_file",3,2,5,0,1298,kw_179},
                {"total_points",9,0,2,0,1283},
                {"use_derivatives",8,0,6,0,1305,0,0.,0.,0.,0,"{Surfpack GP gradie
nt enhancement} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.ht
```

```
ml#ModelSurrG"}
          }
```

42.1.4.187 static KeyWord kw_184 () [static]

Initial value:

```
{
          {"additive",8,0,2,2,1347,0,0.,0.,0.,0,"[CHOOSE correction type]"}
,
          {"combined",8,0,2,2,1351},
          {"first_order",8,0,1,1,1343,0,0.,0.,0.,0,"[CHOOSE correction orde
r]"},
          {"multiplicative",8,0,2,2,1349},
          {"second_order",8,0,1,1,1345},
          {"zeroth_order",8,0,1,1,1341}
          }
```

42.1.4.188 static KeyWord kw_185 () [static]

Initial value:

```
{
          {"correction",8,6,3,3,1339,kw_184,0.,0.,0.,0,"{Surrogate correcti
on approach} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#
ModelSurrH"},
          {"high_fidelity_model_pointer",11,0,2,2,1337,0,0.,0.,0.,0,"{Point
er to the high fidelity model specification} http://dakota.sandia.gov/licensing/v
otd/html-ref/ModelCommands.html#ModelSurrH"},
          {"low_fidelity_model_pointer",11,0,1,1,1335,0,0.,0.,0.,0,"{Pointe
r to the low fidelity model specification} http://dakota.sandia.gov/licensing/vot
d/html-ref/ModelCommands.html#ModelSurrH"}
          }
```

42.1.4.189 static KeyWord kw_186 () [static]

Initial value:

```
{
          {"actual_model_pointer",11,0,2,2,1331,0,0.,0.,0.,0,"{Pointer to t
he truth model specification} http://dakota.sandia.gov/licensing/votd/html-ref/Mo
delCommands.html#ModelSurrMP"},
          {"taylor_series",8,0,1,1,1329,0,0.,0.,0.,0,"{Taylor series local
approximation } http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.ht
ml#ModelSurrL"}
          }
```

42.1.4.190 static KeyWord kw_187 () [static]

Initial value:

```
{
            {"actual_model_pointer",11,0,2,2,1331,0,0.,0.,0.,0,"{Pointer to t
he truth model specification} http://dakota.sandia.gov/licensing/votd/html-ref/Mo
delCommands.html#ModelSurrMP"},
            {"tana",8,0,1,1,1325,0,0.,0.,0.,0,"{Two-point adaptive nonlinear
approximation } http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.ht
ml#ModelSurrMP"}
            }
```

42.1.4.191 static KeyWord kw_188 () [static]

Initial value:

```
{
            {"global",8,18,2,1,1207,kw_183,0.,0.,0.,0,"[CHOOSE surrogate cate
gory]{Global approximations } http://dakota.sandia.gov/licensing/votd/html-ref/Mo
delCommands.html#ModelSurrG"},
            {"hierarchical",8,3,2,1,1333,kw_185,0.,0.,0.,0,"{Hierarchical app
roximation } http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#
ModelSurrH"},
            {"id_surrogates",13,0,1,0,1205,0,0.,0.,0.,0,"{Surrogate response
ids} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSur
rogate"},
            {"local",8,2,2,1,1327,kw_186,0.,0.,0.,0,"{Local approximation} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelSurrL"},
            {"multipoint",8,2,2,1,1323,kw_187,0.,0.,0.,0,"{Multipoint approxi
mation} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#Model
SurrMP"}
            }
```

42.1.4.192 static KeyWord kw_189 () [static]

Initial value:

```
{
            {"id_model",11,0,1,0,1193,0,0.,0.,0.,0,"{Model set identifier} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#ModelIndControl
"},
            {"nested",8,2,4,1,1353,kw_167,0.,0.,0.,0,"[CHOOSE model type]"},
            {"responses_pointer",11,0,3,0,1197,0,0.,0.,0.,0,"{Responses set p
ointer} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#Model
IndControl"},
            {"single",8,1,4,1,1199,kw_168,0.,0.,0.,0,"@"},
            {"surrogate",8,5,4,1,1203,kw_188},
            {"variables_pointer",11,0,2,0,1195,0,0.,0.,0.,0,"{Variables set p
ointer} http://dakota.sandia.gov/licensing/votd/html-ref/ModelCommands.html#Model
IndControl"}
            }
```

42.1.4.193 static KeyWord kw_190 () [static]

Initial value:

```
{
                {"annotated",8,0,2,0,1773,0,0.,0.,0.,0,"{Data file in annotated f
     ormat} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespFnL
     S"},
                {"freeform",8,0,2,0,1775,0,0.,0.,0.,0,"{Data file in freeform for
     mat} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespFnLS"
     },
                {"num_config_variables",0x29,0,3,0,1777,0,0.,0.,0.,0,"{Configurat
     ion variable columns in file} http://dakota.sandia.gov/licensing/votd/html-ref/Re
     spCommands.html#RespFnLS"},
                {"num_experiments",0x29,0,1,0,1771,0,0.,0.,0.,0,"{Experiments (ro
     ws) in file} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#R
     espFnLS"},
                {"num_std_deviations",0x29,0,4,0,1779,0,0.,0.,0.,0,"{Standard dev
     iation columns in file} http://dakota.sandia.gov/licensing/votd/html-ref/RespComm
     ands.html#RespFnLS"}
                }
```

42.1.4.194 static KeyWord kw_191 () [static]

Initial value:

```
{
                {"nonlinear_equality_scale_types",0x80f,0,2,0,1795,0,0.,0.,0.,0,"
     {Nonlinear equality scaling types} http://dakota.sandia.gov/licensing/votd/html-r
     ef/RespCommands.html#RespFnLS",0,"nonlinear_equality_constraints"},
                {"nonlinear_equality_scales",0x80e,0,3,0,1797,0,0.,0.,0.,0,"{Nonl
     inear equality scales} http://dakota.sandia.gov/licensing/votd/html-ref/RespComma
     nds.html#RespFnLS",0,"nonlinear_equality_constraints"},
                {"nonlinear_equality_targets",14,0,1,0,1793,0,0.,0.,0.,0,"{Nonlin
     ear equality targets} http://dakota.sandia.gov/licensing/votd/html-ref/RespComman
     ds.html#RespFnLS",0,"nonlinear_equality_constraints"}
                }
```

42.1.4.195 static KeyWord kw_192 () [static]

Initial value:

```
{
                {"nonlinear_inequality_lower_bounds",14,0,1,0,1783,0,0.,0.,0.,0,"
     {Nonlinear inequality lower bounds} http://dakota.sandia.gov/licensing/votd/html-
     ref/RespCommands.html#RespFnLS",0,"nonlinear_inequality_constraints"},
                {"nonlinear_inequality_scale_types",0x80f,0,3,0,1787,0,0.,0.,0.,0
     ,"{Nonlinear inequality scaling types} http://dakota.sandia.gov/licensing/votd/ht
     ml-ref/RespCommands.html#RespFnLS",0,"nonlinear_inequality_constraints"},
                {"nonlinear_inequality_scales",0x80e,0,4,0,1789,0,0.,0.,0.,0,"{No
     nlinear inequality scales} http://dakota.sandia.gov/licensing/votd/html-ref/RespC
     ommands.html#RespFnLS",0,"nonlinear_inequality_constraints"},
                {"nonlinear_inequality_upper_bounds",14,0,2,0,1785,0,0.,0.,0.,0,"
     {Nonlinear inequality upper bounds} http://dakota.sandia.gov/licensing/votd/html-
     ref/RespCommands.html#RespFnLS",0,"nonlinear_inequality_constraints"}
                }
```

42.1.4.196 static KeyWord kw_193 () [static]

Initial value:

```
{
            {"calibration_data_file",11,5,4,0,1769,kw_190,0.,0.,0.,0,"{Calibr
ation data file name} http://dakota.sandia.gov/licensing/votd/html-ref/RespComman
ds.html#RespFnLS"},
            {"calibration_term_scale_types",0x80f,0,1,0,1763,0,0.,0.,0.,0,"{C
alibration scaling types} http://dakota.sandia.gov/licensing/votd/html-ref/RespCo
mmands.html#RespFnLS",0,"calibration_terms"},
            {"calibration_term_scales",0x80e,0,2,0,1765,0,0.,0.,0.,0,"{Calibr
ation scales} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#
RespFnLS",0,"calibration_terms"},
            {"calibration_weights",14,0,3,0,1767,0,0.,0.,0.,0,"{Calibration t
erm weights} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#R
espFnLS",0,"calibration_terms"},
            {"least_squares_data_file",3,5,4,0,1768,kw_190},
            {"least_squares_term_scale_types",0x807,0,1,0,1762,0,0.,0.,0.,0,0
,0,"calibration_terms"},
            {"least_squares_term_scales",0x806,0,2,0,1764,0,0.,0.,0.,0,0,0,"c
alibration_terms"},
            {"least_squares_weights",6,0,3,0,1766,0,0.,0.,0.,0,0,0,"calibrati
on_terms"},
            {"nonlinear_equality_constraints",0x29,3,6,0,1791,kw_191,0.,0.,0.
,0,"{Number of nonlinear equality constraints} http://dakota.sandia.gov/licensing
/votd/html-ref/RespCommands.html#RespFnLS"},
            {"nonlinear_inequality_constraints",0x29,4,5,0,1781,kw_192,0.,0.,
0.,0,"{Number of nonlinear inequality constraints} http://dakota.sandia.gov/licen
sing/votd/html-ref/RespCommands.html#RespFnLS"},
            {"num_nonlinear_equality_constraints",0x21,3,6,0,1790,kw_191},
            {"num_nonlinear_inequality_constraints",0x21,4,5,0,1780,kw_192}
            }
```

42.1.4.197 static KeyWord kw_194 () [static]

Initial value:

```
{
            {"ignore_bounds",8,0,1,0,1817,0,0.,0.,0.,0,"{Ignore variable boun
ds} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespGradMi
xed"}
            }
```

42.1.4.198 static KeyWord kw_195 () [static]

Initial value:

```
{
            {"central",8,0,6,0,1825,0,0.,0.,0.,0,"[CHOOSE difference interval
]"},
            {"dakota",8,1,4,0,1815,kw_194,0.,0.,0.,0,"@[CHOOSE gradient sourc
e]"},
            {"fd_gradient_step_size",0x406,0,7,0,1826,0,0.,0.,0.001},
            {"fd_step_size",0x40e,0,7,0,1827,0,0.,0.,0.001,0,"{Finite differe
nce step size} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html
#RespGradMixed"},
            {"forward",8,0,6,0,1823,0,0.,0.,0.,0,"@"},
            {"id_analytic_gradients",13,0,2,2,1809,0,0.,0.,0.,0,"{Analytic de
rivatives function list} http://dakota.sandia.gov/licensing/votd/html-ref/RespCom
mands.html#RespGradMixed"},
```

```
                {"id_numerical_gradients",13,0,1,1,1807,0,0.,0.,0.,0,"{Numerical
derivatives function list} http://dakota.sandia.gov/licensing/votd/html-ref/RespC
ommands.html#RespGradMixed"},
                {"interval_type",8,0,5,0,1821,0,0.,0.,0.,0,"{Interval type} http:
//dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespGradNum"},
                {"method_source",8,0,3,0,1813,0,0.,0.,0.,0,"{Method source} http:
//dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespGradNum"},
                {"vendor",8,0,4,0,1819}
                }
```

42.1.4.199 static KeyWord kw_196 () [static]

Initial value:

```
{
                {"fd_hessian_step_size",6,0,1,0,1852},
                {"fd_step_size",14,0,1,0,1853,0,0.,0.,0.,0,"{Finite difference st
ep size} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespH
essMixed"}
                }
```

42.1.4.200 static KeyWord kw_197 () [static]

Initial value:

```
{
                {"damped",8,0,1,0,1863,0,0.,0.,0.,0,"{Numerical safeguarding of B
FGS update} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#Re
spHessMixed"}
                }
```

42.1.4.201 static KeyWord kw_198 () [static]

Initial value:

```
{
                {"bfgs",8,1,1,1,1861,kw_197,0.,0.,0.,0,"[CHOOSE Hessian approx.]"
},
                {"sr1",8,0,1,1,1865}
                }
```

42.1.4.202 static KeyWord kw_199 () [static]

Initial value:

```
{
                {"central",8,0,2,0,1857,0,0.,0.,0.,0,"[CHOOSE difference interval
]"},
                {"forward",8,0,2,0,1855,0,0.,0.,0.,0,"@"},
                {"id_analytic_hessians",13,0,4,0,1867,0,0.,0.,0.,0,"{Analytic Hes
sians function list} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommand
```

```
s.html#RespHessMixed"},
          {"id_numerical_hessians",13,2,1,0,1851,kw_196,0.,0.,0.,0,"{Numeri
cal Hessians function list} http://dakota.sandia.gov/licensing/votd/html-ref/Resp
Commands.html#RespHessMixed"},
          {"id_quasi_hessians",13,2,3,0,1859,kw_198,0.,0.,0.,0,"{Quasi Hess
ians function list} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands
.html#RespHessMixed"}
          }
```

42.1.4.203 static KeyWord kw_200 () [static]

Initial value:

```
{
          {"nonlinear_equality_scale_types",0x80f,0,2,0,1757,0,0.,0.,0.,0,"
{Nonlinear equality constraint scaling types} http://dakota.sandia.gov/licensing/
votd/html-ref/RespCommands.html#RespFnOpt",0,"nonlinear_equality_constraints"},
          {"nonlinear_equality_scales",0x80e,0,3,0,1759,0,0.,0.,0.,0,"{Nonl
inear equality constraint scales} http://dakota.sandia.gov/licensing/votd/html-re
f/RespCommands.html#RespFnOpt",0,"nonlinear_equality_constraints"},
          {"nonlinear_equality_targets",14,0,1,0,1755,0,0.,0.,0.,0,"{Nonlin
ear equality constraint targets} http://dakota.sandia.gov/licensing/votd/html-ref
/RespCommands.html#RespFnOpt",0,"nonlinear_equality_constraints"}
          }
```

42.1.4.204 static KeyWord kw_201 () [static]

Initial value:

```
{
          {"nonlinear_inequality_lower_bounds",14,0,1,0,1745,0,0.,0.,0.,0,"
{Nonlinear inequality constraint lower bounds} http://dakota.sandia.gov/licensing
/votd/html-ref/RespCommands.html#RespFnOpt",0,"nonlinear_inequality_constraints"}
,
          {"nonlinear_inequality_scale_types",0x80f,0,3,0,1749,0,0.,0.,0.,0
,"{Nonlinear inequality constraint scaling types} http://dakota.sandia.gov/licens
ing/votd/html-ref/RespCommands.html#RespFnOpt",0,"nonlinear_inequality_constraint
s"},
          {"nonlinear_inequality_scales",0x80e,0,4,0,1751,0,0.,0.,0.,0,"{No
nlinear inequality constraint scales} http://dakota.sandia.gov/licensing/votd/htm
l-ref/RespCommands.html#RespFnOpt",0,"nonlinear_inequality_constraints"},
          {"nonlinear_inequality_upper_bounds",14,0,2,0,1747,0,0.,0.,0.,0,"
{Nonlinear inequality constraint upper bounds} http://dakota.sandia.gov/licensing
/votd/html-ref/RespCommands.html#RespFnOpt",0,"nonlinear_inequality_constraints"}

          }
```

42.1.4.205 static KeyWord kw_202 () [static]

Initial value:

```
{
          {"multi_objective_weights",14,0,3,0,1741,0,0.,0.,0.,0,"{Multiobje
ctive weightings} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.h
```

```
tml#RespFnOpt",0,"objective_functions"},
          {"nonlinear_equality_constraints",0x29,3,5,0,1753,kw_200,0.,0.,0.
,0,"{Number of nonlinear equality constraints} http://dakota.sandia.gov/licensing
/votd/html-ref/RespCommands.html#RespFnOpt"},
          {"nonlinear_inequality_constraints",0x29,4,4,0,1743,kw_201,0.,0.,
0.,0,"{Number of nonlinear inequality constraints} http://dakota.sandia.gov/licen
sing/votd/html-ref/RespCommands.html#RespFnOpt"},
          {"num_nonlinear_equality_constraints",0x21,3,5,0,1752,kw_200},
          {"num_nonlinear_inequality_constraints",0x21,4,4,0,1742,kw_201},
          {"objective_function_scale_types",0x80f,0,1,0,1737,0,0.,0.,0.,0,"
{Objective function scaling types} http://dakota.sandia.gov/licensing/votd/html-r
ef/RespCommands.html#RespFnOpt",0,"objective_functions"},
          {"objective_function_scales",0x80e,0,2,0,1739,0,0.,0.,0.,0,"{Obje
ctive function scales} http://dakota.sandia.gov/licensing/votd/html-ref/RespComma
nds.html#RespFnOpt",0,"objective_functions"}
          }
```

42.1.4.206 static KeyWord kw_203 () [static]

Initial value:

```
{
          {"central",8,0,6,0,1825,0,0.,0.,0.,0,"[CHOOSE difference interval
]"},
          {"dakota",8,1,4,0,1815,kw_194,0.,0.,0.,0,"@[CHOOSE gradient sourc
e]"},
          {"fd_gradient_step_size",0x406,0,7,0,1826,0,0.,0.,0.001},
          {"fd_step_size",0x40e,0,7,0,1827,0,0.,0.,0.001,0,"{Finite differe
nce step size} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html
#RespGradMixed"},
          {"forward",8,0,6,0,1823,0,0.,0.,0.,0,"@"},
          {"interval_type",8,0,5,0,1821,0,0.,0.,0.,0,"{Interval type} http:
//dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespGradNum"},
          {"method_source",8,0,3,0,1813,0,0.,0.,0.,0,"{Method source} http:
//dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespGradNum"},
          {"vendor",8,0,4,0,1819}
          }
```

42.1.4.207 static KeyWord kw_204 () [static]

Initial value:

```
{
          {"central",8,0,2,0,1837,0,0.,0.,0.,0,"[CHOOSE difference interval
]"},
          {"fd_hessian_step_size",6,0,1,0,1832},
          {"fd_step_size",14,0,1,0,1833,0,0.,0.,0.,0,"{Finite difference st
ep size} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespH
essNum"},
          {"forward",8,0,2,0,1835,0,0.,0.,0.,0,"@"}
          }
```

42.1.4.208 static KeyWord kw_205 () [static]

Initial value:

```
{
                {"damped",8,0,1,0,1843,0,0.,0.,0.,0,"{Numerical safeguarding of B
     FGS update} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#Re
     spHessQuasi"}
                }
```

42.1.4.209 static KeyWord kw_206 () [static]

Initial value:

```
{
                {"bfgs",8,1,1,1,1841,kw_205,0.,0.,0.,0,"[CHOOSE Hessian approx.]"
     },
                {"sr1",8,0,1,1,1845}
                }
```

42.1.4.210 static KeyWord kw_207 () [static]

Initial value:

```
{
                {"analytic_gradients",8,0,4,2,1803,0,0.,0.,0.,0,"[CHOOSE gradient
      type]"},
                {"analytic_hessians",8,0,5,3,1847,0,0.,0.,0.,0,"[CHOOSE Hessian t
     ype]"},
                {"calibration_terms",0x29,12,3,1,1761,kw_193,0.,0.,0.,0,"{Number
     of calibration terms} http://dakota.sandia.gov/licensing/votd/html-ref/RespComman
     ds.html#RespFnLS"},
                {"descriptors",15,0,2,0,1733,0,0.,0.,0.,0,"{Response labels} http
     ://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespLabels"},
                {"id_responses",11,0,1,0,1731,0,0.,0.,0.,0,"{Responses set identi
     fier} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespSetI
     d"},
                {"mixed_gradients",8,10,4,2,1805,kw_195,0.,0.,0.,0,"{Mixed gradie
     nts} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespGradM
     ixed"},
                {"mixed_hessians",8,5,5,3,1849,kw_199,0.,0.,0.,0,"{Mixed Hessians
     } http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespHessMixe
     d"},
                {"no_gradients",8,0,4,2,1801,0,0.,0.,0.,0,"@"},
                {"no_hessians",8,0,5,3,1829,0,0.,0.,0.,0,"@"},
                {"num_least_squares_terms",0x21,12,3,1,1760,kw_193},
                {"num_objective_functions",0x21,7,3,1,1734,kw_202},
                {"num_response_functions",0x21,0,3,1,1798},
                {"numerical_gradients",8,8,4,2,1811,kw_203,0.,0.,0.,0,"{Numerical
      gradients} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#Re
     spGradNum"},
                {"numerical_hessians",8,4,5,3,1831,kw_204,0.,0.,0.,0,"{Numerical
     Hessians} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#Resp
     HessNum"},
                {"objective_functions",0x29,7,3,1,1735,kw_202,0.,0.,0.,0,"{Number
      of objective functions} http://dakota.sandia.gov/licensing/votd/html-ref/RespCom
     mands.html#RespFnOpt"},
                {"quasi_hessians",8,2,5,3,1839,kw_206,0.,0.,0.,0,"{Quasi Hessians
     } http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.html#RespHessQuas
     i"},
                {"response_descriptors",7,0,2,0,1732},
```

```
            {"response_functions",0x29,0,3,1,1799,0,0.,0.,0.,0,"{Number of re
sponse functions} http://dakota.sandia.gov/licensing/votd/html-ref/RespCommands.h
tml#RespFnGen"}
            }
```

42.1.4.211 static KeyWord kw_208 () [static]

Initial value:

```
{
            {"method_list",15,0,1,1,33,0,0.,0.,0.,0,"{List of methods} http:/
/dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratHybrid"}
            }
```

42.1.4.212 static KeyWord kw_209 () [static]

Initial value:

```
{
            {"global_method_pointer",11,0,1,1,25,0,0.,0.,0.,0,"{Pointer to th
e global method specification} http://dakota.sandia.gov/licensing/votd/html-ref/S
tratCommands.html#StratHybrid"},
            {"local_method_pointer",11,0,2,2,27,0,0.,0.,0.,0,"{Pointer to the
 local method specification} http://dakota.sandia.gov/licensing/votd/html-ref/Str
atCommands.html#StratHybrid"},
            {"local_search_probability",10,0,3,0,29,0,0.,0.,0.,0,"{Probabilit
y of executing local searches} http://dakota.sandia.gov/licensing/votd/html-ref/S
tratCommands.html#StratHybrid"}
            }
```

42.1.4.213 static KeyWord kw_210 () [static]

Initial value:

```
{
            {"method_list",15,0,1,1,21,0,0.,0.,0.,0,"{List of methods} http:/
/dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratHybrid"}
            }
```

42.1.4.214 static KeyWord kw_211 () [static]

Initial value:

```
{
            {"collaborative",8,1,1,1,31,kw_208,0.,0.,0.,0,"[CHOOSE hybrid typ
e]{Collaborative hybrid} http://dakota.sandia.gov/licensing/votd/html-ref/StratCo
mmands.html#StratHybrid"},
            {"coupled",0,3,1,1,22,kw_209},
            {"embedded",8,3,1,1,23,kw_209,0.,0.,0.,0,"{Embedded hybrid} http:
//dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratHybrid"},
            {"sequential",8,1,1,1,19,kw_210,0.,0.,0.,0,"{Sequential hybrid} h
```

```
ttp://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratHybrid"},

          {"uncoupled",0,1,1,1,18,kw_210}
          }
```

42.1.4.215 static KeyWord kw_212 () [static]

Initial value:

```
{
          {"seed",9,0,1,0,41,0,0.,0.,0.,0,"{Seed for random starting points
} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratMultiS
tart"}
          }
```

42.1.4.216 static KeyWord kw_213 () [static]

Initial value:

```
{
          {"method_pointer",11,0,1,1,37,0,0.,0.,0.,0,"{Method pointer} http
://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratMultiStart"}
,
          {"random_starts",9,1,2,0,39,kw_212,0.,0.,0.,0,"{Number of random
starting points} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.h
tml#StratMultiStart"},
          {"starting_points",14,0,3,0,43,0,0.,0.,0.,0,"{List of user-specif
ied starting points} http://dakota.sandia.gov/licensing/votd/html-ref/StratComman
ds.html#StratMultiStart"}
          }
```

42.1.4.217 static KeyWord kw_214 () [static]

Initial value:

```
{
          {"seed",9,0,1,0,51,0,0.,0.,0.,0,"{Seed for random weighting sets}
 http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratParetoS
et"}
          }
```

42.1.4.218 static KeyWord kw_215 () [static]

Initial value:

```
{
          {"method_pointer",11,0,1,1,47,0,0.,0.,0.,0,"{Optimization method
pointer} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#Stra
tParetoSet"},
          {"multi_objective_weight_sets",6,0,3,0,52},
          {"opt_method_pointer",3,0,1,1,46},
```

```
            {"random_weight_sets",9,1,2,0,49,kw_214,0.,0.,0.,0,"{Number of ra
ndom weighting sets} http://dakota.sandia.gov/licensing/votd/html-ref/StratComman
ds.html#StratParetoSet"},
            {"weight_sets",14,0,3,0,53,0,0.,0.,0.,0,"{List of user-specified
weighting sets} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.ht
ml#StratParetoSet"}
            }
```

42.1.4.219 static KeyWord kw_216 () [static]

Initial value:

```
{
            {"method_pointer",11,0,1,0,57,0,0.,0.,0.,0,"{Method pointer} http
://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratSingle"}
            }
```

42.1.4.220 static KeyWord kw_217 () [static]

Initial value:

```
{
            {"tabular_graphics_file",11,0,1,0,7,0,0.,0.,0.,0,"{File name for
tabular graphics data} http://dakota.sandia.gov/licensing/votd/html-ref/StratComm
ands.html#StratIndControl"}
            }
```

42.1.4.221 static KeyWord kw_218 () [static]

Initial value:

```
{
            {"graphics",8,0,1,0,3,0,0.,0.,0.,0,"{Graphics flag} http://dakota
.sandia.gov/licensing/votd/html-ref/StratCommands.html#StratIndControl"},
            {"hybrid",8,5,7,1,17,kw_211,0.,0.,0.,0,"[CHOOSE strategy type]{Hy
brid strategy} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.htm
l#StratHybrid"},
            {"iterator_self_scheduling",8,0,5,0,13,0,0.,0.,0.,0,"{Self-schedu
ling of iterator jobs} http://dakota.sandia.gov/licensing/votd/html-ref/StratComm
ands.html#StratIndControl"},
            {"iterator_servers",9,0,4,0,11,0,0.,0.,0.,0,"{Number of iterator
servers} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#Stra
tIndControl"},
            {"iterator_static_scheduling",8,0,6,0,15,0,0.,0.,0.,0,"{Static sc
heduling of iterator jobs} http://dakota.sandia.gov/licensing/votd/html-ref/Strat
Commands.html#StratIndControl"},
            {"multi_start",8,3,7,1,35,kw_213,0.,0.,0.,0,"{Multi-start iterati
on strategy} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#
StratMultiStart"},
            {"output_precision",0x29,0,3,0,9,0,0.,0.,0.,0,"{Numeric output pr
ecision} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#Stra
tIndControl"},
            {"pareto_set",8,5,7,1,45,kw_215,0.,0.,0.,0,"{Pareto set optimizat
ion strategy} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html
```

```
#StratParetoSet"},
          {"single_method",8,1,7,1,55,kw_216,0.,0.,0.,0,"@{Single method st
rategy} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands.html#Strat
Single"},
          {"tabular_graphics_data",8,1,2,0,5,kw_217,0.,0.,0.,0,"{Tabulation
 of graphics data} http://dakota.sandia.gov/licensing/votd/html-ref/StratCommands
.html#StratIndControl"}
          }
```

42.1.4.222 static KeyWord kw_219 () [static]

Initial value:

```
{
          {"alphas",14,0,1,1,1481,0,0.,0.,0.,0,"{beta uncertain alphas} htt
p://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Beta",0,"b
eta_uncertain"},
          {"betas",14,0,2,2,1483,0,0.,0.,0.,0,"{beta uncertain betas} http:
//dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Beta",0,"bet
a_uncertain"},
          {"buv_alphas",6,0,1,1,1480,0,0.,0.,0.,0,0,0,"beta_uncertain"},
          {"buv_betas",6,0,2,2,1482,0,0.,0.,0.,0,0,0,"beta_uncertain"},
          {"buv_descriptors",7,0,5,0,1488,0,0.,0.,0.,0,0,0,"beta_uncertain"
},
          {"buv_lower_bounds",6,0,3,3,1484,0,0.,0.,0.,0,0,0,"beta_uncertain
"},
          {"buv_upper_bounds",6,0,4,4,1486,0,0.,0.,0.,0,0,0,"beta_uncertain
"},
          {"descriptors",15,0,5,0,1489,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Beta",0,"beta_u
ncertain"},
          {"lower_bounds",14,0,3,3,1485,0,0.,0.,0.,0,"{Distribution lower b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Beta",0,"beta_uncertain"},
          {"upper_bounds",14,0,4,4,1487,0,0.,0.,0.,0,"{Distribution upper b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Beta",0,"beta_uncertain"}
          }
```

42.1.4.223 static KeyWord kw_220 () [static]

Initial value:

```
{
          {"descriptors",15,0,3,0,1547,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Binomial",0,"bi
nomial_uncertain"},
          {"num_trials",13,0,2,2,1545,0,0.,0.,0.,0,"{binomial uncertain num
_trials} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAU
V_Binomial",0,"binomial_uncertain"},
          {"prob_per_trial",14,0,1,1,1543,0,0.,0.,0.,0,"{binomial uncertain
 prob_per_trial} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.htm
l#VarDAUV_Binomial",0,"binomial_uncertain"}
          }
```

42.1.4.224 static KeyWord kw_221 () [static]

Initial value:

```
{
                {"cdv_descriptors",7,0,6,0,1384,0,0.,0.,0.,0,0,0,"continuous_desi
     gn"},
                {"cdv_initial_point",6,0,1,0,1374,0,0.,0.,0.,0,0,0,"continuous_de
     sign"},
                {"cdv_lower_bounds",6,0,2,0,1376,0,0.,0.,0.,0,0,0,"continuous_des
     ign"},
                {"cdv_scale_types",0x807,0,4,0,1380,0,0.,0.,0.,0,0,0,"continuous_
     design"},
                {"cdv_scales",0x806,0,5,0,1382,0,0.,0.,0.,0,0,0,"continuous_desig
     n"},
                {"cdv_upper_bounds",6,0,3,0,1378,0,0.,0.,0.,0,0,0,"continuous_des
     ign"},
                {"descriptors",15,0,6,0,1385,0,0.,0.,0.,0,"{Descriptors} http://d
     akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCDV",0,"continuous_d
     esign"},
                {"initial_point",14,0,1,0,1375,0,0.,0.,0.,0,"{Initial point} http
     ://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCDV",0,"continuo
     us_design"},
                {"lower_bounds",14,0,2,0,1377,0,0.,0.,0.,0,"{Lower bounds} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCDV",0,"continuous
     _design"},
                {"scale_types",0x80f,0,4,0,1381,0,0.,0.,0.,0,"{Scaling types} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCDV",0,"continu
     ous_design"},
                {"scales",0x80e,0,5,0,1383,0,0.,0.,0.,0,"{Scales} http://dakota.s
     andia.gov/licensing/votd/html-ref/VarCommands.html#VarCDV",0,"continuous_design"}
     ,
                {"upper_bounds",14,0,3,0,1379,0,0.,0.,0.,0,"{Upper bounds} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCDV",0,"continuous
     _design"}
                }
```

42.1.4.225 static KeyWord kw_222 () [static]

Initial value:

```
{
                {"csv_descriptors",7,0,4,0,1602,0,0.,0.,0.,0,0,0,"continuous_stat
     e"},
                {"csv_initial_state",6,0,1,0,1596,0,0.,0.,0.,0,0,0,"continuous_st
     ate"},
                {"csv_lower_bounds",6,0,2,0,1598,0,0.,0.,0.,0,0,0,"continuous_sta
     te"},
                {"csv_upper_bounds",6,0,3,0,1600,0,0.,0.,0.,0,0,0,"continuous_sta
     te"},
                {"descriptors",15,0,4,0,1603,0,0.,0.,0.,0,"{Descriptors} http://d
     akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCSV",0,"continuous_s
     tate"},
                {"initial_state",14,0,1,0,1597,0,0.,0.,0.,0,"{Initial states} htt
     p://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCSV",0,"continu
     ous_state"},
                {"lower_bounds",14,0,2,0,1599,0,0.,0.,0.,0,"{Lower bounds} http:/
     /dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCSV",0,"continuous
     _state"},
```

```
            {"upper_bounds",14,0,3,0,1601,0,0.,0.,0.,0,"{Upper bounds} http:/
/dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCSV",0,"continuous
_state"}
            }
```

42.1.4.226 static KeyWord kw_223 () [static]

Initial value:

```
{
            {"ddv_descriptors",7,0,4,0,1394,0,0.,0.,0.,0,0,0,"discrete_design
_range"},
            {"ddv_initial_point",5,0,1,0,1388,0,0.,0.,0.,0,0,0,"discrete_desi
gn_range"},
            {"ddv_lower_bounds",5,0,2,0,1390,0,0.,0.,0.,0,0,0,"discrete_desig
n_range"},
            {"ddv_upper_bounds",5,0,3,0,1392,0,0.,0.,0.,0,0,0,"discrete_desig
n_range"},
            {"descriptors",15,0,4,0,1395,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDRIV",0,"discrete_d
esign_range"},
            {"initial_point",13,0,1,0,1389,0,0.,0.,0.,0,"{Initial point} http
://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDRIV",0,"discre
te_design_range"},
            {"lower_bounds",13,0,2,0,1391,0,0.,0.,0.,0,"{Lower bounds} http:/
/dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDRIV",0,"discrete
_design_range"},
            {"upper_bounds",13,0,3,0,1393,0,0.,0.,0.,0,"{Upper bounds} http:/
/dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDRIV",0,"discrete
_design_range"}
            }
```

42.1.4.227 static KeyWord kw_224 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1405,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDSIV",0,"discrete_d
esign_set_integer"},
            {"initial_point",13,0,1,0,1399,0,0.,0.,0.,0,"{Initial point} http
://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDSIV",0,"discre
te_design_set_integer"},
            {"num_set_values",13,0,2,0,1401,0,0.,0.,0.,0,"{Number of values f
or each variable} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.ht
ml#VarDDSIV",0,"discrete_design_set_integer"},
            {"set_values",13,0,3,1,1403,0,0.,0.,0.,0,"{Set values} http://dak
ota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDSIV"}
            }
```

42.1.4.228 static KeyWord kw_225 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1415,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDSRV",0,"discrete_d
esign_set_real"},
            {"initial_point",14,0,1,0,1409,0,0.,0.,0.,0,"{Initial point} http
://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDSRV",0,"discre
te_design_set_real"},
            {"num_set_values",13,0,2,0,1411,0,0.,0.,0.,0,"{Number of values f
or each variable} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.ht
ml#VarDDSRV",0,"discrete_design_set_real"},
            {"set_values",14,0,3,1,1413,0,0.,0.,0.,0,"{Set values} http://dak
ota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDDSRV"}
            }
```

42.1.4.229 static KeyWord kw_226 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1613,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSRIV",0,"discrete_s
tate_range"},
            {"dsv_descriptors",7,0,4,0,1612,0,0.,0.,0.,0,0,0,"discrete_state_
range"},
            {"dsv_initial_state",5,0,1,0,1606,0,0.,0.,0.,0,0,0,"discrete_stat
e_range"},
            {"dsv_lower_bounds",5,0,2,0,1608,0,0.,0.,0.,0,0,0,"discrete_state
_range"},
            {"dsv_upper_bounds",5,0,3,0,1610,0,0.,0.,0.,0,0,0,"discrete_state
_range"},
            {"initial_state",13,0,1,0,1607,0,0.,0.,0.,0,"{Initial states} htt
p://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSRIV",0,"discr
ete_state_range"},
            {"lower_bounds",13,0,2,0,1609,0,0.,0.,0.,0,"{Lower bounds} http:/
/dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSRIV",0,"discrete
_state_range"},
            {"upper_bounds",13,0,3,0,1611,0,0.,0.,0.,0,"{Upper bounds} http:/
/dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSRIV",0,"discrete
_state_range"}
            }
```

42.1.4.230 static KeyWord kw_227 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1623,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSSIV",0,"discrete_s
tate_set_integer"},
            {"initial_state",13,0,1,0,1617,0,0.,0.,0.,0,"{Initial state} http
://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSSIV",0,"discre
te_state_set_integer"},
            {"num_set_values",13,0,2,0,1619,0,0.,0.,0.,0,"{Number of values f
or each variable} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.ht
ml#VarDSSIV",0,"discrete_state_set_integer"},
            {"set_values",13,0,3,1,1621,0,0.,0.,0.,0,"{Set values} http://dak
ota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSSIV"}
            }
```

42.1.4.231 static KeyWord kw_228 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1633,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSSRV",0,"discrete_s
tate_set_real"},
            {"initial_state",14,0,1,0,1627,0,0.,0.,0.,0,"{Initial state} http
://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSSRV",0,"discre
te_state_set_real"},
            {"num_set_values",13,0,2,0,1629,0,0.,0.,0.,0,"{Number of values f
or each variable} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.ht
ml#VarDSSRV",0,"discrete_state_set_real"},
            {"set_values",14,0,3,1,1631,0,0.,0.,0.,0,"{Set values} http://dak
ota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDSSRV"}
            }
```

42.1.4.232 static KeyWord kw_229 () [static]

Initial value:

```
{
            {"betas",14,0,1,1,1475,0,0.,0.,0.,0,"{exponential uncertain betas
} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Expon
ential",0,"exponential_uncertain"},
            {"descriptors",15,0,2,0,1477,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Exponential",0,
"exponential_uncertain"},
            {"euv_betas",6,0,1,1,1474,0,0.,0.,0.,0,0,0,"exponential_uncertain
"},
            {"euv_descriptors",7,0,2,0,1476,0,0.,0.,0.,0,0,0,"exponential_unc
ertain"}
            }
```

42.1.4.233 static KeyWord kw_230 () [static]

Initial value:

```
{
            {"alphas",14,0,1,1,1509,0,0.,0.,0.,0,"{frechet uncertain alphas}
http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Frechet
",0,"frechet_uncertain"},
            {"betas",14,0,2,2,1511,0,0.,0.,0.,0,"{frechet uncertain betas} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Frechet",
0,"frechet_uncertain"},
            {"descriptors",15,0,3,0,1513,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Frechet",0,"fre
chet_uncertain"},
            {"fuv_alphas",6,0,1,1,1508,0,0.,0.,0.,0,0,0,"frechet_uncertain"},

            {"fuv_betas",6,0,2,2,1510,0,0.,0.,0.,0,0,0,"frechet_uncertain"},
            {"fuv_descriptors",7,0,3,0,1512,0,0.,0.,0.,0,0,0,"frechet_uncerta
in"}
            }
```

42.1.4.234 static KeyWord kw_231 () [static]

Initial value:

```
{
            {"alphas",14,0,1,1,1493,0,0.,0.,0.,0,"{gamma uncertain alphas} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Gamma",0,
"gamma_uncertain"},
            {"betas",14,0,2,2,1495,0,0.,0.,0.,0,"{gamma uncertain betas} http
://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Gamma",0,"g
amma_uncertain"},
            {"descriptors",15,0,3,0,1497,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Gamma",0,"gamma
_uncertain"},
            {"gauv_alphas",6,0,1,1,1492,0,0.,0.,0.,0,0,0,"gamma_uncertain"},
            {"gauv_betas",6,0,2,2,1494,0,0.,0.,0.,0,0,0,"gamma_uncertain"},
            {"gauv_descriptors",7,0,3,0,1496,0,0.,0.,0.,0,0,0,"gamma_uncertai
n"}
            }
```

42.1.4.235 static KeyWord kw_232 () [static]

Initial value:

```
{
            {"descriptors",15,0,2,0,1561,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Geometric",0,"g
eometric_uncertain"},
            {"prob_per_trial",14,0,1,1,1559,0,0.,0.,0.,0,"{geometric uncertai
n prob_per_trial} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.ht
ml#VarDAUV_Geometric",0,"geometric_uncertain"}
            }
```

42.1.4.236 static KeyWord kw_233 () [static]

Initial value:

```
{
            {"alphas",14,0,1,1,1501,0,0.,0.,0.,0,"{gumbel uncertain alphas} h
ttp://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Gumbel",
0,"gumbel_uncertain"},
            {"betas",14,0,2,2,1503,0,0.,0.,0.,0,"{gumbel uncertain betas} htt
p://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Gumbel",0,
"gumbel_uncertain"},
            {"descriptors",15,0,3,0,1505,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Gumbel",0,"gumb
el_uncertain"},
            {"guuv_alphas",6,0,1,1,1500,0,0.,0.,0.,0,0,0,"gumbel_uncertain"},

            {"guuv_betas",6,0,2,2,1502,0,0.,0.,0.,0,0,0,"gumbel_uncertain"},
            {"guuv_descriptors",7,0,3,0,1504,0,0.,0.,0.,0,0,0,"gumbel_uncerta
in"}
            }
```

42.1.4.237 static KeyWord kw_234 () [static]

Initial value:

```
{
            {"abscissas",14,0,2,1,1527,0,0.,0.,0.,0,"{sets of abscissas for b
in-based histogram variables} http://dakota.sandia.gov/licensing/votd/html-ref/Va
rCommands.html#VarCAUV_Bin_Histogram"},
            {"counts",14,0,3,2,1531,0,0.,0.,0.,0,"{sets of counts for bin-bas
ed histogram variables} http://dakota.sandia.gov/licensing/votd/html-ref/VarComma
nds.html#VarCAUV_Bin_Histogram"},
            {"descriptors",15,0,4,0,1533,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Bin_Histogram",
0,"histogram_bin_uncertain"},
            {"huv_bin_abscissas",6,0,2,1,1526},
            {"huv_bin_counts",6,0,3,2,1530},
            {"huv_bin_descriptors",7,0,4,0,1532,0,0.,0.,0.,0,0,0,"histogram_b
in_uncertain"},
            {"huv_bin_ordinates",6,0,3,2,1528},
            {"huv_num_bin_pairs",5,0,1,0,1524,0,0.,0.,0.,0,0,0,"histogram_bin
_uncertain"},
            {"num_pairs",13,0,1,0,1525,0,0.,0.,0.,0,"{key to apportionment am
ong bin-based histogram variables} http://dakota.sandia.gov/licensing/votd/html-r
ef/VarCommands.html#VarCAUV_Bin_Histogram",0,"histogram_bin_uncertain"},
            {"ordinates",14,0,3,2,1529,0,0.,0.,0.,0,"{sets of ordinates for b
in-based histogram variables} http://dakota.sandia.gov/licensing/votd/html-ref/Va
rCommands.html#VarCAUV_Bin_Histogram"}
            }
```

42.1.4.238 static KeyWord kw_235 () [static]

Initial value:

```
{
            {"abscissas",14,0,2,1,1577,0,0.,0.,0.,0,"{sets of abscissas for p
oint-based histogram variables} http://dakota.sandia.gov/licensing/votd/html-ref/
VarCommands.html#VarDAUV_Point_Histogram"},
            {"counts",14,0,3,2,1579,0,0.,0.,0.,0,"{sets of counts for point-b
ased histogram variables} http://dakota.sandia.gov/licensing/votd/html-ref/VarCom
mands.html#VarDAUV_Point_Histogram"},
            {"descriptors",15,0,4,0,1581,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Point_Histogram
",0,"histogram_point_uncertain"},
            {"huv_num_point_pairs",5,0,1,0,1574,0,0.,0.,0.,0,0,0,"histogram_p
oint_uncertain"},
            {"huv_point_abscissas",6,0,2,1,1576},
            {"huv_point_counts",6,0,3,2,1578},
            {"huv_point_descriptors",7,0,4,0,1580,0,0.,0.,0.,0,0,0,"histogram
_point_uncertain"},
            {"num_pairs",13,0,1,0,1575,0,0.,0.,0.,0,"{key to apportionment am
ong point-based histogram variables} http://dakota.sandia.gov/licensing/votd/html
-ref/VarCommands.html#VarDAUV_Point_Histogram",0,"histogram_point_uncertain"}
            }
```

42.1.4.239 static KeyWord kw_236 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1571,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Hypergeometric"
,0,"hypergeometric_uncertain"},
            {"num_drawn",13,0,3,3,1569,0,0.,0.,0.,0,"{hypergeometric uncertai
n num_drawn } http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#V
arDAUV_Hypergeometric",0,"hypergeometric_uncertain"},
            {"selected_population",13,0,2,2,1567,0,0.,0.,0.,0,"{hypergeometri
c uncertain selected_population} http://dakota.sandia.gov/licensing/votd/html-ref
/VarCommands.html#VarDAUV_Hypergeometric",0,"hypergeometric_uncertain"},
            {"total_population",13,0,1,1,1565,0,0.,0.,0.,0,"{hypergeometric u
ncertain total_population} http://dakota.sandia.gov/licensing/votd/html-ref/VarCo
mmands.html#VarDAUV_Hypergeometric",0,"hypergeometric_uncertain"}
            }
```

42.1.4.240 static KeyWord kw_237 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1593,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCEUV_Interval",0,"in
terval_uncertain"},
            {"interval_bounds",14,0,3,2,1591,0,0.,0.,0.,0,"{bounds per interv
al} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCEUV_Int
erval"},
            {"interval_probs",14,0,2,1,1589,0,0.,0.,0.,0,"{basic probability
assignments per interval} http://dakota.sandia.gov/licensing/votd/html-ref/VarCom
mands.html#VarCEUV_Interval"},
            {"iuv_descriptors",7,0,4,0,1592,0,0.,0.,0.,0,0,0,"interval_uncert
ain"},
            {"iuv_interval_bounds",6,0,3,2,1590},
            {"iuv_interval_probs",6,0,2,1,1588},
            {"iuv_num_intervals",5,0,1,0,1586,0,0.,0.,0.,0,0,0,"interval_unce
rtain"},
            {"num_intervals",13,0,1,0,1587,0,0.,0.,0.,0,"{number of intervals
 defined for each interval variable} http://dakota.sandia.gov/licensing/votd/html
-ref/VarCommands.html#VarCEUV_Interval",0,"interval_uncertain"}
            }
```

42.1.4.241 static KeyWord kw_238 () [static]

Initial value:

```
{
            {"lnuv_zetas",6,0,1,1,1432,0,0.,0.,0.,0,0,0,"lognormal_uncertain"
},
            {"zetas",14,0,1,1,1433,0,0.,0.,0.,0,"{lognormal uncertain zetas}
http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Lognorm
al",0,"lognormal_uncertain"}
            }
```

42.1.4.242 static KeyWord kw_239 () [static]

Initial value:

```
{
            {"error_factors",14,0,1,1,1439,0,0.,0.,0.,0,"[CHOOSE variance spe
    c.]{lognormal uncertain error factors} http://dakota.sandia.gov/licensing/votd/ht
    ml-ref/VarCommands.html#VarCAUV_Lognormal",0,"lognormal_uncertain"},
            {"lnuv_error_factors",6,0,1,1,1438,0,0.,0.,0.,0,0,0,"lognormal_un
    certain"},
            {"lnuv_std_deviations",6,0,1,1,1436,0,0.,0.,0.,0,0,0,"lognormal_u
    ncertain"},
            {"std_deviations",14,0,1,1,1437,0,0.,0.,0.,0,"@{lognormal uncerta
    in standard deviations} http://dakota.sandia.gov/licensing/votd/html-ref/VarComma
    nds.html#VarCAUV_Lognormal",0,"lognormal_uncertain"}
            }
```

42.1.4.243 static KeyWord kw_240 () [static]

Initial value:

```
{
            {"descriptors",15,0,4,0,1445,0,0.,0.,0.,0,"{Descriptors} http://d
    akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Lognormal",0,"l
    ognormal_uncertain"},
            {"lambdas",14,2,1,1,1431,kw_238,0.,0.,0.,0,"[CHOOSE characterizat
    ion]{lognormal uncertain lambdas} http://dakota.sandia.gov/licensing/votd/html-re
    f/VarCommands.html#VarCAUV_Lognormal",0,"lognormal_uncertain"},
            {"lnuv_descriptors",7,0,4,0,1444,0,0.,0.,0.,0,0,0,"lognormal_unce
    rtain"},
            {"lnuv_lambdas",6,2,1,1,1430,kw_238,0.,0.,0.,0,0,0,"lognormal_unc
    ertain"},
            {"lnuv_lower_bounds",6,0,2,0,1440,0,0.,0.,0.,0,0,0,"lognormal_unc
    ertain"},
            {"lnuv_means",6,4,1,1,1434,kw_239,0.,0.,0.,0,0,0,"lognormal_uncer
    tain"},
            {"lnuv_upper_bounds",6,0,3,0,1442,0,0.,0.,0.,0,0,0,"lognormal_unc
    ertain"},
            {"lower_bounds",14,0,2,0,1441,0,0.,0.,0.,0,"{Distribution lower b
    ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
    Lognormal",0,"lognormal_uncertain"},
            {"means",14,4,1,1,1435,kw_239,0.,0.,0.,0,"@{lognormal uncertain m
    eans} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_L
    ognormal",0,"lognormal_uncertain"},
            {"upper_bounds",14,0,3,0,1443,0,0.,0.,0.,0,"{Distribution upper b
    ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
    Lognormal",0,"lognormal_uncertain"}
            }
```

42.1.4.244 static KeyWord kw_241 () [static]

Initial value:

```
{
            {"descriptors",15,0,3,0,1461,0,0.,0.,0.,0,"{Descriptors} http://d
    akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Loguniform",0,"
    loguniform_uncertain"},
            {"lower_bounds",14,0,1,1,1457,0,0.,0.,0.,0,"{Distribution lower b
    ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
    Loguniform",0,"loguniform_uncertain"},
            {"luuv_descriptors",7,0,3,0,1460,0,0.,0.,0.,0,0,0,"loguniform_unc
```

```
ertain"},
          {"luuv_lower_bounds",6,0,1,1,1456,0,0.,0.,0.,0,0,0,"loguniform_un
certain"},
          {"luuv_upper_bounds",6,0,2,2,1458,0,0.,0.,0.,0,0,0,"loguniform_un
certain"},
          {"upper_bounds",14,0,2,2,1459,0,0.,0.,0.,0,"{Distribution upper b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Loguniform",0,"loguniform_uncertain"}
          }
```

42.1.4.245 static KeyWord kw_242 () [static]

Initial value:

```
{
          {"descriptors",15,0,3,0,1555,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Negative_Binomi
al",0,"negative_binomial_uncertain"},
          {"num_trials",13,0,2,2,1553,0,0.,0.,0.,0,"{negative binomial unce
rtain success num_trials} http://dakota.sandia.gov/licensing/votd/html-ref/VarCom
mands.html#VarDAUV_Negative_Binomial",0,"negative_binomial_uncertain"},
          {"prob_per_trial",14,0,1,1,1551,0,0.,0.,0.,0,"{negative binomial
uncertain success prob_per_trial} http://dakota.sandia.gov/licensing/votd/html-re
f/VarCommands.html#VarDAUV_Negative_Binomial",0,"negative_binomial_uncertain"}
          }
```

42.1.4.246 static KeyWord kw_243 () [static]

Initial value:

```
{
          {"descriptors",15,0,5,0,1427,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Normal",0,"norm
al_uncertain"},
          {"lower_bounds",14,0,3,0,1423,0,0.,0.,0.,0,"{Distribution lower b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Normal",0,"normal_uncertain"},
          {"means",14,0,1,1,1419,0,0.,0.,0.,0,"{normal uncertain means} htt
p://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Normal",0,
"normal_uncertain"},
          {"nuv_descriptors",7,0,5,0,1426,0,0.,0.,0.,0,0,0,"normal_uncertai
n"},
          {"nuv_lower_bounds",6,0,3,0,1422,0,0.,0.,0.,0,0,0,"normal_uncerta
in"},
          {"nuv_means",6,0,1,1,1418,0,0.,0.,0.,0,0,0,"normal_uncertain"},
          {"nuv_std_deviations",6,0,2,2,1420,0,0.,0.,0.,0,0,0,"normal_uncer
tain"},
          {"nuv_upper_bounds",6,0,4,0,1424,0,0.,0.,0.,0,0,0,"normal_uncerta
in"},
          {"std_deviations",14,0,2,2,1421,0,0.,0.,0.,0,"{normal uncertain s
tandard deviations} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.
html#VarCAUV_Normal",0,"normal_uncertain"},
          {"upper_bounds",14,0,4,0,1425,0,0.,0.,0.,0,"{Distribution upper b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Normal",0,"normal_uncertain"}
          }
```

42.1.4.247 static KeyWord kw_244 () [static]

Initial value:

```
{
                {"descriptors",15,0,2,0,1539,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Poisson",0,"poi
sson_uncertain"},
                {"lambdas",14,0,1,1,1537,0,0.,0.,0.,0,"{poisson uncertain lambdas
} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarDAUV_Poiss
on",0,"poisson_uncertain"}
                }
```

42.1.4.248 static KeyWord kw_245 () [static]

Initial value:

```
{
                {"descriptors",15,0,4,0,1471,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Triangular",0,"
triangular_uncertain"},
                {"lower_bounds",14,0,2,2,1467,0,0.,0.,0.,0,"{Distribution lower b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Triangular",0,"triangular_uncertain"},
                {"modes",14,0,1,1,1465,0,0.,0.,0.,0,"{triangular uncertain modes}
 http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Triang
ular",0,"triangular_uncertain"},
                {"tuv_descriptors",7,0,4,0,1470,0,0.,0.,0.,0,0,0,"triangular_unce
rtain"},
                {"tuv_lower_bounds",6,0,2,2,1466,0,0.,0.,0.,0,0,0,"triangular_unc
ertain"},
                {"tuv_modes",6,0,1,1,1464,0,0.,0.,0.,0,0,0,"triangular_uncertain"
},
                {"tuv_upper_bounds",6,0,3,3,1468,0,0.,0.,0.,0,0,0,"triangular_unc
ertain"},
                {"upper_bounds",14,0,3,3,1469,0,0.,0.,0.,0,"{Distribution upper b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Triangular",0,"triangular_uncertain"}
                }
```

42.1.4.249 static KeyWord kw_246 () [static]

Initial value:

```
{
                {"descriptors",15,0,3,0,1453,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Uniform",0,"uni
form_uncertain"},
                {"lower_bounds",14,0,1,1,1449,0,0.,0.,0.,0,"{Distribution lower b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Uniform",0,"uniform_uncertain"},
                {"upper_bounds",14,0,2,2,1451,0,0.,0.,0.,0,"{Distribution upper b
ounds} http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_
Uniform",0,"uniform_uncertain"},
                {"uuv_descriptors",7,0,3,0,1452,0,0.,0.,0.,0,0,0,"uniform_uncerta
in"},
```

```
            {"uuv_lower_bounds",6,0,1,1,1448,0,0.,0.,0.,0,0,0,"uniform_uncert
ain"},
            {"uuv_upper_bounds",6,0,2,2,1450,0,0.,0.,0.,0,0,0,"uniform_uncert
ain"}
            }
```

42.1.4.250 static KeyWord kw_247 () [static]

Initial value:

```
{
            {"alphas",14,0,1,1,1517,0,0.,0.,0.,0,"{weibull uncertain alphas}
http://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Weibull
",0,"weibull_uncertain"},
            {"betas",14,0,2,2,1519,0,0.,0.,0.,0,"{weibull uncertain betas} ht
tp://dakota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Weibull",
0,"weibull_uncertain"},
            {"descriptors",15,0,3,0,1521,0,0.,0.,0.,0,"{Descriptors} http://d
akota.sandia.gov/licensing/votd/html-ref/VarCommands.html#VarCAUV_Weibull",0,"wei
bull_uncertain"},
            {"wuv_alphas",6,0,1,1,1516,0,0.,0.,0.,0,0,0,"weibull_uncertain"},

            {"wuv_betas",6,0,2,2,1518,0,0.,0.,0.,0,0,0,"weibull_uncertain"},
            {"wuv_descriptors",7,0,3,0,1520,0,0.,0.,0.,0,0,0,"weibull_uncerta
in"}
            }
```

42.1.4.251 static KeyWord kw_249 () [static]

Initial value:

```
{
            {"interface",0x308,10,5,5,1635,kw_9,0.,0.,0.,0,"{Interface} An in
terface specifies how function evaluations will be performed in order to map a se
t of parameters into a set of responses. http://www.cs.sandia.gov/DAKOTA/licensin
g/votd/html-ref/InterfCommands.html"},
            {"method",0x308,75,2,2,59,kw_164,0.,0.,0.,0,"{Method} A method sp
ecifies the name and controls of an iterative procedure, e.g., a sensitivity anal
ysis, uncertainty quantification, or optimization method. http://www.cs.sandia.go
v/DAKOTA/licensing/votd/html-ref/MethodCommands.html"},
            {"model",8,6,3,3,1191,kw_189,0.,0.,0.,0,"{Model} A model consists
 of a model type and maps specified variables through an interface to generate re
sponses. http://www.cs.sandia.gov/DAKOTA/licensing/votd/html-ref/ModelCommands.ht
ml"},
            {"responses",0x308,18,6,6,1729,kw_207,0.,0.,0.,0,"{Responses} A r
esponses object specifies the data that can be returned to DAKOTA through the int
erface after the completion of a function evaluation. http://www.cs.sandia.gov/DA
KOTA/licensing/votd/html-ref/RespCommands.html"},
            {"strategy",0x108,10,1,1,1,kw_218,0.,0.,0.,0,"{Strategy} The stra
tegy specifies the top level technique which will govern the management of iterat
ors and models in the solution of the problem of interest. http://www.cs.sandia.g
ov/DAKOTA/licensing/votd/html-ref/StratCommands.html"},
            {"variables",0x308,29,4,4,1369,kw_248,0.,0.,0.,0,"{Variables} A v
ariables object specifies the parameter set to be iterated by a particular method
. http://www.cs.sandia.gov/DAKOTA/licensing/votd/html-ref/VarCommands.html"}
            }
```

42.1.4.252 KeyWord kw_250[4] [static]

Initial value:

```
{
                {"descriptors",15,0,4,0,0,0.,0.,0,N_vae(dailbl,DAUIVar_hypergeome
     tric)},
                {"num_drawn",13,0,3,3,0,0.,0.,0,N_vam(intDL,hyperGeomUncNumDrawn)
     },
                {"selected_population",13,0,2,2,0,0.,0.,0,N_vam(intDL,hyperGeomUn
     cSelectedPop)},
                {"total_population",13,0,1,1,0,0.,0.,0,N_vam(intDL,hyperGeomUncTo
     talPop)}
                }
```

42.1.4.253 KeyWord kw_251[8] [static]

Initial value:

```
{
                {"descriptors",15,0,4,0,0,0.,0.,0,N_vae(ceulbl,CEUVar_interval)},

                {"interval_bounds",14,0,3,2,0,0.,0.,0,N_vam(vrl,Var_Info_Ivb)},
                {"interval_probs",14,0,2,1,0,0.,0.,0,N_vam(vrl,Var_Info_Ivp)},
                {"iuv_descriptors",7,0,4,0,0,0.,0.,-3,N_vae(ceulbl,CEUVar_interva
     l)},
                {"iuv_interval_bounds",6,0,3,2,0,0.,0.,-3,N_vam(vrl,Var_Info_Ivb)
     },
                {"iuv_interval_probs",6,0,2,1,0,0.,0.,-3,N_vam(vrl,Var_Info_Ivp)}
     ,
                {"iuv_num_intervals",5,0,1,0,0,0.,0.,1,N_vam(vil,Var_Info_nIv)},
                {"num_intervals",13,0,1,0,0,0.,0.,0,N_vam(vil,Var_Info_nIv)}
                }
```

42.1.4.254 KeyWord kw_252[2] [static]

Initial value:

```
{
                {"lnuv_zetas",6,0,1,1,0,0.,0.,1,N_vam(RealLb,lognormalUncZetas)},

                {"zetas",14,0,1,1,0,0.,0.,0,N_vam(RealLb,lognormalUncZetas)}
                }
```

42.1.4.255 KeyWord kw_253[4] [static]

Initial value:

```
{
                {"error_factors",14,0,1,1,0,0.,0.,0,N_vam(RealLb,lognormalUncErrF
     acts)},
                {"lnuv_error_factors",6,0,1,1,0,0.,0.,-1,N_vam(RealLb,lognormalUn
     cErrFacts)},
```

```
                {"lnuv_std_deviations",6,0,1,1,0,0.,0.,1,N_vam(RealLb,lognormalUn
cStdDevs)},
                {"std_deviations",14,0,1,1,0,0.,0.,0,N_vam(RealLb,lognormalUncStd
Devs)}
                }
```

42.1.4.256 KeyWord kw_254[10] [static]

Initial value:

```
{
                {"descriptors",15,0,4,0,0,0.,0.,0,N_vae(caulbl,CAUVar_lognormal)}
,
                {"lambdas",14,2,1,1,kw_252,0.,0.,0,N_vam(RealLd,lognormalUncLambd
as)},
                {"lnuv_descriptors",7,0,4,0,0,0.,0.,-2,N_vae(caulbl,CAUVar_lognor
mal)},
                {"lnuv_lambdas",6,2,1,1,kw_252,0.,0.,-2,N_vam(RealLd,lognormalUnc
Lambdas)},
                {"lnuv_lower_bounds",6,0,2,0,0,0.,0.,3,N_vam(RealLb,lognormalUncL
owerBnds)},
                {"lnuv_means",6,4,1,1,kw_253,0.,0.,3,N_vam(RealLb,lognormalUncMea
ns)},
                {"lnuv_upper_bounds",6,0,3,0,0,0.,0.,3,N_vam(RealUb,lognormalUncU
pperBnds)},
                {"lower_bounds",14,0,2,0,0,0.,0.,0,N_vam(RealLb,lognormalUncLower
Bnds)},
                {"means",14,4,1,1,kw_253,0.,0.,0,N_vam(RealLb,lognormalUncMeans)}
,
                {"upper_bounds",14,0,3,0,0,0.,0.,0,N_vam(RealUb,lognormalUncUpper
Bnds)}
                }
```

42.1.4.257 KeyWord kw_255[6] [static]

Initial value:

```
{
                {"descriptors",15,0,3,0,0,0.,0.,0,N_vae(caulbl,CAUVar_loguniform)
},
                {"lower_bounds",14,0,1,1,0,0.,0.,0,N_vam(RealLb,loguniformUncLowe
rBnds)},
                {"luuv_descriptors",7,0,3,0,0,0.,0.,-2,N_vae(caulbl,CAUVar_loguni
form)},
                {"luuv_lower_bounds",6,0,1,1,0,0.,0.,-2,N_vam(RealLb,loguniformUn
cLowerBnds)},
                {"luuv_upper_bounds",6,0,2,2,0,0.,0.,1,N_vam(RealUb,loguniformUnc
UpperBnds)},
                {"upper_bounds",14,0,2,2,0,0.,0.,0,N_vam(RealUb,loguniformUncUppe
rBnds)}
                }
```

42.1.4.258 KeyWord kw_256[3] [static]

Initial value:

```
{
                {"descriptors",15,0,3,0,0,0.,0.,0,N_vae(dailbl,DAUIVar_negative_b
     inomial)},
                {"num_trials",13,0,2,2,0,0.,0.,0,N_vam(intDL,negBinomialUncNumTri
     als)},
                {"prob_per_trial",14,0,1,1,0,0.,0.,0,N_vam(RealLd,negBinomialUncP
     robPerTrial)}
                }
```

42.1.4.259 KeyWord kw_257[10] [static]

Initial value:

```
{
                {"descriptors",15,0,5,0,0,0.,0.,0,N_vae(caulbl,CAUVar_normal)},
                {"lower_bounds",14,0,3,0,0,0.,0.,0,N_vam(RealLd,normalUncLowerBnd
     s)},
                {"means",14,0,1,1,0,0.,0.,0,N_vam(RealLd,normalUncMeans)},
                {"nuv_descriptors",7,0,5,0,0,0.,0.,-3,N_vae(caulbl,CAUVar_normal)
     },
                {"nuv_lower_bounds",6,0,3,0,0,0.,0.,-3,N_vam(RealLd,normalUncLowe
     rBnds)},
                {"nuv_means",6,0,1,1,0,0.,0.,-3,N_vam(RealLd,normalUncMeans)},
                {"nuv_std_deviations",6,0,2,2,0,0.,0.,2,N_vam(RealLb,normalUncStd
     Devs)},
                {"nuv_upper_bounds",6,0,4,0,0,0.,0.,2,N_vam(RealLd,normalUncUpper
     Bnds)},
                {"std_deviations",14,0,2,2,0,0.,0.,0,N_vam(RealLb,normalUncStdDev
     s)},
                {"upper_bounds",14,0,4,0,0,0.,0.,0,N_vam(RealLd,normalUncUpperBnd
     s)}
                }
```

42.1.4.260 KeyWord kw_258[2] [static]

Initial value:

```
{
                {"descriptors",15,0,2,0,0,0.,0.,0,N_vae(dailbl,DAUIVar_poisson)},

                {"lambdas",14,0,1,1,0,0.,0.,0,N_vam(RealLd,poissonUncLambdas)}
                }
```

42.1.4.261 KeyWord kw_259[8] [static]

Initial value:

```
{
                {"descriptors",15,0,4,0,0,0.,0.,0,N_vae(caulbl,CAUVar_triangular)
     },
                {"lower_bounds",14,0,2,2,0,0.,0.,0,N_vam(RealLb,triangularUncLowe
     rBnds)},
                {"modes",14,0,1,1,0,0.,0.,0,N_vam(RealLd,triangularUncModes)},
                {"tuv_descriptors",7,0,4,0,0,0.,0.,-3,N_vae(caulbl,CAUVar_triangu
```

```
lar)},
          {"tuv_lower_bounds",6,0,2,2,0,0.,0.,-3,N_vam(RealLb,triangularUnc
LowerBnds)},
          {"tuv_modes",6,0,1,1,0,0.,0.,-3,N_vam(RealLd,triangularUncModes)}
,
          {"tuv_upper_bounds",6,0,3,3,0,0.,0.,1,N_vam(RealUb,triangularUncU
pperBnds)},
          {"upper_bounds",14,0,3,3,0,0.,0.,0,N_vam(RealUb,triangularUncUppe
rBnds)}
          }
```

42.1.4.262 KeyWord kw_260[6] [static]

Initial value:

```
{
          {"descriptors",15,0,3,0,0,0.,0.,0,N_vae(caulbl,CAUVar_uniform)},
          {"lower_bounds",14,0,1,1,0,0.,0.,0,N_vam(RealLb,uniformUncLowerBn
ds)},
          {"upper_bounds",14,0,2,2,0,0.,0.,0,N_vam(RealUb,uniformUncUpperBn
ds)},
          {"uuv_descriptors",7,0,3,0,0,0.,0.,-3,N_vae(caulbl,CAUVar_uniform
)},
          {"uuv_lower_bounds",6,0,1,1,0,0.,0.,-3,N_vam(RealLb,uniformUncLow
erBnds)},
          {"uuv_upper_bounds",6,0,2,2,0,0.,0.,-3,N_vam(RealUb,uniformUncUpp
erBnds)}
          }
```

42.1.4.263 KeyWord kw_261[6] [static]

Initial value:

```
{
          {"alphas",14,0,1,1,0,0.,0.,0,N_vam(RealLb,weibullUncAlphas)},
          {"betas",14,0,2,2,0,0.,0.,0,N_vam(RealLb,weibullUncBetas)},
          {"descriptors",15,0,3,0,0,0.,0.,0,N_vae(caulbl,CAUVar_weibull)},
          {"wuv_alphas",6,0,1,1,0,0.,0.,-3,N_vam(RealLb,weibullUncAlphas)},

          {"wuv_betas",6,0,2,2,0,0.,0.,-3,N_vam(RealLb,weibullUncBetas)},
          {"wuv_descriptors",7,0,3,0,0,0.,0.,-3,N_vae(caulbl,CAUVar_weibull
)}
          }
```

42.1.4.264 KeyWord kw_263[6] [static]

Initial value:

```
{
          {"interface",0x308,10,5,5,kw_9,0.,0.,0,N_ifm3(start,0,stop)},
          {"method",0x308,75,2,2,kw_177,0.,0.,0,N_mdm3(start,0,stop)},
          {"model",8,6,3,3,kw_203,0.,0.,0,N_mom3(start,0,stop)},
          {"responses",0x308,18,6,6,kw_221,0.,0.,0,N_rem3(start,0,stop)},
          {"strategy",0x108,10,1,1,kw_232,0.,0.,0,NIDRProblemDescDB::strate
```

```
gy_start},
          {"variables",0x308,29,4,4,kw_262,0.,0.,0,N_vam3(start,0,stop)}
          }
```

42.1.4.265 Var_uinfo CAUVLbl[CAUVar_Nkinds] [static]

Initial value:

```
{
       UncInfo(nuv_, Normal),
       UncInfo(lnuv_, Lognormal),
       UncInfo(uuv_, Uniform),
       UncInfo(luuv_, Loguniform),
       UncInfo(tuv_, Triangular),
       UncInfo(euv_, Exponential),
       UncInfo(beuv_, Beta),
       UncInfo(gauv_, Gamma),
       UncInfo(guuv_, Gumbel),
       UncInfo(fuv_, Frechet),
       UncInfo(wuv_, Weibull),
       UncInfo(hbuv_, HistogramBin)
       }
```

42.1.4.266 Var_uinfo DAUIVLbl[DAUIVar_Nkinds] [static]

Initial value:

```
{
       UncInfo(puv_, Poisson),
       UncInfo(biuv_, Binomial),
       UncInfo(nbuv_, NegBinomial),
       UncInfo(geuv_, Geometric),
       UncInfo(hguv_, HyperGeom)
       }
```

42.1.4.267 Var_uinfo DAURVLbl[DAURVar_Nkinds] [static]

Initial value:

```
{
       UncInfo(hpuv_, HistogramPt)
       }
```

42.1.4.268 Var_uinfo CEUVLbl[CEUVar_Nkinds] [static]

Initial value:

```
{
       UncInfo(iuv_, Interval)
       }
```

42.1.4.269 Var_uinfo DiscSetLbl[DiscSetVar_Nkinds] [static]

Initial value:

```
{
       DiscSetInfo(ddsiv_, DesSetInt),
       DiscSetInfo(ddsrv_, DesSetReal),
       DiscSetInfo(dssiv_, StateSetInt),
       DiscSetInfo(dssrv_, StateSetReal)
       }
```

42.1.4.270 VarLabelChk Vlch[ ] [static]

Initial value:

```
{
        { AVI numContinuousDesVars, AVI continuousDesignLabels, "cdv_", "cdv_des
     criptors" },
        { AVI numDiscreteDesRangeVars, AVI discreteDesignRangeLabels, "ddriv_",
     "ddriv_descriptors" },
        { AVI numDiscreteDesSetIntVars, AVI discreteDesignSetIntLabels, "ddsiv_"
     , "ddsiv_descriptors" },
        { AVI numDiscreteDesSetRealVars, AVI discreteDesignSetRealLabels, "ddsrv
     _", "ddsrv_descriptors" },
        { AVI numContinuousStateVars, AVI continuousStateLabels, "csv_", "csv_de
     scriptors" },
        { AVI numDiscreteStateRangeVars, AVI discreteStateRangeLabels, "dsriv_",
      "dsriv_descriptors" },
        { AVI numDiscreteStateSetIntVars, AVI discreteStateSetIntLabels, "dssiv_
     ", "dssiv_descriptors" },
        { AVI numDiscreteStateSetRealVars, AVI discreteStateSetRealLabels, "dssr
     v_", "dssrv_descriptors" },
        { AVI numContinuousDesVars, AVI continuousDesignScaleTypes, 0, "cdv_scal
     e_types" }
        }
```

42.1.4.271 VLstuff VLS[N_VLS] [static]

Initial value:

```
{
{CAUVar_Nkinds,  1, AVI CAUv,  CAUVLbl,
       DVR continuousAleatoryUncLabels,
       DVR continuousAleatoryUncLowerBnds,
       DVR continuousAleatoryUncUpperBnds,
       DVR continuousAleatoryUncVars},
{CEUVar_Nkinds,  1, AVI CEUv,  CEUVLbl,
       DVR continuousEpistemicUncLabels,
       DVR continuousEpistemicUncLowerBnds,
       DVR continuousEpistemicUncUpperBnds,
       DVR continuousEpistemicUncVars},
{DAUIVar_Nkinds, 0, AVI DAUIv, DAUIVLbl,
       DVR  discreteIntAleatoryUncLabels,
       RDVR discreteIntAleatoryUncLowerBnds,
       RDVR discreteIntAleatoryUncUpperBnds,
       RDVR discreteIntAleatoryUncVars},
```

```
{DAURVar_Nkinds, 1, AVI DAURv, DAURVLbl,
       DVR discreteRealAleatoryUncLabels,
       DVR discreteRealAleatoryUncLowerBnds,
       DVR discreteRealAleatoryUncUpperBnds,
       DVR discreteRealAleatoryUncVars}}
```

42.1.4.272 Var_bgen var_mp_bgen[ ] [static]

Initial value:

```
{
                Vchu0(gamma_uncertain,numGammaUncVars,Gamma),
                Vchu0(gumbel_uncertain,numGumbelUncVars,Gumbel),
                Vchu0(frechet_uncertain,numFrechetUncVars,Frechet),
                Vchu0(weibull_uncertain,numWeibullUncVars,Weibull),
                Vchu0(histogram_bin_uncertain,numHistogramBinUncVars,HistogramBin
     )
                }
```

42.1.4.273 Var_bgen var_mp_bgen_audr[ ] [static]

Initial value:

```
{
                Vchu0(histogram_point_uncertain,numHistogramPtUncVars,HistogramPt
     )
                }
```

42.1.4.274 Var_bgen var_mp_bgen_audi[ ] [static]

Initial value:

```
{
                Vchu0(poisson_uncertain,numPoissonUncVars,Poisson),
                Vchu0(binomial_uncertain,numBinomialUncVars,Binomial),
                Vchu0(negative_binomial_uncertain,numNegBinomialUncVars,NegBinomi
     al),
                Vchu0(geometric_uncertain,numGeometricUncVars,Geometric),
                Vchu0(hypergeometric_uncertain,numHyperGeomUncVars,HyperGeom)
                }
```

42.1.4.275 Var_bgen var_mp_bgen_eu[ ] [static]

Initial value:

```
{
                Vchu0(interval_uncertain,numIntervalUncVars,Interval)
                }
```

42.1.4.276 Var_bgen var_mp_bgen_dis[ ] [static]

Initial value:

```
{
                Vchu0(discrete_design_set_integer,numDiscreteDesSetIntVars,DDSI),

                Vchu0(discrete_design_set_real,numDiscreteDesSetRealVars,DDSR),
                Vchu0(discrete_state_set_integer,numDiscreteStateSetIntVars,DSSI)
     ,
                Vchu0(discrete_state_set_real,numDiscreteStateSetRealVars,DSSR)
                }
```

42.1.4.277 VarBgen Bgen[ ] [static]

Initial value:

```
{
        BgenInit(var_mp_bgen_audr),
        BgenInit(var_mp_bgen_audi),
        BgenInit(var_mp_bgen_eu)}
```

42.1.4.278 Var_bchk var_mp_bndchk[ ] [static]

Initial value:

```
{
        Vchv(continuous_design,numContinuousDesVars,continuousDesign),
        Vchu1(normal_uncertain,numNormalUncVars,normalUnc),
        Vchu1(lognormal_uncertain,numLognormalUncVars,lognormalUnc),
        Vchu(uniform_uncertain,numUniformUncVars,uniformUnc),
        Vchu(loguniform_uncertain,numLoguniformUncVars,loguniformUnc),
        Vchu(triangular_uncertain,numTriangularUncVars,triangularUnc),
        Vchu0(exponential_uncertain,numExponentialUncVars,Exponential),
        Vchu(beta_uncertain,numBetaUncVars,betaUnc),
        Vchv(continuous_state,numContinuousStateVars,continuousState)
        }
```

42.1.4.279 Var_ibchk var_mp_ibndchk[ ] [static]

Initial value:

```
{
        Vchi(discrete_design_range,numDiscreteDesRangeVars,discreteDesignRange),
        Vchi(discrete_state_range,numDiscreteStateRangeVars,discreteStateRange)
        }
```

42.2 SIM Namespace Reference

A sample namespace for derived classes that use assign_rep() to plug facilities into DAKOTA.

Classes

- class ParallelDirectApplicInterface

  Sample derived interface class for testing parallel simulator plug-ins using assign_rep().

- class SerialDirectApplicInterface

  Sample derived interface class for testing serial simulator plug-ins using assign_rep().

42.2.1 Detailed Description

A sample namespace for derived classes that use assign_rep() to plug facilities into DAKOTA. A typical use of plug-ins with assign_rep() is to publish a simulation interface for use in library mode See Interfacing with DAKOTA as a Library for more information.

Chapter 43

Class Documentation

43.1 ActiveSet Class Reference

Container class for active set tracking information. Contains the active set request vector and the derivative variables vector.

Public Member Functions

- ActiveSet ()

  default constructor

- ActiveSet (size_t num_fns, size_t num_deriv_vars)

  standard constructor

- ActiveSet (size_t num_fns)

  partial constructor

- ActiveSet (const ActiveSet &set)

  copy constructor

- ~ActiveSet ()

  destructor

- ActiveSet & operator= (const ActiveSet &set)

  assignment operator

- void reshape (size_t num_fns, size_t num_deriv_vars)

  reshape requestVector and derivVarsVector

- void reshape (size_t num_fns)

  reshape requestVector

- const ShortArray & request_vector () const

  return the request vector

- void request_vector (const ShortArray &rv)

  set the request vector

- void request_values (const short rv_val)

  set all request vector values

- short request_value (const size_t index) const

  get the value of an entry in the request vector

- void request_value (const short rv_val, const size_t index)

  set the value of an entry in the request vector

- const SizetArray & derivative_vector () const

  return the derivative variables vector

- void derivative_vector (const SizetArray &dvv)

  set the derivative variables vector from a SizetArray

- void derivative_vector (SizetMultiArrayConstView dvv)

  set the derivative variables vector from a SizetMultiArrayConstView

- void derivative_start_value (size_t dvv_start_val)

  set the derivative variables vector values

- void read (std::istream &s)

  read an active set object from an std::istream

- void write (std::ostream &s) const

  write an active set object to an std::ostream

- void write_annotated (std::ostream &s) const

  write an active set object to an std::ostream in annotated format

- void read (BiStream &s)

  read an active set object from the binary restart stream

- void write (BoStream &s) const

  write an active set object to the binary restart stream

- void read (MPIUnpackBuffer &s)

  read an active set object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write an active set object to a packed MPI buffer

Private Attributes

- ShortArray requestVector

  the vector of response requests

- SizetArray derivVarsVector

  the vector of variable ids used for computing derivatives

Friends

- bool operator== (const ActiveSet &set1, const ActiveSet &set2)

  equality operator

- bool operator!= (const ActiveSet &set1, const ActiveSet &set2)

  inequality operator

43.1.1 Detailed Description

Container class for active set tracking information. Contains the active set request vector and the derivative variables vector. The ActiveSet class is a small class whose initial design function is to avoid having to pass the ASV and DVV separately. It is not part of a class hierarchy and does not employ reference-counting/ representation-sharing idioms (e.g., handle-body).

43.1.2 Member Data Documentation

43.1.2.1 ShortArray requestVector `[private]`

the vector of response requests It uses a 0 value for inactive functions and sums 1 (value), 2 (gradient), and 4 (Hessian) for active functions.

Referenced by ActiveSet::ActiveSet(), ActiveSet::operator=(), Dakota::operator==(), ActiveSet::read(), ActiveSet::request_value(), ActiveSet::request_values(), ActiveSet::request_vector(), ActiveSet::reshape(), ActiveSet::write(), and ActiveSet::write_annotated().

43.1.2.2 SizetArray derivVarsVector `[private]`

the vector of variable ids used for computing derivatives These ids will generally identify either the active continuous variables or the inactive continuous variables.

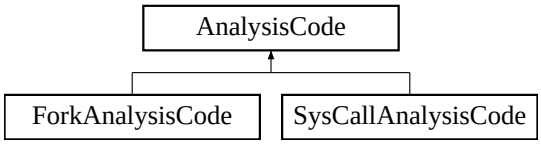
Referenced by ActiveSet::ActiveSet(), ActiveSet::derivative_start_value(), ActiveSet::derivative_vector(), ActiveSet::operator=(), Dakota::operator==(), ActiveSet::read(), ActiveSet::reshape(), ActiveSet::write(), and ActiveSet::write_annotated().

The documentation for this class was generated from the following files:

- DakotaActiveSet.H
- DakotaActiveSet.C

43.2 AnalysisCode Class Reference

Base class providing common functionality for derived classes (SysCallAnalysisCode and ForkAnalysisCode) which spawn separate processes for managing simulations. Inheritance diagram for AnalysisCode::



Public Member Functions

- void define_filenames (const int id)

  define modified filenames from user input by handling Unix temp file and tagging options

- void write_parameters_files (const Variables &vars, const ActiveSet &set, const Response &response, const int id)

  write the parameters data and response request data to one or more parameters files (using one or more invocations of write_parameters_file()) in either standard or aprepro format

- void read_results_files (Response &response, const int id)

  read the response object from one or more results files

- const std::vector< String > & program_names () const

  return programNames

- const std::string & input_filter_name () const

  return iFilterName

- const std::string & output_filter_name () const

  return oFilterName

- const std::string & parameters_filename () const

  return paramsFileName

- const std::string & results_filename () const

  return resultsFileName

- const std::string & results_filename (const int id)

  return the results filename entry in fileNameMap corresponding to id

- void suppress_output_flag (const bool flag)

  set suppressOutputFlag

- bool suppress_output_flag () const

  return suppressOutputFlag

- bool command_line_arguments () const

  return commandLineArgs

- bool multiple_parameters_filenames () const

  return multipleParamsFiles

- void file_cleanup () const

  remove temporary files if not fileSaveFlag

Protected Member Functions

- AnalysisCode (const ProblemDescDB &problem_db)

  constructor

- ~AnalysisCode ()

  destructor

- const char * work_dir () const

  return Workdir if useWorkdir is true (only called by derived classes)

Protected Attributes

- bool suppressOutputFlag

  flag set by master processor to suppress output from slave processors

- short outputLevel

  output verbosity level: {SILENT,QUIET,NORMAL,VERBOSE,DEBUG}_OUTPUT

- bool fileTagFlag

  flags tagging of parameter/results files

- bool fileSaveFlag

  flags retention of parameter/results files

- bool commandLineArgs

  flag indicating use of passing of filenames as command line arguments to the analysis drivers and input/output filters

- bool apreproFlag

  flag indicating use of the APREPRO (the Sandia "A PRE PROcessor" utility) format for parameter files

- bool multipleParamsFiles

  flag indicating the need for separate parameters files for multiple analysis drivers

- std::string iFilterName

  the name of the input filter (input_filter user specification)

- std::string oFilterName

  the name of the output filter (output_filter user specification)

- std::vector< String > programNames

  the names of the analysis code programs (analysis_drivers user specification)

- size_t numPrograms

  the number of analysis code programs (length of programNames)

- std::string specifiedParamsFileName

  the name of the parameters file from user specification

- std::string paramsFileName

  the parameters file name actually used (modified with tagging or temp files)

- std::string specifiedResultsFileName

  the name of the results file from user specification

- std::string resultsFileName

  the results file name actually used (modified with tagging or temp files)

- bool allowExistingResults

  by default analysis code interfaces delete results files if they exist; user may override with this flag and we'll try to gather and only fork if needed

- std::string curWorkdir

  working directory when useWorkdir is true

- std::map< int, std::pair< std::string, std::string > > fileNameMap

  stores parameters and results file names used in spawning function evaluations. Map key is the function evaluation identifier.

- bool useWorkdir

  whether to use a new or specified work_directory

- std::string workDir

  its name, if specified...

- bool dirTag

whether to tag the working directory

- bool dirSave

  whether dir_save was specified

- bool dirDel

  whether to delete the directory when Dakota terminates

- std::string templateDir

  template directory (if specified)

- StringArray templateFiles

  template files (if specified)

- bool templateCopy

  whether to force a copy (versus link) every time

- bool templateReplace

  whether to replace existing files

- bool haveTemplateDir

  state variable for template directory

- bool haveWorkdir

  for dirTag, whether we have workDir

- std::string dakDir

  Dakota directory (if needed).

Private Member Functions

- void write_parameters_file (const Variables &vars, const ActiveSet &set, const Response &response, const std::string &prog, const std::vector< String > &an_comps, const std::string &params_fname)

  write the variables, active set vector, derivative variables vector, and analysis components to the specified parameters file in either standard or aprepro format

Private Attributes

- ParallelLibrary & parallelLib

  reference to the ParallelLibrary object. Used in define_filenames().

- String2DArray analysisComponents

  the set of optional analysis components used by the analysis drivers (from the analysis_components interface specification)

43.2.1 Detailed Description

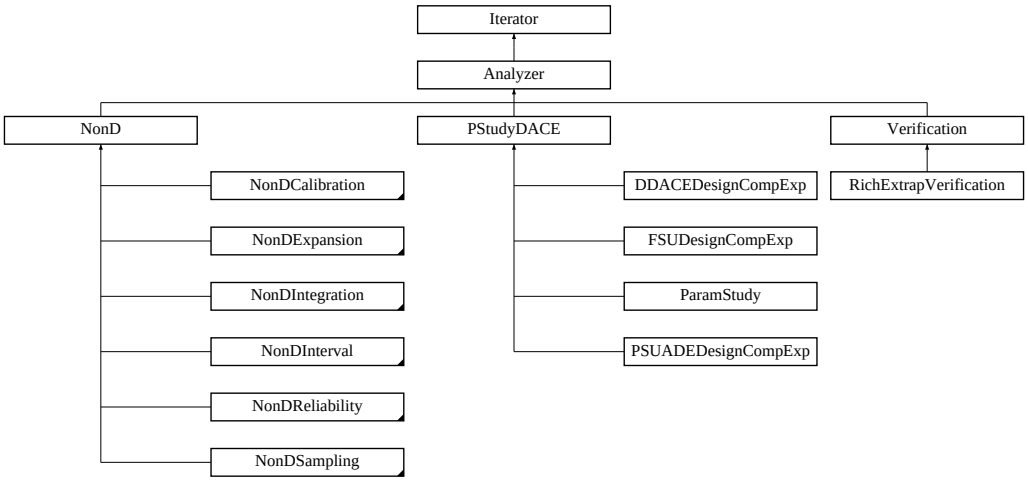
Base class providing common functionality for derived classes (SysCallAnalysisCode and ForkAnalysisCode) which spawn separate processes for managing simulations. The AnalysisCode class hierarchy provides simulation spawning services for ApplicationInterface derived classes and alleviates these classes of some of the specifics of simulation code management. The hierarchy does not employ the letter-envelope technique since the ApplicationInterface derived classes instantiate the appropriate derived AnalysisCode class directly.

The documentation for this class was generated from the following files:

- AnalysisCode.H
- AnalysisCode.C

43.3 Analyzer Class Reference

Base class for NonD, DACE, and ParamStudy branches of the iterator hierarchy. Inheritance diagram for Analyzer::



Public Member Functions

- const VariablesArray & all_variables ()

  return the complete set of evaluated variables

- const RealMatrix & all_samples ()

  return the complete set of evaluated samples

- const IntResponseMap & all_responses () const

  return the complete set of computed responses

- virtual void vary_pattern (bool pattern_flag)

  sets varyPattern in derived classes that support it

Protected Member Functions

- Analyzer ()

  default constructor

- Analyzer (Model &model)

  standard constructor

- Analyzer (NoDBBaseConstructor, Model &model)

alternate constructor for instantiations "on the fly" with a Model

- Analyzer (NoDBBaseConstructor)

  alternate constructor for instantiations "on the fly" without a Model

- ~Analyzer ()

  destructor

- virtual void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

- virtual void update_model_from_sample (Model &model, const Real ∗sample_vars)

  update model's current variables with data from sample

- virtual void update_model_from_variables (Model &model, const Variables &vars)

  update model's current variables with data from vars

- void pre_output ()
- void print_results (std::ostream &s)

  print the final iterator results

- const Variables & variables_results () const

  return a single final iterator solution (variables)

- const Response & response_results () const

  return a single final iterator solution (response)

- const VariablesArray & variables_array_results ()

  return multiple final iterator solutions (variables). This should only be used if returns_multiple_points() returns true.

- const ResponseArray & response_array_results ()

  return multiple final iterator solutions (response). This should only be used if returns_multiple_points() returns true.

- void response_results_active_set (const ActiveSet &set)

  set the requested data for the final iterator response results

- bool compact_mode () const

  returns Analyzer::compactMode

- bool returns_multiple_points () const

  indicates if this iterator returns multiple final points. Default return is false. Override to return true if appropriate.

- void evaluate_parameter_sets (Model &model, bool log_resp_flag, bool log_best_flag)

  perform function evaluations to map parameter sets (allVariables) into response sets (allResponses)

- void variance_based_decomp (int ncont, int ndiscint, int ndiscreal, int num_samples)
- void read_variables_responses (int num_evals, size_t num_vars)

  convenience function for reading variables/responses (used in derived classes post_input)

- void print_sobol_indices (std::ostream &s) const

  Printing of VBD results.

- void sample_to_variables (const Real *sample_c_vars, Variables &vars)

  convert samples array to variables array; e.g., allSamples to allVariables

- void samples_to_variables_array (const RealMatrix &sample_matrix, VariablesArray &vars_array)

  convert samples array to variables array; e.g., allSamples to allVariables

- void variables_array_to_samples (const VariablesArray &vars_array, RealMatrix &sample_matrix)

  convert variables array to samples array; e.g., allVariables to allSamples

Protected Attributes

- bool compactMode

  switch for allSamples (compact mode) instead of allVariables (normal mode)

- VariablesArray allVariables

  array of all variables to be evaluated in evaluate_parameter_sets()

- RealMatrix allSamples

  compact alternative to allVariables

- IntResponseMap allResponses

  array of all responses to be computed in evaluate_parameter_sets()

- StringArray allHeaders

  array of headers to insert into output while evaluating allVariables

- size_t numObjFns

  number of objective functions

- size_t numLSqTerms

  number of least squares terms

- RealPairPRPMultiMap bestVarsRespMap

  map which stores best set of solutions

Private Member Functions

- void compute_best_metrics (const Response &response, std::pair< Real, Real > &metrics)

  compares current evaluation to best evaluation and updates best

- void update_best (const Variables &vars, int eval_id, const Response &response)

  compares current evaluation to best evaluation and updates best

- void update_best (const Real *sample_c_vars, int eval_id, const Response &response)

  compares current evaluation to best evaluation and updates best

Private Attributes

- Real vbdDropTol

  tolerance for omitting output of small VBD indices

- RealVectorArray S4

  VBD main effect indices.

- RealVectorArray T4

  VBD total effect indices.

43.3.1 Detailed Description

Base class for NonD, DACE, and ParamStudy branches of the iterator hierarchy. The Analyzer class provides common data and functionality for various types of systems analysis, including nondeterministic analysis, design of experiments, and parameter studies.

43.3.2 Member Function Documentation

43.3.2.1 void pre_output () [protected, virtual]

Generate tabular output with active variables (compactMode) or all variables with their labels and response labels, with no data. Variables are sequenced {cv, div, drv}

Reimplemented from Iterator.

References Analyzer::allSamples, Analyzer::allVariables, ParallelLibrary::command_line_pre_run_output(), ParallelLibrary::command_line_user_modes(), Analyzer::compactMode, Model::current_response(), Model::current_variables(), Dakota::filename(), Iterator::iteratedModel, Iterator::outputLevel, Model::parallel_library(), Dakota::write_data_tabular(), Dakota::write_precision, and Iterator::writePrecision.

43.3.2.2 void print_results (std::ostream & *s*) [protected, virtual]

print the final iterator results This virtual function provides additional iterator-specific final results outputs beyond the function evaluation summary printed in finalize_run().

Reimplemented from Iterator.

Reimplemented in PStudyDACE, Verification, NonDExpansion, NonDGlobalReliability, NonDGPMSABayesCalibration, NonDIncremLHSSampling, NonDInterval, NonDLHSSampling, NonDLocalReliability, and RichExtrapVerification.

References Analyzer::bestVarsRespMap, ParamResponsePair::eval_id(), Response::function_values(), Analyzer::numLSqTerms, Analyzer::numObjFns, ParamResponsePair::prp_parameters(), ParamResponsePair::prp_response(), and Dakota::write_data_partial().

43.3.2.3 void evaluate_parameter_sets (Model & *model*, bool *log_resp_flag*, bool *log_best_flag*) [protected]

perform function evaluations to map parameter sets (allVariables) into response sets (allResponses) Convenience function for derived classes with sets of function evaluations to perform (e.g., NonDSampling, DDACEDesignCompExp, FSUDesignCompExp, ParamStudy).

References Iterator::activeSet, Analyzer::allHeaders, Analyzer::allResponses, Analyzer::allSamples, Analyzer::allVariables, Model::asynch_compute_response(), Iterator::asynchFlag, Analyzer::compactMode, Model::compute_response(), Response::copy(), Model::current_response(), Model::current_variables(), Model::evaluation_id(), Model::synchronize(), Analyzer::update_best(), Analyzer::update_model_from_sample(), and Analyzer::update_model_from_variables().

Referenced by NonDSparseGrid::evaluate_set(), PSUADEDesignCompExp::extract_trends(), ParamStudy::extract_trends(), FSUDesignCompExp::extract_trends(), DDACEDesignCompExp::extract_trends(), NonDLHSSampling::quantify_uncertainty(), NonDIntegration::quantify_uncertainty(), NonDIncremLHSSampling::quantify_uncertainty(), NonDAdaptImpSampling::quantify_uncertainty(), and Analyzer::variance_based_decomp().

43.3.2.4 void variance_based_decomp (int *ncont*, int *ndiscint*, int *ndiscreal*, int *num_samples*) [protected]

Calculation of sensitivity indices obtained by variance based decomposition. These indices are obtained by the Saltelli version of the Sobol VBD which uses (K+2)∗N function evaluations, where K is the number of dimensions (uncertain vars) and N is the number of samples.

References Dakota::abort_handler(), Analyzer::allResponses, Analyzer::allSamples, Analyzer::allVariables, Analyzer::compactMode, Variables::continuous_variables(), Dakota::copy_data(), Variables::discrete_int_variables(), Variables::discrete_real_variables(), Analyzer::evaluate_parameter_sets(), Analyzer::get_parameter_sets(), Iterator::iteratedModel, Iterator::numFunctions, Analyzer::S4, Analyzer::T4, and Analyzer::vary_pattern().

Referenced by FSUDesignCompExp::extract_trends(), DDACEDesignCompExp::extract_trends(), and NonDLHSSampling::quantify_uncertainty().

43.3.2.5 void read_variables_responses (int *num_evals*, size_t *num_vars*) [protected]

convenience function for reading variables/responses (used in derived classes post_input) read num_evals variables/responses from file

References Dakota::abort_handler(), Analyzer::allResponses, Analyzer::allSamples, Analyzer::allVariables, ParallelLibrary::command_line_post_run_input(), ParallelLibrary::command_line_user_modes(), Analyzer::compactMode, Response::copy(), Variables::copy(), Model::current_response(), Model::current_variables(), Dakota::filename(), Iterator::iteratedModel, Iterator::outputLevel, Model::parallel_library(), and Analyzer::update_best().

Referenced by PSUADEDesignCompExp::post_input(), ParamStudy::post_input(), NonDLHSSampling::post_input(), FSUDesignCompExp::post_input(), and DDACEDesignCompExp::post_input().

43.3.2.6 void print_sobol_indices (std::ostream & *s*) const [protected]

Printing of VBD results. printing of variance based decomposition indices.

References Model::continuous_variable_labels(), Model::discrete_int_variable_labels(), Model::discrete_real_variable_labels(), Iterator::iteratedModel, Iterator::numContinuousVars, Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, Iterator::numFunctions, Model::response_labels(), Analyzer::S4, Analyzer::T4, Analyzer::vbdDropTol, and Dakota::write_precision.

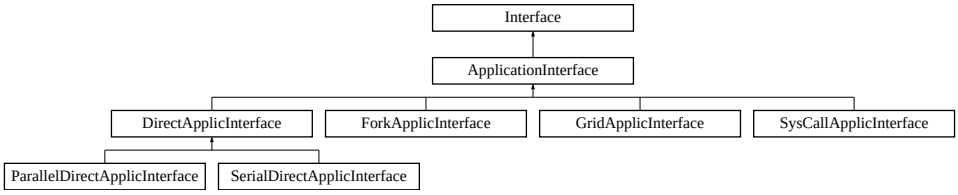
Referenced by NonDLHSSampling::print_results(), and PStudyDACE::print_results().

The documentation for this class was generated from the following files:

- DakotaAnalyzer.H
- DakotaAnalyzer.C

43.4 ApplicationInterface Class Reference

Derived class within the interface class hierarchy for supporting interfaces to simulation codes. Inheritance diagram for ApplicationInterface::



Public Member Functions

- ApplicationInterface (const ProblemDescDB &problem_db)

  constructor

- ~ApplicationInterface ()

  destructor

Protected Member Functions

- void init_communicators (const IntArray &message_lengths, const int &max_iterator_concurrency)

  allocate communicator partitions for concurrent evaluations within an iterator and concurrent multiprocessor analyses within an evaluation.

- void set_communicators (const IntArray &message_lengths)

  set the local parallel partition data for an interface (the partitions are already allocated in ParallelLibrary).

- void free_communicators ()

  deallocate communicator partitions for concurrent evaluations within an iterator and concurrent multiprocessor analyses within an evaluation.

- void init_serial ()
- int asynch_local_evaluation_concurrency () const

  return asynchLocalEvalConcurrency

- String interface_synchronization () const

  return interfaceSynchronization

- bool evaluation_cache () const

  return evalCacheFlag

- void map (const Variables &vars, const ActiveSet &set, Response &response, const bool asynch_flag=false)

  Provides a "mapping" of variables to responses using a simulation. Protected due to Interface letter-envelope idiom.

- void manage_failure (const Variables &vars, const ActiveSet &set, Response &response, int failed_eval_id)

  manages a simulation failure using abort/retry/recover/continuation

- const IntResponseMap & synch ()

  executes a blocking schedule for asynchronous evaluations in the beforeSynchCorePRPQueue and returns all jobs

- const IntResponseMap & synch_nowait ()

  executes a nonblocking schedule for asynchronous evaluations in the beforeSynchCorePRPQueue and returns a partial set of completed jobs

- void serve_evaluations ()

  run on evaluation servers to serve the iterator master

- void stop_evaluation_servers ()

  used by the iterator master to terminate evaluation servers

- bool check_multiprocessor_configuration ()

  default checks on multiprocessor analysis configuration

- bool check_direct_asynchronous_configuration (int max_iterator_concurrency)

  default checks on asynchonous configuration for direct interfaces

- virtual void derived_map (const Variables &vars, const ActiveSet &set, Response &response, int fn_eval_id)

  Called by map() and other functions to execute the simulation in synchronous mode. The portion of performing an evaluation that is specific to a derived class.

- virtual void derived_map_asynch (const ParamResponsePair &pair)

  Called by map() and other functions to execute the simulation in asynchronous mode. The portion of performing an asynchronous evaluation that is specific to a derived class.

- virtual void derived_synch (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version waits for at least one completion.

- virtual void derived_synch_nowait (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version is nonblocking and will return without any completions if none are immediately available.

- virtual void check_configuration (int max_iterator_concurrency)

perform some error checks on the parallel configuration

- void self_schedule_analyses ()

  blocking self-schedule of all analyses within a function evaluation using message passing

- void serve_analyses_synch ()

  serve the master analysis scheduler and manage one synchronous analysis job at a time

- virtual int derived_synchronous_local_analysis (const int &analysis_id)

  Execute a particular analysis (identified by analysis_id) synchronously on the local processor. Used for the derived class specifics within ApplicationInterface::serve_analyses_synch().

Protected Attributes

- ParallelLibrary & parallelLib

  reference to the ParallelLibrary object used to manage MPI partitions for the concurrent evaluations and concurrent analyses parallelism levels

- bool suppressOutput

  flag for suppressing output on slave processors

- int evalCommSize

  size of evalComm

- int evalCommRank

  processor rank within evalComm

- int evalServerId

  evaluation server identifier

- bool eaDedMasterFlag

  flag for dedicated master partitioning at ea level

- int analysisCommSize

  size of analysisComm

- int analysisCommRank

  processor rank within analysisComm

- int analysisServerId

  analysis server identifier

- int numAnalysisServers

  number of analysis servers

- bool multiProcAnalysisFlag

  flag for multiprocessor analysis partitions

- bool asynchLocalAnalysisFlag

  flag for asynchronous local parallelism of analyses

- int asynchLocalAnalysisConcurrency

  limits the number of concurrent analyses in asynchronous local scheduling and specifies hybrid concurrency when message passing

- int numAnalysisDrivers

  the number of analysis drivers used for each function evaluation (from the analysis_drivers interface specification)

- IntSet completionSet

  the set of completed fn_eval_id's populated by derived_synch() and derived_synch_nowait()

Private Member Functions

- bool duplication_detect (const Variables &vars, Response &response, const bool asynch_flag)

  checks data_pairs and beforeSynchCorePRPQueue to see if the current evaluation request has already been performed or queued

- void self_schedule_evaluations ()

  blocking self-schedule of all evaluations in beforeSynchCorePRPQueue using message passing; executes on iteratorComm master

- void static_schedule_evaluations ()

  blocking static schedule of all evaluations in beforeSynchCorePRPQueue using message passing; executes on iteratorComm master

- void asynchronous_local_evaluations (PRPQueue &prp_queue)

  perform all jobs in prp_queue using asynchronous approaches on the local processor

- void asynchronous_local_evaluations_static (PRPQueue &prp_queue)

  perform all the jobs in prp_queue using asynchronous approaches on the local processor, but schedule statically such that eval_id is always replaced with an equivalent one, modulo asynchLocalEvalConcurrency

- void synchronous_local_evaluations (PRPQueue &prp_queue)

  perform all jobs in prp_queue using synchronous approaches on the local processor

- void asynchronous_local_evaluations_nowait (PRPQueue &prp_queue)

  launch new jobs in prp_queue asynchronously (if capacity is available), perform nonblocking query of all running jobs, and process any completed jobs (handles both local self- and local static-scheduling cases)

- void serve_evaluations_synch ()

serve the evaluation message passing schedulers and perform one synchronous evaluation at a time

- void serve_evaluations_asynch ()

  serve the evaluation message passing schedulers and manage multiple asynchronous evaluations

- void serve_evaluations_peer ()

  serve the evaluation message passing schedulers and perform one synchronous evaluation at a time as part of the 1st peer

- void set_evaluation_communicators (const IntArray &message_lengths)

  convenience function for updating the local evaluation partition data following ParallelLibrary::init_evaluation_communicators().

- void set_analysis_communicators ()

  convenience function for updating the local analysis partition data following ParallelLibrary::init_analysis_communicators().

- const ParamResponsePair & get_source_pair (const Variables &target_vars)

  convenience function for the continuation approach in manage_failure() for finding the nearest successful "source" evaluation to the failed "target"

- void continuation (const Variables &target_vars, const ActiveSet &set, Response &response, const ParamResponsePair &source_pair, int failed_eval_id)

  performs a 0th order continuation method to step from a successful "source" evaluation to the failed "target". Invoked by manage_failure() for failAction == "continuation".

- void common_input_filtering (const Variables &vars)

  common input filtering operations, e.g. mesh movement

- void common_output_filtering (Response &response)

  common output filtering operations, e.g. data filtering

Private Attributes

- int worldSize

  size of MPI_COMM_WORLD

- int worldRank

  processor rank within MPI_COMM_WORLD

- int iteratorCommSize

  size of iteratorComm

- int iteratorCommRank

  processor rank within iteratorComm

- bool ieMessagePass

  flag for message passing at ie scheduling level

- int numEvalServers

  number of evaluation servers

- bool eaMessagePass

  flag for message passing at ea scheduling level

- int procsPerAnalysis

  processors per analysis servers

- int lenVarsMessage

  length of a MPIPackBuffer containing a Variables object; computed in Model::init_communicators()

- int lenVarsActSetMessage

  length of a MPIPackBuffer containing a Variables object and an ActiveSet object; computed in Model::init_communicators()

- int lenResponseMessage

  length of a MPIPackBuffer containing a Response object; computed in Model::init_communicators()

- int lenPRPairMessage

  length of a MPIPackBuffer containing a ParamResponsePair object; computed in Model::init_communicators()

- String evalScheduling

  user specification of evaluation scheduling algorithm (self, static, or no spec). Used for manual overrides of the auto-configure logic in ParallelLibrary::resolve_inputs().

- String analysisScheduling

  user specification of analysis scheduling algorithm (self, static, or no spec). Used for manual overrides of the auto-configure logic in ParallelLibrary::resolve_inputs().

- int asynchLocalEvalConcurrency

  limits the number of concurrent evaluations in asynchronous local scheduling and specifies hybrid concurrency when message passing

- bool asynchLocalEvalStatic

  whether the asynchronous local evaluations are to be performed with a static schedule (default false)

- IntArray localServerJobMap

  array with one entry per local "server" indicating the job (fn_eval_id) currently running on the server (used for asynchronour local static schedules)

- String interfaceSynchronization

  interface synchronization specification: synchronous (default) or asynchronous

- bool headerFlag

  used by synch_nowait to manage output frequency (since this function may be called many times prior to any completions)

- bool asvControlFlag

  used to manage a user request to deactivate the active set vector control. true = modify the ASV each evaluation as appropriate (default); false = ASV values are static so that the user need not check them on each evaluation.

- bool evalCacheFlag

  used to manage a user request to deactivate the function evaluation cache (i.e., queries and insertions using the data_pairs cache).

- bool restartFileFlag

  used to manage a user request to deactivate the restart file (i.e., insertions into write_restart).

- ShortArray defaultASV

  the static ASV values used when the user has selected asvControl = off

- String failAction

  mitigation action for captured simulation failures: abort, retry, recover, or continuation

- int failRetryLimit

  limit on the number of retries for the retry failAction

- RealVector failRecoveryFnVals

  the dummy function values used for the recover failAction

- IntResponseMap historyDuplicateMap

  used to bookkeep asynchronous evaluations which duplicate data_pairs evaluations. Map key is evalIdCntr, map value is corresponding response.

- std::map< int, std::pair< PRPQueueHIter, Response > > beforeSynchDuplicateMap

  used to bookkeep evalIdCntr, beforeSynchCorePRPQueue iterator, and response of asynchronous evaluations which duplicate queued beforeSynchCorePRPQueue evaluations

- PRPQueue beforeSynchCorePRPQueue

  used to bookkeep vars/set/response of nonduplicate asynchronous core evaluations. This is the queue of jobs populated by asynchronous map() that is later scheduled in synch() or synch_nowait().

- PRPQueue beforeSynchAlgPRPQueue

  used to bookkeep vars/set/response of asynchronous algebraic evaluations. This is the queue of algebraic jobs populated by asynchronous map() that is later evaluated in synch() or synch_nowait().

- IntSet runningSet

  used by asynchronous_local_nowait to bookkeep which jobs are running

43.4.1 Detailed Description

Derived class within the interface class hierarchy for supporting interfaces to simulation codes. ApplicationInterface provides an interface class for performing parameter to response mappings using simulation code(s). It provides common functionality for a number of derived classes and contains the majority of all of the scheduling algorithms in DAKOTA. The derived classes provide the specifics for managing code invocations using system calls, forks, direct procedure calls, or distributed resource facilities.

43.4.2 Member Function Documentation

43.4.2.1 void init_serial () `[inline, protected, virtual]`

DataInterface.C defaults of 0 servers are needed to distinguish an explicit user request for 1 server (serialization of a parallelism level) from no user request (use parallel auto-config). This default causes problems when init_communicators() is not called for an interface object (e.g., static scheduling fails in DirectApplicInterface::derived_map() for NestedModel::optionalInterface). This is the reason for this function: to reset certain defaults for interface objects that are used serially.

Reimplemented from Interface.

References ApplicationInterface::numAnalysisServers, and ApplicationInterface::numEvalServers.

43.4.2.2 void map (const Variables & *vars*, const ActiveSet & *set*, Response & *response*, const bool *asynch_flag* = `false`) `[protected, virtual]`

Provides a "mapping" of variables to responses using a simulation. Protected due to Interface letter-envelope idiom. The function evaluator for application interfaces. Called from derived_compute_response() and derived_asynch_compute_response() in derived Model classes. If asynch_flag is not set, perform a blocking evaluation (using derived_map()). If asynch_flag is set, add the job to the beforeSynchCorePRPQueue queue for execution by one of the scheduler routines in synch() or synch_nowait(). Duplicate function evaluations are detected with duplication_detect().

Reimplemented from Interface.

References Response::active_set(), Interface::algebraic_mappings(), Interface::algebraicMappings, Interface::asv_mapping(), ApplicationInterface::asvControlFlag, ParallelLibrary::bcast_e(), ApplicationInterface::beforeSynchAlgPRPQueue, ApplicationInterface::beforeSynchCorePRPQueue, Response::copy(), Interface::coreMappings, Interface::currEvalId, Dakota::data_pairs, ApplicationInterface::defaultASV, ApplicationInterface::derived_map(), ApplicationInterface::duplication_detect(), ApplicationInterface::evalCacheFlag, Interface::evalIdCntr, Interface::fineGrainEvalCounters, Interface::fnGradCounter, Interface::fnHessCounter, Interface::fnLabels, Interface::fnValCounter, Response::function_labels(), Interface::init_algebraic_mappings(), Interface::interfaceId, ApplicationInterface::lenVarsActSetMessage, ApplicationInterface::manage_failure(), Interface::multiProcEvalFlag, Interface::newEvalIdCntr, Interface::newFnGradCounter, Interface::newFnHessCounter, Interface::newFnValCounter, Interface::outputLevel, ApplicationInterface::parallelLib, ActiveSet::request_vector(), Interface::response_mapping(), ApplicationInterface::restartFileFlag, and Dakota::write_restart.

43.4.2.3 const IntResponseMap & synch () [protected, virtual]

executes a blocking schedule for asynchronous evaluations in the beforeSynchCorePRPQueue and returns all jobs This function provides blocking synchronization for all cases of asynchronous evaluations, including the local asynchronous case (background system call, nonblocking fork, & multithreads), the message passing case, and the hybrid case. Called from derived_synchronize() in derived Model classes.

Reimplemented from Interface.

References Interface::algebraic_mappings(), Interface::algebraicMappings, ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::asynchLocalEvalStatic, ApplicationInterface::asynchronous_local_evaluations(), ApplicationInterface::asynchronous_local_evaluations_static(), ApplicationInterface::beforeSynchAlgPRPQueue, ApplicationInterface::beforeSynchCorePRPQueue, ApplicationInterface::beforeSynchDuplicateMap, Interface::coreMappings, ApplicationInterface::historyDuplicateMap, Interface::ieDedMasterFlag, ApplicationInterface::ieMessagePass, Interface::outputLevel, Interface::rawResponseMap, Interface::response_mapping(), ApplicationInterface::self_schedule_evaluations(), and ApplicationInterface::static_schedule_evaluations().

43.4.2.4 const IntResponseMap & synch_nowait () [protected, virtual]

executes a nonblocking schedule for asynchronous evaluations in the beforeSynchCorePRPQueue and returns a partial set of completed jobs This function will eventually provide nonblocking synchronization for all cases of asynchronous evaluations, however it currently supports only the local asynchronous case since nonblocking message passing schedulers have not yet been implemented. Called from derived_synchronize_nowait() in derived Model classes.

Reimplemented from Interface.

References Dakota::abort_handler(), Interface::algebraic_mappings(), Interface::algebraicMappings, ApplicationInterface::asynchronous_local_evaluations_nowait(), ApplicationInterface::beforeSynchAlgPRPQueue, ApplicationInterface::beforeSynchCorePRPQueue, ApplicationInterface::beforeSynchDuplicateMap, Interface::coreMappings, ParamResponsePair::eval_id(), ApplicationInterface::headerFlag, ApplicationInterface::historyDuplicateMap, ApplicationInterface::ieMessagePass, Dakota::lookup_by_eval_id(), Interface::outputLevel, ParamResponsePair::prp_response(), Interface::rawResponseMap, Interface::response_mapping(), and Response::update().

43.4.2.5 void serve_evaluations () [protected, virtual]

run on evaluation servers to serve the iterator master Invoked by the serve() function in derived Model classes. Passes control to serve_evaluations_asynch(), serve_evaluations_peer(), or serve_evaluations_synch() according to specified concurrency and self/static scheduler configuration.

Reimplemented from Interface.

References ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::evalServerId, Interface::ieDedMasterFlag, ApplicationInterface::serve_evaluations_asynch(), ApplicationInterface::serve_evaluations_peer(), and ApplicationInterface::serve_evaluations_synch().

43.4.2.6 void stop_evaluation_servers () [protected, virtual]

used by the iterator master to terminate evaluation servers This code is executed on the iteratorComm rank 0 processor when iteration on a particular model is complete. It sends a termination signal (tag = 0 instead of a valid fn_eval_id) to each of the slave analysis servers. NOTE: This function is called from the Strategy layer even when in serial mode. Therefore, use iteratorCommSize to provide appropriate fall through behavior.

Reimplemented from Interface.

References ParallelLibrary::bcast_e(), ParallelLibrary::free(), Interface::ieDedMasterFlag, ParallelLibrary::isend_ie(), ApplicationInterface::iteratorCommSize, Interface::multiProcEvalFlag, ApplicationInterface::numEvalServers, and ApplicationInterface::parallelLib.

43.4.2.7 void check_configuration (int *max_iterator_concurrency*) [protected, virtual]

perform some error checks on the parallel configuration Override this definition if plug-in to allow batch processing in Plugin{Serial,Parallel}DirectApplicInterface.C

Reimplemented in ParallelDirectApplicInterface, and SerialDirectApplicInterface.

References Dakota::abort_handler(), ApplicationInterface::check_direct_asynchronous_configuration(), and ApplicationInterface::check_multiprocessor_configuration().

Referenced by ApplicationInterface::init_communicators().

43.4.2.8 void self_schedule_analyses () [protected]

blocking self-schedule of all analyses within a function evaluation using message passing This code is called from derived classes to provide the master portion of a master-slave algorithm for the dynamic self-scheduling of analyses among slave servers. It is patterned after self_schedule_evaluations(). It performs no analyses locally and matches either serve_analyses_synch() or serve_analyses_asynch() on the slave servers, depending on the value of asynchLocalAnalysisConcurrency. Self-scheduling approach assigns jobs in 2 passes. The 1st pass gives each server the same number of jobs (equal to asynchLocalAnalysisConcurrency). The 2nd pass assigns the remaining jobs to slave servers as previous jobs are completed. Single- and multilevel parallel use intra- and inter-communicators, respectively, for send/receive. Specific syntax is encapsulated within ParallelLibrary.

References ApplicationInterface::asynchLocalAnalysisConcurrency, ParallelLibrary::free(), ParallelLibrary::irecv_ea(), ParallelLibrary::isend_ea(), ApplicationInterface::numAnalysisDrivers, ApplicationInterface::numAnalysisServers, ApplicationInterface::parallelLib, ParallelLibrary::waitall(), and ParallelLibrary::waitsome().

Referenced by DirectApplicInterface::derived_map(), ForkApplicInterface::fork_application(), and SysCallApplicInterface::spawn_application().

43.4.2.9 void serve_analyses_synch () [protected]

serve the master analysis scheduler and manage one synchronous analysis job at a time This code is called from derived classes to run synchronous analyses on slave processors. The slaves receive requests (blocking receive), do local derived_map_ac's, and return codes. This is done continuously until a termination signal is received from the master. It is patterned after serve_evaluations_synch().

References ApplicationInterface::analysisCommRank, ParallelLibrary::bcast_a(), ApplicationInterface::derived_synchronous_local_analysis(), ParallelLibrary::isend_ea(), ApplicationInterface::multiProcAnalysisFlag, ApplicationInterface::parallelLib, ParallelLibrary::recv_ea(), and ParallelLibrary::wait().

Referenced by DirectApplicInterface::derived_map(), ForkApplicInterface::fork_application(), and SysCallApplicInterface::spawn_application().

43.4.2.10 bool duplication_detect (const Variables & *vars*, Response & *response*, const bool *asynch_flag*) [private]

checks data_pairs and beforeSynchCorePRPQueue to see if the current evaluation request has already been performed or queued Called from map() to check incoming evaluation request for duplication with content of data_pairs and beforeSynchCorePRPQueue. If duplication is detected, return true, else return false. Manage bookkeeping with historyDuplicateMap and beforeSynchDuplicateMap. Note that the list searches can get very expensive if a long list is searched on every new function evaluation (either from a large number of previous jobs, a large number of pending jobs, or both). For this reason, a user request for deactivation of the evaluation cache results in a complete bypass of duplication_detect(), even though a beforeSynchCorePRPQueue search would still be meaningful. Since the intent of this request is to streamline operations, both list searches are bypassed.

References Response::active_set(), ApplicationInterface::beforeSynchCorePRPQueue, ApplicationInterface::beforeSynchDuplicateMap, Response::copy(), Dakota::data_pairs, Interface::evalIdCntr, Dakota::hashedQueueEnd(), ApplicationInterface::historyDuplicateMap, Interface::interfaceId, Dakota::lookup_by_val(), and Response::update().

Referenced by ApplicationInterface::map().

43.4.2.11 void self_schedule_evaluations () [private]

blocking self-schedule of all evaluations in beforeSynchCorePRPQueue using message passing; executes on iteratorComm master This code is called from synch() to provide the master portion of a master-slave algorithm for the dynamic self-scheduling of evaluations among slave servers. It performs no evaluations locally and matches either serve_evaluations_synch() or serve_evaluations_asynch() on the slave servers, depending on the value of asynchLocalEvalConcurrency. Self-scheduling approach assigns jobs in 2 passes. The 1st pass gives each server the same number of jobs (equal to asynchLocalEvalConcurrency). The 2nd pass assigns the remaining jobs to slave servers as previous jobs are completed. Single- and multilevel parallel use intra- and inter-communicators, respectively, for send/receive. Specific syntax is encapsulated within ParallelLibrary.

References ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::beforeSynchCorePRPQueue, Dakota::data_pairs, ApplicationInterface::evalCacheFlag, ParallelLibrary::free(), ParallelLibrary::irecv_ie(), ParallelLibrary::isend_ie(), ApplicationInterface::lenResponseMessage, Dakota::lookup_by_eval_id(), ApplicationInterface::numEvalServers, Interface::outputLevel, ApplicationInterface::parallelLib, Interface::rawResponseMap, MPIUnpackBuffer::reset(), MPIPackBuffer::reset(), MPIUnpackBuffer::resize(), ApplicationInterface::restartFileFlag, ParallelLibrary::waitall(), ParallelLibrary::waitsome(), and Dakota::write_restart.

Referenced by ApplicationInterface::synch().

43.4.2.12 void static_schedule_evaluations () [private]

blocking static schedule of all evaluations in beforeSynchCorePRPQueue using message passing; executes on iteratorComm master This code runs on the iteratorCommRank 0 processor (the iterator) and is called from synch() in order to assign a static schedule. It matches serve_evaluations_peer() for any other processors within the first evaluation partition and serve_evaluations_{synch,asynch}() for all other evaluation partitions (depending on asynchLocalEvalConcurrency). It performs function evaluations locally for its portion of the static schedule using either asynchronous_local_evaluations() or synchronous_local_evaluations(). Single-level and multilevel parallel use intra- and inter-communicators, respectively, for send/receive. Specific syntax is encapsulated within ParallelLibrary. The iteratorCommRank 0 processor assigns the static schedule since it is the only processor with access to beforeSynchCorePRPQueue (it runs the iterator and calls synchronize). The alternate design of each peer selecting its own jobs using the modulus operator would be applicable if execution of this function (and therefore the job list) were distributed.

References ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::asynchLocalEvalStatic, ApplicationInterface::asynchronous_local_evaluations(), ApplicationInterface::beforeSynchCorePRPQueue, Dakota::data_pairs, ApplicationInterface::evalCacheFlag, ParallelLibrary::free(), ParallelLibrary::irecv_ie(), ParallelLibrary::isend_ie(), ApplicationInterface::lenResponseMessage, ApplicationInterface::numEvalServers, Interface::outputLevel, ApplicationInterface::parallelLib, Interface::rawResponseMap, MPIUnpackBuffer::resize(), ApplicationInterface::restartFileFlag, ApplicationInterface::synchronous_local_evaluations(), ParallelLibrary::waitall(), and Dakota::write_restart.

Referenced by ApplicationInterface::synch().

43.4.2.13 void asynchronous_local_evaluations (PRPQueue & *prp_queue*) [private]

perform all jobs in prp_queue using asynchronous approaches on the local processor This function provides blocking synchronization for the local asynch case (background system call, nonblocking fork, or threads). It can be called from synch() for a complete local scheduling of all asynchronous jobs or from static_schedule_evaluations() to perform a local portion of the total job set. It uses the derived_map_asynch() to initiate asynchronous evaluations and derived_synch() to capture completed jobs, and mirrors the self_schedule_evaluations() message passing scheduler as much as possible (derived_synch() is modeled after MPI_Waitsome()).

References ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::completionSet, Dakota::data_pairs, ApplicationInterface::derived_map_asynch(), ApplicationInterface::derived_synch(), ApplicationInterface::evalCacheFlag, Dakota::lookup_by_eval_id(), Interface::outputLevel, Interface::rawResponseMap, ApplicationInterface::restartFileFlag, and Dakota::write_restart.

Referenced by ApplicationInterface::static_schedule_evaluations(), and ApplicationInterface::synch().

43.4.2.14 void asynchronous_local_evaluations_static (PRPQueue & *prp_queue*) [private]

perform all the jobs in prp_queue using asynchronous approaches on the local processor, but schedule statically such that eval_id is always replaced with an equivalent one, modulo asynchLocalEvalConcurrency Locally statically-scheduled counterpart to asynchronous_local_evaluations. This scheduling policy specifically ensures that a completed asynchronous evaluation eval_id is replaced with an equivalent one, modulo asynchLocalEvalConcurrency. Designed to help with parallel tiling. A disadvantage of this scheduling policy is that is could leave local asynchronous worker "servers" idle in parsing the prp_queue, e.g., when restarting and some evals are already complete. In fact, anytime this function is called with non-contiguous eval_id's the full possible concurrency won't be leveraged.

This is currently only supported when DAKOTA is running in serial. Supporting in the MPI static / asynch local hybrid mode would require MPI static schedule that is either fully round-robin or fully block scheduled, not the present hybrid. It is not clear how to support this in the MPI self scheduled / asynch local hybrid mode.

If local evaluation concurrency is unlimited, this function is not needed.

References ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::completionSet, Dakota::data_pairs, ApplicationInterface::derived_map_asynch(), ApplicationInterface::derived_synch(), ApplicationInterface::evalCacheFlag, ApplicationInterface::localServerJobMap, Dakota::lookup_by_eval_id(), Interface::outputLevel, Interface::rawResponseMap, ApplicationInterface::restartFileFlag, ApplicationInterface::runningSet, and Dakota::write_restart.

Referenced by ApplicationInterface::synch().

43.4.2.15 void synchronous_local_evaluations (PRPQueue & *prp_queue*) [private]

perform all jobs in prp_queue using synchronous approaches on the local processor This function provides blocking synchronization for the local synchronous case (foreground system call, blocking fork, or procedure call from derived_map()). It is called from static_schedule_evaluations() to perform a local portion of the total job set.

References ParallelLibrary::bcast_e(), Interface::currEvalId, Dakota::data_pairs, ApplicationInterface::derived_map(), ApplicationInterface::evalCacheFlag, ApplicationInterface::lenVarsActSetMessage, ApplicationInterface::manage_failure(), Interface::multiProcEvalFlag, Interface::outputLevel, ApplicationInterface::parallelLib, Interface::rawResponseMap, ApplicationInterface::restartFileFlag, and Dakota::write_restart.

Referenced by ApplicationInterface::static_schedule_evaluations().

43.4.2.16 void asynchronous_local_evaluations_nowait (PRPQueue & *prp_queue*) [private]

launch new jobs in prp_queue asynchronously (if capacity is available), perform nonblocking query of all running jobs, and process any completed jobs (handles both local self- and local static-scheduling cases) This function provides nonblocking synchronization for the local asynch case (background system call, nonblocking fork, or threads). It is called from synch_nowait() and passed the complete set of all asynchronous jobs (beforeSynchCorePRPQueue). It uses derived_map_asynch() to initiate asynchronous evaluations and derived_synch_nowait() to capture completed jobs in nonblocking mode. It mirrors a nonblocking message passing scheduler as much as possible (derived_synch_nowait() modeled after MPI_Testsome()). The result of this function is rawResponseMap, which uses eval_id as a key. It is assumed that the incoming prp_queue contains only active and new jobs - i.e., all completed jobs are cleared by synch_nowait().

Also supports asynchronous local evaluations with static scheduling. This scheduling policy specifically ensures that a completed asynchronous evaluation eval_id is replaced with an equivalent one, modulo asynchLocalEvalConcurrency. In the nowait case, this could render some servers idle if evaluations don't come in eval_id order or some evaluations are cancelled by the caller in between calls. If this function is called with unlimited local eval concurrency, the static scheduling request is ignored.

References ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::asynchLocalEvalStatic, ApplicationInterface::completionSet, Dakota::data_pairs, ApplicationInterface::derived_map_asynch(), ApplicationInterface::derived_synch_nowait(), ApplicationInterface::evalCacheFlag, ApplicationInterface::localServerJobMap, Dakota::lookup_by_eval_id(), Interface::outputLevel, Interface::rawResponseMap, ApplicationInterface::restartFileFlag, ApplicationInterface::runningSet, and Dakota::write_restart.

Referenced by ApplicationInterface::synch_nowait().

43.4.2.17 void serve_evaluations_synch () [private]

serve the evaluation message passing schedulers and perform one synchronous evaluation at a time This code is invoked by serve_evaluations() to perform one synchronous job at a time on each slave/peer server. The servers receive requests (blocking receive), do local synchronous maps, and return results. This is done continuously until a termination signal is received from the master (sent via stop_evaluation_servers()).

References ParallelLibrary::bcast_e(), Interface::currEvalId, ApplicationInterface::derived_map(), ApplicationInterface::evalCommRank, ParallelLibrary::isend_ie(), ApplicationInterface::lenResponseMessage, ApplicationInterface::lenVarsActSetMessage, ApplicationInterface::manage_failure(), Interface::multiProcEvalFlag, ApplicationInterface::parallelLib, ParallelLibrary::recv_ie(), MPIPackBuffer::reset(), ParallelLibrary::wait(), and Variables::write_annotated().

Referenced by ApplicationInterface::serve_evaluations().

43.4.2.18 void serve_evaluations_asynch () [private]

serve the evaluation message passing schedulers and manage multiple asynchronous evaluations This code is invoked by serve_evaluations() to perform multiple asynchronous jobs on each slave/peer server. The servers test for any incoming jobs, launch any new jobs, process any completed jobs, and return any results. Each of these components is nonblocking, although the server loop continues until a termination signal is received from the master (sent via stop_evaluation_servers()). In the master-slave case, the master maintains the correct number of jobs on each slave. In the static scheduling case, each server is responsible for limiting concurrency (since the entire static schedule is sent to the peers at start up).

References Dakota::abort_handler(), ApplicationInterface::asynchLocalEvalConcurrency, ApplicationInterface::completionSet, ApplicationInterface::derived_map_asynch(), ApplicationInterface::derived_synch_nowait(), Interface::interfaceId, ParallelLibrary::irecv_ie(), ApplicationInterface::lenResponseMessage, ApplicationInterface::lenVarsActSetMessage, Dakota::lookup_by_eval_id(), ApplicationInterface::parallelLib, ParallelLibrary::recv_ie(), MPIUnpackBuffer::reset(), ParallelLibrary::send_ie(), and ParallelLibrary::test().

Referenced by ApplicationInterface::serve_evaluations().

43.4.2.19 void serve_evaluations_peer () [private]

serve the evaluation message passing schedulers and perform one synchronous evaluation at a time as part of the 1st peer This code is invoked by serve_evaluations() to perform a synchronous evaluation in coordination with the iteratorCommRank 0 processor (the iterator) for static schedules. The bcast() matches either the bcast() in synchronous_local_evaluations(), which is invoked by static_schedule_evaluations()), or the bcast() in map().

References ParallelLibrary::bcast_e(), Interface::currEvalId, ApplicationInterface::derived_map(), ApplicationInterface::lenVarsActSetMessage, ApplicationInterface::manage_failure(), ApplicationInterface::parallelLib, and Variables::write_annotated().

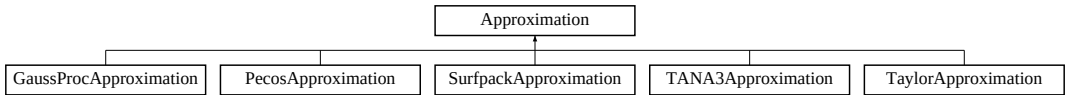
Referenced by ApplicationInterface::serve_evaluations().

The documentation for this class was generated from the following files:

- ApplicationInterface.H
- ApplicationInterface.C

43.5 Approximation Class Reference

Base class for the approximation class hierarchy. Inheritance diagram for Approximation::



Public Member Functions

- Approximation ()

  default constructor

- Approximation (ProblemDescDB &problem_db, size_t num_vars)

  standard constructor for envelope

- Approximation (const String &approx_type, const UShortArray &approx_order, size_t num_vars, short data_order)

  alternate constructor

- Approximation (const Approximation &approx)

  copy constructor

- virtual ~Approximation ()

  destructor

- Approximation operator= (const Approximation &approx)

  assignment operator

- virtual void build ()

  builds the approximation from scratch

- virtual void rebuild ()

  rebuilds the approximation incrementally

- virtual void pop (bool save_data)

  removes entries from end of SurrogateData::{vars,resp}Data (last points appended)

- virtual void restore ()

  restores state prior to previous append()

- virtual bool restore_available ()

  queries availability of restoration for trial set

- virtual size_t restoration_index ()

return index of trial set within restorable bookkeeping sets

- virtual void finalize ()

  finalize approximation by applying all remaining trial sets

- virtual size_t finalization_index (size_t i)

  return index of i-th trailing trial set within restorable bookkeeping sets

- virtual void store ()

  store current approximation for later combination

- virtual void combine (short corr_type)

  combine current approximation with previously stored approximation

- virtual Real get_value (const RealVector &x)

  retrieve the approximate function value for a given parameter vector

- virtual const RealVector & get_gradient (const RealVector &x)

  retrieve the approximate function gradient for a given parameter vector

- virtual const RealSymMatrix & get_hessian (const RealVector &x)

  retrieve the approximate function Hessian for a given parameter vector

- virtual Real get_prediction_variance (const RealVector &x)

  retrieve the variance of the predicted value for a given parameter vector

- virtual Real get_diagnostic (const String &metric_type)

  retrieve the diagnostic metric for the diagnostic type specified

- virtual const RealVector & approximation_coefficients () const

  return the coefficient array computed by build()/rebuild()

- virtual void approximation_coefficients (const RealVector &approx_coeffs)

  set the coefficient array from external sources, rather than computing with build()/rebuild()

- virtual void print_coefficients (std::ostream &s) const

  print the coefficient array computed in build()/rebuild()

- virtual int min_coefficients () const

  return the minimum number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- virtual int recommended_coefficients () const

  return the recommended number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- virtual int num_constraints () const

  return the number of constraints to be enforced via an anchor point

- virtual void clear_current ()

  clear current build data in preparation for next build

- virtual const bool diagnostics_available ()

  check if diagnostics are available for this approximation type

- int min_points (bool constraint_flag) const

  return the minimum number of points required to build the approximation type in numVars dimensions. Uses ∗_-coefficients() and num_constraints().

- int recommended_points (bool constraint_flag) const

  return the recommended number of samples to build the approximation type in numVars dimensions (default same as min_points)

- int num_variables () const

  return the number of variables used in the approximation

- const Pecos::SurrogateData & approximation_data () const

  return approxData

- void add (const Pecos::SurrogateDataVars &sdv, bool anchor_flag)

  append to SurrogateData::varsData or assign to SurrogateData::anchorVars

- void add (const Variables &vars, bool anchor_flag, bool deep_copy)

  extract the relevant RealVector from Variables and invoke add(RealVector&)

- void add (const Real ∗sample_c_vars, bool anchor_flag, bool deep_copy)

  create a RealVector view and invoke add(RealVector&)

- void add (const RealVector &sample_c_vars, bool anchor_flag, bool deep_copy)

  shared code among add(Variables&) and add(Real∗); adds a new data point by either appending to SurrogateData::varsData or assigning to SurrogateData::anchorVars, as dictated by anchor_flag. Uses add_point() and add_anchor().

- void add (const Pecos::SurrogateDataResp &sdr, bool anchor_flag)

  append to SurrogateData::respData or assign to SurrogateData::anchorResp

- void add (const Response &response, int fn_index, bool anchor_flag, bool deep_copy)

  adds a new data point by either appending to SurrogateData::respData or assigning to SurrogateData::anchorResp, as dictated by anchor_flag. Uses add_point() and add_anchor().

- void pop_count (size_t count)

  sets popCount (number of entries to pop from end of SurrogateData::{vars,resp}Data, based on size of last data set appended)

- size_t pop_count () const

  returns popCount (number of entries to pop from end of SurrogateData::{vars,resp}Data, based on size of last data set appended)

- void clear_all ()

  clear all build data (current and history) to restore original state

- void clear_anchor ()

  clear SurrogateData::anchor{Vars,Resp}

- void clear_data ()

  clear SurrogateData::{vars,resp}Data

- void set_bounds (const RealVector &lower, const RealVector &upper)

  set approximation lower and upper bounds (currently only used by graphics)

- Approximation * approx_rep () const

  returns approxRep for access to derived class member functions that are not mapped to the top Approximation level

Protected Member Functions

- Approximation (BaseConstructor, const ProblemDescDB &problem_db, size_t num_vars)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- Approximation (BaseConstructor, const String &approx_type, size_t num_vars, short data_order)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

Protected Attributes

- short outputLevel

  output verbosity level: {SILENT,QUIET,NORMAL,VERBOSE,DEBUG}_OUTPUT

- int numVars

  number of variables in the approximation

- String approxType

  approximation type identifier

- short buildDataOrder

  order of the data used for surrogate construction, in ActiveSet request vector 3-bit format.

- RealVector approxGradient

  gradient of the approximation returned by get_gradient()

- RealSymMatrix approxHessian

  Hessian of the approximation returned by get_hessian().

- Pecos::SurrogateData approxData

  contains the variables/response data for constructing a single approximation model (one response function)

- RealVector approxLowerBounds

  approximation lower bounds (used by 3D graphics and Surfpack KrigingModel)

- RealVector approxUpperBounds

  approximation upper bounds (used by 3D graphics and Surfpack KrigingModel)

Private Member Functions

- Approximation * get_approx (ProblemDescDB &problem_db, size_t num_vars)

  Used only by the standard envelope constructor to initialize approxRep to the appropriate derived type.

- Approximation * get_approx (const String &approx_type, const UShortArray &approx_order, size_t num_vars, short data_order)

  Used only by the alternate envelope constructor to initialize approxRep to the appropriate derived type.

Private Attributes

- size_t popCount

  number of points previously added by append() to be removed by pop()

- Approximation * approxRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing approxRep

43.5.1 Detailed Description

Base class for the approximation class hierarchy. The Approximation class is the base class for the response data fit approximation class hierarchy in DAKOTA. One instance of an Approximation must be created for each function to be approximated (a vector of Approximations is contained in ApproximationInterface). For memory efficiency and enhanced polymorphism, the approximation hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Approximation) serves as the envelope and one of the derived classes (selected in Approximation::get_approx()) serves as the letter.

43.5.2 Constructor & Destructor Documentation

43.5.2.1 Approximation ()

default constructor The default constructor is used in Array<Approximation> instantiations and by the alternate envelope constructor. approxRep is NULL in this case (problem_db is needed to build a meaningful Approximation object). This makes it necessary to check for NULL in the copy constructor, assignment operator, and destructor.

43.5.2.2 Approximation (ProblemDescDB & *problem_db*, size_t *num_vars*)

standard constructor for envelope Envelope constructor only needs to extract enough data to properly execute get_approx, since Approximation(BaseConstructor, problem_db) builds the actual base class data for the derived approximations.

References Dakota::abort_handler(), Approximation::approxRep, and Approximation::get_approx().

43.5.2.3 Approximation (const String & *approx_type*, const UShortArray & *approx_order*, size_t *num_vars*, short *data_order*)

alternate constructor This is the alternate envelope constructor for instantiations on the fly. Since it does not have access to problem_db, the letter class is not fully populated. This constructor executes get_approx(type), which invokes the default constructor of the derived letter class, which in turn invokes the default constructor of the base class.

References Dakota::abort_handler(), Approximation::approxRep, and Approximation::get_approx().

43.5.2.4 Approximation (const Approximation & *approx*)

copy constructor Copy constructor manages sharing of approxRep and incrementing of referenceCount.

References Approximation::approxRep, and Approximation::referenceCount.

43.5.2.5 ∼Approximation () `[virtual]`

destructor Destructor decrements referenceCount and only deletes approxRep when referenceCount reaches zero.

References Approximation::approxRep, and Approximation::referenceCount.

43.5.2.6 Approximation (BaseConstructor, const ProblemDescDB & *problem_db*, size_t *num_vars*) `[protected]`

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_approx() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid recursion in the base class constructor calling get_approx() again). Since the letter IS the representation, its rep pointer is set to NULL (an uninitialized pointer causes problems in ∼Approximation).

approxType.ends("_interpolation_polynomial") && approxType.ends("_orthogonal_polynomial"))

References Approximation::approxType, and ProblemDescDB::get_bool().

43.5.2.7 Approximation (BaseConstructor, const String & *approx_type*, size_t *num_vars*, short *data_order*) [protected]

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_approx() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid recursion in the base class constructor calling get_approx() again). Since the letter IS the representation, its rep pointer is set to NULL (an uninitialized pointer causes problems in ∼Approximation).

43.5.3 Member Function Documentation

43.5.3.1 Approximation operator= (const Approximation & *approx*)

assignment operator Assignment operator decrements referenceCount for old approxRep, assigns new approxRep, and increments referenceCount for new approxRep.

References Approximation::approxRep, and Approximation::referenceCount.

43.5.3.2 void build () [virtual]

builds the approximation from scratch This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented in GaussProcApproximation, PecosApproximation, SurfpackApproximation, TANA3Approximation, and TaylorApproximation.

References Dakota::abort_handler(), Approximation::approxData, Approximation::approxRep, Approximation::build(), Approximation::min_points(), and Approximation::numVars.

Referenced by Approximation::build(), and Approximation::rebuild().

43.5.3.3 void rebuild () [virtual]

rebuilds the approximation incrementally This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented in PecosApproximation.

References Approximation::approxRep, Approximation::build(), and Approximation::rebuild().

Referenced by Approximation::rebuild().

43.5.3.4 void pop (bool *save_data*) [virtual]

removes entries from end of SurrogateData::{vars,resp}Data (last points appended) This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented in PecosApproximation.

References Approximation::approxData, Approximation::approxRep, Approximation::pop(), and Approximation::popCount.

Referenced by Approximation::pop().

43.5.3.5 void restore () [virtual]

restores state prior to previous append() This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented in PecosApproximation.

References Approximation::approxData, Approximation::approxRep, Approximation::popCount, Approximation::restoration_index(), and Approximation::restore().

Referenced by Approximation::restore().

43.5.3.6 void finalize () [virtual]

finalize approximation by applying all remaining trial sets This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented in PecosApproximation.

References Approximation::approxData, Approximation::approxRep, Approximation::finalization_index(), and Approximation::finalize().

Referenced by Approximation::finalize().

43.5.3.7 void clear_current () [inline, virtual]

clear current build data in preparation for next build Redefined by TANA3Approximation to clear current data but preserve history.

Reimplemented in TANA3Approximation.

References Approximation::approxRep, Approximation::clear_all(), and Approximation::clear_current().

Referenced by Approximation::clear_current().

43.5.3.8 void clear_all () [inline]

clear all build data (current and history) to restore original state Clears out any history (e.g., TANA3Approximation use for a different response function in NonDReliability).

References Approximation::approxData, Approximation::approxRep, and Approximation::clear_all().

Referenced by Approximation::clear_all(), and Approximation::clear_current().

43.5.3.9 Approximation * get_approx (ProblemDescDB & *problem_db*, size_t *num_vars*) [private]

Used only by the standard envelope constructor to initialize approxRep to the appropriate derived type. Used only by the envelope constructor to initialize approxRep to the appropriate derived type.

References String::ends(), and ProblemDescDB::get_string().

Referenced by Approximation::Approximation().

43.5.3.10 Approximation * get_approx (const String & *approx_type*, const UShortArray & *approx_order*, size_t *num_vars*, short *data_order*) [private]

Used only by the alternate envelope constructor to initialize approxRep to the appropriate derived type. Used only by the envelope constructor to initialize approxRep to the appropriate derived type.

References String::ends().

43.5.4 Member Data Documentation

43.5.4.1 short buildDataOrder [protected]

order of the data used for surrogate construction, in ActiveSet request vector 3-bit format. This setting distinguishes derivative data intended for use in construction (includes derivatives w.r.t. the build variables) from derivative data that may be approximated separately (excludes derivatives w.r.t. auxilliary variables). This setting should also not be inferred directly from the responses specification, since we may need gradient support for evaluating gradients at a single point (e.g., the center of a trust region), but not require gradient evaluations at every point.

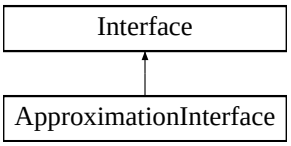
Referenced by SurfpackApproximation::add_sdp_to_surfdata(), TaylorApproximation::build(), TANA3Approximation::build(), GaussProcApproximation::GaussProcApproximation(), TaylorApproximation::get_gradient(), TaylorApproximation::get_hessian(), TaylorApproximation::get_value(), TaylorApproximation::min_coefficients(), Approximation::min_points(), PecosApproximation::PecosApproximation(), Approximation::recommended_points(), SurfpackApproximation::SurfpackApproximation(), SurfpackApproximation::surrogates_to_surf_data(), TANA3Approximation::TANA3Approximation(), and TaylorApproximation::TaylorApproximation().

The documentation for this class was generated from the following files:

- DakotaApproximation.H
- DakotaApproximation.C

43.6 ApproximationInterface Class Reference

Derived class within the interface class hierarchy for supporting approximations to simulation-based results. Inheritance diagram for ApproximationInterface::



Public Member Functions

- ApproximationInterface (ProblemDescDB &problem_db, const Variables &am_vars, bool am_cache, const String &am_interface_id, size_t num_fns)

  primary constructor

- ApproximationInterface (const String &approx_type, const UShortArray &approx_order, const Variables &am_vars, bool am_cache, const String &am_interface_id, size_t num_fns, short data_order, short output_level)

  alternate constructor for instantiations on the fly

- ~ApproximationInterface ()

  destructor

Protected Member Functions

- void map (const Variables &vars, const ActiveSet &set, Response &response, const bool asynch_flag=false)

  the function evaluator: provides an approximate "mapping" from the variables to the responses using functionSurfaces

- int minimum_points (bool constraint_flag) const

  returns the minimum number of samples required to build the functionSurfaces

- int recommended_points (bool constraint_flag) const

  returns the recommended number of samples recommended to build the functionSurfaces

- void approximation_function_indices (const IntSet &approx_fn_indices)

  set the (currently active) approximation function index set

- void update_approximation (const Variables &vars, const IntResponsePair &response_pr)
- void update_approximation (const RealMatrix &samples, const IntResponseMap &resp_map)
- void update_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map)

- void append_approximation (const Variables &vars, const IntResponsePair &response_pr)
- void append_approximation (const RealMatrix &samples, const IntResponseMap &resp_map)
- void append_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map)
- void build_approximation (const RealVector &lower_bnds, const RealVector &upper_bnds)
- void rebuild_approximation (const BoolDeque &rebuild_deque)
- void pop_approximation (bool save_surr_data)
- void restore_approximation ()
- bool restore_available ()
- void finalize_approximation ()

  finalizes the approximation by applying all trial increments

- void store_approximation ()

  move the current approximation into storage for later combination

- void combine_approximation (short corr_type)

  combine the current approximation with one previously stored

- void clear_current ()

  clears current data from an approximation interface

- void clear_all ()

  clears all data from an approximation interface

- std::vector< Approximation > & approximations ()

  retrieve the Approximations within an ApproximationInterface

- const Pecos::SurrogateData & approximation_data (size_t index)

  retrieve the approximation data from a particular Approximation within an ApproximationInterface

- const RealVectorArray & approximation_coefficients ()

  retrieve the approximation coefficients from each Approximation within an ApproximationInterface

- void approximation_coefficients (const RealVectorArray &approx_coeffs)

  set the approximation coefficients within each Approximation within an ApproximationInterface

- const RealVector & approximation_variances (const RealVector &c_vars)

  retrieve the approximation variances from each Approximation within an ApproximationInterface

- const IntResponseMap & synch ()

  recovers data from a series of asynchronous evaluations (blocking)

- const IntResponseMap & synch_nowait ()

  recovers data from a series of asynchronous evaluations (nonblocking)

Private Member Functions

- void mixed_add (const Variables &vars, const Response &response, bool anchor)

  add variables/response data to functionSurfaces using a mixture of shallow and deep copies

- void mixed_add (const Real *c_vars, const Response &response, bool anchor)

  add variables/response data to functionSurfaces using a mixture of shallow and deep copies

- void shallow_add (const Variables &vars, const Response &response, bool anchor)

  add variables/response data to functionSurfaces using a shallow copy

- void update_pop_counts (const IntResponseMap &resp_map)

  update the popCount within each of the functionSurfaces based on the active set definitions within resp_map

Private Attributes

- IntSet approxFnIndices

  for incomplete approximation sets, this array specifies the response function subset that is approximated

- std::vector< Approximation > functionSurfaces

  list of approximations, one per response function

- RealVectorArray functionSurfaceCoeffs

  array of approximation coefficient vectors, one vector per response function

- RealVector functionSurfaceVariances

  vector of approximation variances, one value per response function

- StringArray diagnosticSet

  set of diagnostic metrics

- Variables actualModelVars

  copy of the actualModel variables object used to simplify conversion among differing variable views

- bool actualModelCache

  indicates usage of an evaluation cache by the actualModel

- String actualModelInterfaceId

  the interface id from the actualModel used for ordered PRPCache lookups

- IntResponseMap beforeSynchResponseMap

  bookkeeping map to catalogue responses generated in map() for use in synch() and synch_nowait(). This supports pseudo-asynchronous operations (approximate responses are always computed synchronously, but asynchronous virtual functions are supported through bookkeeping).

43.6.1 Detailed Description

Derived class within the interface class hierarchy for supporting approximations to simulation-based results. ApproximationInterface provides an interface class for building a set of global/local/multipoint approximations and performing approximate function evaluations using them. It contains a list of Approximation objects, one for each response function.

43.6.2 Member Function Documentation

43.6.2.1 void update_approximation (const Variables & *vars*, const IntResponsePair & *response_pr*) [protected, virtual]

This function populates/replaces each Approximation::anchorPoint with the incoming variables/response data point.

Reimplemented from Interface.

References ApproximationInterface::actualModelCache, ApproximationInterface::actualModelInterfaceId, Dakota::data_pairs, Dakota::lookup_by_ids(), ApproximationInterface::mixed_add(), and ApproximationInterface::shallow_add().

43.6.2.2 void update_approximation (const RealMatrix & *samples*, const IntResponseMap & *resp_map*) [protected, virtual]

This function populates/replaces each Approximation::currentPoints with the incoming variables/response arrays.

Reimplemented from Interface.

References Dakota::abort_handler(), ApproximationInterface::actualModelCache, ApproximationInterface::actualModelInterfaceId, ApproximationInterface::approxFnIndices, Dakota::data_pairs, ApproximationInterface::functionSurfaces, Dakota::lookup_by_ids(), ApproximationInterface::mixed_add(), and ApproximationInterface::shallow_add().

43.6.2.3 void update_approximation (const VariablesArray & *vars_array*, const IntResponseMap & *resp_map*) [protected, virtual]

This function populates/replaces each Approximation::currentPoints with the incoming variables/response arrays.

Reimplemented from Interface.

References Dakota::abort_handler(), ApproximationInterface::actualModelCache, ApproximationInterface::actualModelInterfaceId, ApproximationInterface::approxFnIndices, Dakota::data_pairs, ApproximationInterface::functionSurfaces, Dakota::lookup_by_ids(), ApproximationInterface::mixed_add(), and ApproximationInterface::shallow_add().

43.6.2.4 void append_approximation (const Variables & *vars*, const IntResponsePair & *response_pr*) [protected, virtual]

This function appends to each Approximation::currentPoints with one incoming variables/response data point.

Reimplemented from Interface.

References ApproximationInterface::actualModelCache, ApproximationInterface::actualModelInterfaceId, ApproximationInterface::approxFnIndices, Dakota::data_pairs, ApproximationInterface::functionSurfaces, Dakota::lookup_by_ids(), ApproximationInterface::mixed_add(), and ApproximationInterface::shallow_add().

43.6.2.5 void append_approximation (const RealMatrix & *samples*, const IntResponseMap & *resp_map*) [protected, virtual]

This function appends to each Approximation::currentPoints with multiple incoming variables/response data points.

Reimplemented from Interface.

References Dakota::abort_handler(), ApproximationInterface::actualModelCache, ApproximationInterface::actualModelInterfaceId, Dakota::data_pairs, Dakota::lookup_by_ids(), ApproximationInterface::mixed_add(), ApproximationInterface::shallow_add(), and ApproximationInterface::update_pop_counts().

43.6.2.6 void append_approximation (const VariablesArray & *vars_array*, const IntResponseMap & *resp_map*) [protected, virtual]

This function appends to each Approximation::currentPoints with multiple incoming variables/response data points.

Reimplemented from Interface.

References Dakota::abort_handler(), ApproximationInterface::actualModelCache, ApproximationInterface::actualModelInterfaceId, Dakota::data_pairs, Dakota::lookup_by_ids(), ApproximationInterface::mixed_add(), ApproximationInterface::shallow_add(), and ApproximationInterface::update_pop_counts().

43.6.2.7 void build_approximation (const RealVector & *lower_bnds*, const RealVector & *upper_bnds*) [protected, virtual]

This function finds the coefficients for each Approximation based on the data passed through update_approximation() calls. The bounds are used only for graphics visualization.

Reimplemented from Interface.

References ApproximationInterface::approxFnIndices, ApproximationInterface::diagnosticSet, ApproximationInterface::functionSurfaces, and Interface::outputLevel.

43.6.2.8 void rebuild_approximation (const BoolDeque & *rebuild_deque*) [protected, virtual]

This function updates the coefficients for each Approximation based on data increments provided by {update,append}_approximation().

Reimplemented from Interface.

References ApproximationInterface::approxFnIndices, and ApproximationInterface::functionSurfaces.

43.6.2.9 void pop_approximation (bool *save_surr_data*) [protected, virtual]

This function removes data provided by a previous call to append_approximation().

Reimplemented from Interface.

References ApproximationInterface::approxFnIndices, and ApproximationInterface::functionSurfaces.

43.6.2.10 void restore_approximation () [protected, virtual]

This function updates the coefficients for each Approximation based on data increments provided by {update,append}_approximation().

Reimplemented from Interface.

References ApproximationInterface::approxFnIndices, and ApproximationInterface::functionSurfaces.

43.6.2.11 bool restore_available () [protected, virtual]

This function updates the coefficients for each Approximation based on data increments provided by {update,append}_approximation().

Reimplemented from Interface.

References ApproximationInterface::approxFnIndices, and ApproximationInterface::functionSurfaces.

43.6.3 Member Data Documentation

43.6.3.1 std::vector<Approximation> functionSurfaces [private]

list of approximations, one per response function This formulation allows the use of mixed approximations (i.e., different approximations used for different response functions), although the input specification is not currently general enough to support it.

Referenced by ApproximationInterface::append_approximation(), ApproximationInterface::approximation_coefficients(), ApproximationInterface::approximation_data(), ApproximationInterface::approximation_variances(), ApproximationInterface::ApproximationInterface(), ApproximationInterface::approximations(), ApproximationInterface::build_approximation(), ApproximationInterface::clear_all(), ApproximationInterface::clear_current(), ApproximationInterface::combine_approximation(), ApproximationInterface::finalize_approximation(), ApproximationInterface::map(), ApproximationInterface::minimum_points(), ApproximationInterface::mixed_add(), ApproximationInterface::pop_approximation(), ApproximationInterface::rebuild_approximation(), ApproximationInterface::recommended_points(), ApproximationInterface::restore_approximation(), ApproximationInterface::restore_available(), ApproximationInterface::shallow_add(), ApproximationInterface::store_approximation(), ApproximationInterface::update_approximation(), and ApproximationInterface::update_pop_counts().

The documentation for this class was generated from the following files:

- ApproximationInterface.H
- ApproximationInterface.C

43.7 APPSEvalMgr Class Reference

Evaluation manager class for APPSPACK.

Public Member Functions

- APPSEvalMgr (Model &model)

  constructor

- ~APPSEvalMgr ()

  destructor

- bool isReadyForWork () const

  tells APPS whether or not there is a processor available to perform a function evaluation

- bool submit (const int apps_tag, const HOPSPACK::Vector &apps_xtrial, HOPSPACK::EvalRequestType apps_request)

  performs a function evaluation at APPS-provided x_in

- int recv (int &apps_tag, HOPSPACK::Vector &apps_f, HOPSPACK::Vector &apps_cEqs, HOPSPACK::Vector &apps_cIneqs, string &apps_msg)

  returns a function value to APPS

- void printDebugInfo (void) const

  empty implementation of debug info needed to complete the interface

- void printTimingInfo (void) const

  empty implementation of timing info needed to complete the interface

- void set_asynch_flag (const bool dakotaAsynchFlag)

  publishes whether or not to do asynchronous evaluations

- void set_blocking_synch (const bool blockingSynchFlag)

  publishes whether or not APPS is operating synchronously

- void set_total_workers (const int numDakotaWorkers)

  publishes the number of processors available for function evaluations

- void set_constraint_map (std::vector< int > constraintMapIndices, std::vector< double > constraintMapMultipliers, std::vector< double > constraintMapOffsets)

  publishes constraint transformation

Private Attributes

- Model & iteratedModel

  reference to the APPSOptimizer's model passed in the constructor

- bool modelAsynchFlag

  flag for asynchronous function evaluations

- bool blockingSynch

  flag for APPS synchronous behavior

- int numWorkersUsed

  number of processors actively performing function evaluations

- int numWorkersTotal

  total number of processors available for performing function evaluations

- std::vector< int > constrMapIndices

  map from Dakota constraint number to APPS constraint number

- std::vector< double > constrMapMultipliers

  multipliers for constraint transformations

- std::vector< double > constrMapOffsets

  offsets for constraint transformations

- RealVector xTrial

  trial iterate

- std::map< int, int > tagList

  map of DAKOTA eval id to APPS eval id (for asynchronous evaluations)

- std::map< int, RealVector > functionList

  map of APPS eval id to responses (for synchronous evaluations)

- IntResponseMap dakotaResponseMap

  map of DAKOTA responses returned by synchronize_nowait()

43.7.1 Detailed Description

Evaluation manager class for APPSPACK. The APPSEvalMgr class is derived from APPSPACK's Executor class. It implements the methods of that class in such away that allows DAKOTA to manage the computation of responses instead of APPS. Iterate and response values are passed between Dakota and APPSPACK via this interface.

43.7.2 Constructor & Destructor Documentation

43.7.2.1 APPSEvalMgr (Model & *model*)

constructor Evaluation manager class for APPSPACK.

The APPSEvalMgr class is derived from APPSPACK's Executor class. It implements the methods of that class in such away that allows DAKOTA to manage the computation of responses instead of APPS. Iterate and response values are passed between Dakota and APPSPACK via this interface.

43.7.3 Member Function Documentation

43.7.3.1 bool isReadyForWork () const

tells APPS whether or not there is a processor available to perform a function evaluation Check to see if all processors available for function evaluations are being used. If not, tell APPS that one is available.

References APPSEvalMgr::numWorkersTotal, and APPSEvalMgr::numWorkersUsed.

43.7.3.2 bool submit (const int *apps_tag*, const HOPSPACK::Vector & *apps_xtrial*, HOPSPACK::EvalRequestType *apps_request*)

performs a function evaluation at APPS-provided x_in Convert APPSPACK vector of variables to DAKOTA vector of variables and perform function evaluation asynchronously or not as specified in the DAKOTA input deck. If evaluation is asynchronous, map the dakota id to the APPS tag. If evaluation is synchronous, map the responses to the APPS tag.

References Model::asynch_compute_response(), Model::compute_response(), Model::continuous_variables(), Model::current_response(), Model::evaluation_id(), Response::function_values(), APPSEvalMgr::functionList, APPSEvalMgr::iteratedModel, APPSEvalMgr::modelAsynchFlag, APPSEvalMgr::numWorkersTotal, APPSEvalMgr::numWorkersUsed, APPSEvalMgr::tagList, and APPSEvalMgr::xTrial.

43.7.3.3 int recv (int & *apps_tag*, HOPSPACK::Vector & *apps_f*, HOPSPACK::Vector & *apps_cEqs*, HOPSPACK::Vector & *apps_cIneqs*, string & *apps_msg*)

returns a function value to APPS Retrieve a set of reponse values, convert to APPS data structures, and return them to APPS. APPS tags are tied to corresponding responses using the appropriate (i.e., asynchronous or synchronous) map.

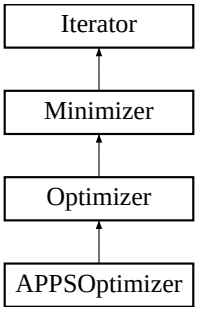
References APPSEvalMgr::blockingSynch, APPSEvalMgr::constrMapIndices, APPSEvalMgr::constrMapMultipliers, APPSEvalMgr::constrMapOffsets, APPSEvalMgr::dakotaResponseMap, APPSEvalMgr::functionList, APPSEvalMgr::iteratedModel, APPSEvalMgr::modelAsynchFlag, Model::num_nonlinear_eq_constraints(), APPSEvalMgr::numWorkersUsed, Model::synchronize(), Model::synchronize_nowait(), and APPSEvalMgr::tagList.

The documentation for this class was generated from the following files:

- APPSEvalMgr.H
- APPSEvalMgr.C

43.8 APPSOptimizer Class Reference

Wrapper class for APPSPACK. Inheritance diagram for APPSOptimizer::



Public Member Functions

- APPSOptimizer (Model &model)

  constructor

- APPSOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor for on-the-fly instantiations

- ∼APPSOptimizer ()

  destructor

- void find_optimum ()

  Performs the iterations to determine the optimal solution.

Protected Member Functions

- void set_apps_parameters ()

  sets options for specific methods based on user specifications

- void initialize_variables_and_constraints ()

  initializes problem variables and constraints

Protected Attributes

- HOPSPACK::ParameterList params

  Pointer to APPS parameter list.

- HOPSPACK::ParameterList ∗ problemParams

Pointer to APPS problem parameter sublist.

- HOPSPACK::ParameterList * linearParams

  Pointer to APPS linear constraint parameter sublist.

- HOPSPACK::ParameterList * mediatorParams

  Pointer to APPS mediator parameter sublist.

- HOPSPACK::ParameterList * citizenParams

  Pointer to APPS citizen/algorithm parameter sublist.

- APPSEvalMgr * evalMgr

  Pointer to the APPS evaluation manager object.

- std::vector< int > constraintMapIndices

  map from Dakota constraint number to APPS constraint number

- std::vector< double > constraintMapMultipliers

  multipliers for constraint transformations

- std::vector< double > constraintMapOffsets

  offsets for constraint transformations

43.8.1 Detailed Description

Wrapper class for APPSPACK. The APPSOptimizer class provides a wrapper for APPSPACK, a Sandia-developed C++ library for generalized pattern search. APPSPACK defaults to a coordinate pattern search but also allows for augmented search patterns. It can solve problems with bounds, linear constraints, and general nonlinear constraints. APPSOptimizer uses an APPSEvalMgr object to manage the function evaluations.

The user input mappings are as follows: `output` `max_function_evaluations`, `constraint_tol` `initial_delta`, `contraction_factor`, `threshold_delta`, `solution_target`, `synchronization`, `merit_function`, `constraint_penalty`, and `smoothing_factor` are mapped into APPS's `"Debug"`, "Maximum Evaluations", "Bounds Tolerance"/"Machine Epsilon"/"Constraint Tolerance", "Initial Step", "Contraction Factor", "Step Tolerance", "Function Tolerance", "Synchronous", "Method", "Initial Penalty Value", and "Initial Smoothing Value" data attributes. Refer to the APPS web site (`http://software.sandia.gov/appspack`) for additional information on APPS objects and controls.

43.8.2 Constructor & Destructor Documentation

43.8.2.1 APPSOptimizer (Model & *model*)

constructor Wrapper class for HOPSPACK.

The APPSOptimizer class provides a wrapper for HOPSPACK, a Sandia-developed C++ library for generalized pattern search. HOPSPACK defaults to a coordinate pattern search but also allows for augmented search patterns.

It can solve problems with bounds, linear constraints, and general nonlinear constraints. APPSOptimizer uses an APPSEvalMgr object to manage the function evaluations.

The user input mappings are as follows: `output` `max_function_evaluations`, `constraint_tol` `initial_delta`, `contraction_factor`, `threshold_delta`, `solution_target`, `synchronization`, `merit_function`, `constraint_penalty`, and `smoothing_factor` are mapped into HOPS's `"Display"`, "Maximum Evaluations", "Active Tolerance"/"Nonlinear Active Tolerance", "Initial Step", "Contraction Factor", "Step Tolerance", "Objective Target", "Synchronous Evaluations", "Penalty Function", "Penalty Parameter", and "Penalty Smoothing Value" data attributes. Refer to the HOPS web site (`https://software.sandia.gov/trac/hopspack`) for additional information on HOPS objects and controls.

References APPSOptimizer::evalMgr, Model::init_communicators(), Iterator::iteratedModel, Optimizer::localObjectiveRecast, Iterator::maxConcurrency, Minimizer::scaleFlag, and APPSOptimizer::set_apps_parameters().

43.8.3 Member Function Documentation

43.8.3.1 void find_optimum () [virtual]

Performs the iterations to determine the optimal solution. find_optimum redefines the Optimizer virtual function to perform the optimization using HOPS. It first sets up the problem data, then executes minimize() on the HOPS optimizer, and finally catalogues the results.

Implements Optimizer.

References Model::asynch_flag(), Iterator::bestResponseArray, Iterator::bestVariablesArray, APPSOptimizer::constraintMapIndices, APPSOptimizer::constraintMapMultipliers, APPSOptimizer::constraintMapOffsets, APPSOptimizer::evalMgr, Model::evaluation_capacity(), APPSOptimizer::initialize_variables_and_constraints(), Iterator::iteratedModel, Optimizer::localObjectiveRecast, Iterator::numContinuousVars, Iterator::numFunctions, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, APPSOptimizer::params, APPSEvalMgr::set_asynch_flag(), and APPSEvalMgr::set_total_workers().

43.8.3.2 void set_apps_parameters () [protected]

sets options for specific methods based on user specifications Set all of the HOPS algorithmic parameters as specified in the DAKOTA input deck. This is called at construction time.

References APPSOptimizer::citizenParams, Minimizer::constraintTol, APPSOptimizer::evalMgr, ProblemDescDB::get_real(), ProblemDescDB::get_string(), ProblemDescDB::is_null(), APPSOptimizer::linearParams, Iterator::maxConcurrency, Iterator::maxFunctionEvals, APPSOptimizer::mediatorParams, Iterator::numContinuousVars, Minimizer::numNonlinearConstraints, Iterator::outputLevel, APPSOptimizer::params, Iterator::probDescDB, APPSOptimizer::problemParams, and APPSEvalMgr::set_blocking_synch().

Referenced by APPSOptimizer::APPSOptimizer().

43.8.3.3 void initialize_variables_and_constraints () [protected]

initializes problem variables and constraints Set the variables and constraints as specified in the DAKOTA input deck. This is done at run time.

References Minimizer::bigRealBoundSize, APPSOptimizer::constraintMapIndices, APPSOptimizer::constraintMapMultipliers, APPSOptimizer::constraintMapOffsets, Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::continuous_variables(), APPSOptimizer::evalMgr, Iterator::iteratedModel, Model::linear_eq_constraint_coeffs(), Model::linear_eq_constraint_targets(), Model::linear_ineq_constraint_coeffs(), Model::linear_ineq_constraint_lower_bounds(), Model::linear_ineq_constraint_upper_bounds(), APPSOptimizer::linearParams, Model::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Iterator::numContinuousVars, Minimizer::numLinearEqConstraints, Minimizer::numLinearIneqConstraints, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, APPSOptimizer::problemParams, and APPSEvalMgr::set_constraint_map().

Referenced by APPSOptimizer::find_optimum().

The documentation for this class was generated from the following files:

- APPSOptimizer.H
- APPSOptimizer.C

43.9 BaseConstructor Struct Reference

Dummy struct for overloading letter-envelope constructors.

Public Member Functions

- BaseConstructor (int=0)

  C++ structs can have constructors.

43.9.1 Detailed Description

Dummy struct for overloading letter-envelope constructors. BaseConstructor is used to overload the constructor for the base class portion of letter objects. It avoids infinite recursion (Coplien p.139) in the letter-envelope idiom by preventing the letter from instantiating another envelope. Putting this struct here avoids circular dependencies.

The documentation for this struct was generated from the following file:

- global_defs.h

43.10 BiStream Class Reference

The binary input stream class. Overloads the >> operator for all data types.

Public Member Functions

- BiStream ()

  Default constructor, need to open.

- BiStream (const char *s)

  Constructor takes name of input file.

- BiStream (const char *s, std::ios_base::openmode mode)

  Constructor takes name of input file, mode.

- ~BiStream ()

  Destructor, calls xdr_destroy to delete xdr stream.

- BiStream & operator>> (std::string &ds)

  Binary Input stream operator>>.

- BiStream & operator>> (char *s)

  Input operator, reads char from binary stream BiStream.*

- BiStream & operator>> (char &c)

  Input operator, reads char from binary stream BiStream.

- BiStream & operator>> (int &i)

  Input operator, reads int from binary stream BiStream.*

- BiStream & operator>> (long &l)

  Input operator, reads long from binary stream BiStream.

- BiStream & operator>> (short &s)

  Input operator, reads short from binary stream BiStream.

- BiStream & operator>> (bool &b)

  Input operator, reads bool from binary stream BiStream.

- BiStream & operator>> (double &d)

  Input operator, reads double from binary stream BiStream.

- BiStream & operator>> (float &f)

  Input operator, reads float from binary stream BiStream.

- BiStream & operator>> (unsigned char &c)

  Input operator, reads unsigned char∗ from binary stream BiStream.

- BiStream & operator>> (unsigned int &i)

  Input operator, reads unsigned int from binary stream BiStream.

- BiStream & operator>> (unsigned long &l)

  Input operator, reads unsigned long from binary stream BiStream.

- BiStream & operator>> (unsigned short &s)

  Input operator, reads unsigned short from binary stream BiStream.

Private Attributes

- XDR xdrInBuf

  XDR input stream buffer.

- char inBuf [MAX_NETOBJ_SZ]

  Buffer to hold data as it is read in.

43.10.1 Detailed Description

The binary input stream class. Overloads the >> operator for all data types. The Dakota::BiStream class is a binary input class which overloads the >> operator for all standard data types (int, char, float, etc). The class relies on the methods within the ifstream base class. The Dakota::BiStream class inherits from the ifstream class. If available, the class utilize rpc/xdr to construct machine independent binary files. These Dakota restart files can be moved from host to host. The motivation to develop these classes was to replace the Rogue wave classes which Dakota historically used for binary I/O.

43.10.2 Constructor & Destructor Documentation

43.10.2.1 BiStream ()

Default constructor, need to open. Default constructor, allocates xdr stream , but does not call the open method. The open method must be called before stream can be read.

References BiStream::inBuf, and BiStream::xdrInBuf.

43.10.2.2 BiStream (const char ∗ *s*)

Constructor takes name of input file. Constructor which takes a char∗ filename. Calls the base class open method with the filename and no other arguments. Also allocates the xdr stream.

References BiStream::inBuf, and BiStream::xdrInBuf.

43.10.2.3 BiStream (const char ∗ *s*, std::ios_base::openmode *mode*)

Constructor takes name of input file, mode. Constructor which takes a char∗ filename and int flags. Calls the base class open method with the filename and flags as arguments. Also allocates xdr stream.

References BiStream::inBuf, and BiStream::xdrInBuf.

43.10.2.4 ∼BiStream ()

Destructor, calls xdr_destroy to delete xdr stream. Destructor, destroys the xdr stream allocated in constructor

References BiStream::xdrInBuf.

43.10.3 Member Function Documentation

43.10.3.1 BiStream & operator>> (std::string & *ds*)

Binary Input stream operator>>. The std::string input operator must first read both the xdr buffer size and the size of the string written. Once these are read it can then read and convert the std::string correctly.

References BiStream::inBuf, and BiStream::xdrInBuf.

43.10.3.2 BiStream & operator>> (char ∗ *s*)

Input operator, reads char∗ from binary stream BiStream. Reading char array is a special case. The method has no way of knowing if the length to the input array is large enough, it assumes it is one char longer than actual string, (Null terminator added). As with the std::string the size of the xdr buffer as well as the char array size written must be read from the stream prior to reading and converting the char array.

References BiStream::inBuf, and BiStream::xdrInBuf.

The documentation for this class was generated from the following files:

- DakotaBinStream.H
- DakotaBinStream.C

43.11 BoStream Class Reference

The binary output stream class. Overloads the << operator for all data types.

Public Member Functions

- BoStream ()

  Default constructor, need to open.

- BoStream (const char *s)

  Constructor takes name of input file.

- BoStream (const char *s, std::ios_base::openmode mode)

  Constructor takes name of input file, mode.

- ~BoStream () throw ()

  Destructor, calls xdr_destroy to delete xdr stream.

- BoStream & operator<< (const std::string &ds)

  Binary Output stream operator<<.

- BoStream & operator<< (const char *s)

  Output operator, writes char TO binary stream BoStream.*

- BoStream & operator<< (const char &c)

  Output operator, writes char to binary stream BoStream.

- BoStream & operator<< (const int &i)

  Output operator, writes int to binary stream BoStream.

- BoStream & operator<< (const long &l)

  Output operator, writes long to binary stream BoStream.

- BoStream & operator<< (const short &s)

  Output operator, writes short to binary stream BoStream.

- BoStream & operator<< (const bool &b)

  Output operator, writes bool to binary stream BoStream.

- BoStream & operator<< (const double &d)

  Output operator, writes double to binary stream BoStream.

- BoStream & operator<< (const float &f)

  Output operator, writes float to binary stream BoStream.

- BoStream & operator<< (const unsigned char &c)

  Output operator, writes unsigned char to binary stream BoStream.

- BoStream & operator<< (const unsigned int &i)

  Output operator, writes unsigned int to binary stream BoStream.

- BoStream & operator<< (const unsigned long &l)

  Output operator, writes unsigned long to binary stream BoStream.

- BoStream & operator<< (const unsigned short &s)

  Output operator, writes unsigned short to binary stream BoStream.

Private Attributes

- XDR xdrOutBuf

  XDR output stream buffer.

- char outBuf [MAX_NETOBJ_SZ]

  Buffer to hold converted data before it is written.

43.11.1 Detailed Description

The binary output stream class. Overloads the << operator for all data types. The Dakota::BoStream class is a binary output classes which overloads the << operator for all standard data types (int, char, float, etc). The class relies on the built in write methods within the ostream base classes. Dakota::BoStream inherits from the ofstream class. The motivation to develop this class was to replace the Rogue wave class which Dakota historically used for binary I/O. If available, the class utilize rpc/xdr to construct machine independent binary files. These Dakota restart files can be moved between hosts.

43.11.2 Constructor & Destructor Documentation

43.11.2.1 BoStream ()

Default constructor, need to open. Default constructor allocates the xdr stream but does not call the open() method. The open() method must be called before stream can be written to.

References BoStream::outBuf, and BoStream::xdrOutBuf.

43.11.2.2 BoStream (const char ∗ *s*)

Constructor takes name of input file. Constructor, takes char ∗ filename as argument. Calls base class open method with filename and no other arguments. Also allocates xdr stream

References BoStream::outBuf, and BoStream::xdrOutBuf.

43.11.2.3 BoStream (const char * *s*, std::ios_base::openmode *mode*)

Constructor takes name of input file, mode. Constructor, takes char * filename and int flags as arguments. Calls base class open method with filename and flags as arguments. Also allocates xdr stream. Note : If no rpc/xdr support xdr calls are #ifdef'd out.

References BoStream::outBuf, and BoStream::xdrOutBuf.

43.11.3 Member Function Documentation

43.11.3.1 BoStream & operator<< (const std::string & *ds*)

Binary Output stream operator<<. The std::string operator<< must first write the xdr buffer size and the original string size to the stream. The input operator needs this information to be able to correctly read and convert the std::string.

References BoStream::outBuf, and BoStream::xdrOutBuf.

43.11.3.2 BoStream & operator<< (const char * *s*)

Output operator, writes char* TO binary stream BoStream. The output of char* is the same as the output of the std::string. The size of the xdr buffer and the size of the string must be written first, then the string itself.

References BoStream::outBuf, and BoStream::xdrOutBuf.

The documentation for this class was generated from the following files:

- DakotaBinStream.H
- DakotaBinStream.C

43.12 COLINApplication Class Reference

Public Member Functions

- COLINApplication ()

  Default constructor. Rrequired by COLIN's ApplicationHandle creation.

- COLINApplication (Model &model)

  Constructor with Model (not presently used).

- ~COLINApplication ()

  Destructor.

- void set_problem (Model &model)

  Helper function called after default construction to extract problem information from the Model and set it for COLIN.

- void set_blocking_synch (const bool blockingSynchFlag)

  publishes whether or not COLIN is operating synchronously

- virtual utilib::Any spawn_evaluation_impl (const utilib::Any &domain, const colin::AppRequest::request_map_t &requests, utilib::seed_t &seed)

  Schedule one or more requests at specified domain point, returning a DAKOTA-specific evaluation tracking ID.

- virtual bool evaluation_available ()

  Check to see if there are any function values ready to be collected.

- virtual void perform_evaluation_impl (const utilib::Any &domain, const colin::AppRequest::request_map_t &requests, utilib::seed_t &seed, colin::AppResponse::response_map_t &colin_responses)

  Perform a function evaluation at t given point.

- virtual utilib::Any collect_evaluation_impl (colin::AppResponse::response_map_t &responses, utilib::seed_t &seed)

  Collect a completed evaluation from DAKOTA.

- virtual void colin_request_to_dakota_request (const utilib::Any &domain, const colin::AppRequest::request_map_t &requests, utilib::seed_t &seed)

  Helper function to convert evaluation request data from COLIN structures to DAKOTA structures.

- virtual void dakota_response_to_colin_response (const Response &dakota_response, colin::AppResponse::response_map_t &colin_responses)

  Gelper function to convert evaluation response data from DAKOTA structures to COLIN structures.

- virtual bool map_domain (const utilib::Any &src, utilib::Any &native, bool forward=true) const

  Map the domain point into data type desired by this application context.

Protected Attributes

- Model iteratedModel

  Shallow copy of the model on which COLIN will iterate.

- bool blockingSynch

  Flag for COLIN synchronous behavior (Pattern Search only).

- ActiveSet activeSet

  Local copy of model's active set for convenience.

- std::vector< int > requestedEvals

  Evaluations queued for asynch evaluation.

- IntResponseMap dakota_responses

  eval_id to response mapping to cache completed jobs.

43.12.1 Detailed Description

COLINApplication is a DAKOTA class that is derived from COLIN's Application hierarchy. It redefines a variety of virtual COLIN functions to use the corresponding DAKOTA functions. This is a more flexible algorithm library interfacing approach than can be obtained with the function pointer approaches used by NPSOLOptimizer and SNLLOptimizer.

43.12.2 Member Function Documentation

43.12.2.1 void set_problem (Model & *model*)

Helper function called after default construction to extract problem information from the Model and set it for COLIN. Set variable bounds and linear and nonlinear constraints. This avoids using probDescDB, so it is called by both the standard and the on-the-fly COLINOptimizer constructors.

References Response::active_set(), COLINApplication::activeSet, Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::current_response(), Model::cv(), Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Model::discrete_int_lower_bounds(), Model::discrete_int_upper_bounds(), Model::div(), Model::drv(), COLINApplication::iteratedModel, Model::linear_eq_constraint_coeffs(), Model::linear_eq_constraint_targets(), Model::linear_ineq_constraint_coeffs(), Model::linear_ineq_constraint_lower_bounds(), Model::linear_ineq_constraint_upper_bounds(), Model::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Model::num_functions(), Model::num_linear_eq_constraints(), Model::num_linear_ineq_constraints(), Model::num_nonlinear_eq_constraints(), and Model::num_nonlinear_ineq_constraints().

Referenced by COLINApplication::COLINApplication().

43.12.2.2 utilib::Any spawn_evaluation_impl (const utilib::Any & *domain*, const colin::AppRequest::request_map_t & *requests*, utilib::seed_t & *seed*) `[virtual]`

Schedule one or more requests at specified domain point, returning a DAKOTA-specific evaluation tracking ID. Schedule one or more requests at specified domain point, returning a DAKOTA-specific evaluation tracking ID. This is only called by COLIN's concurrent evaluator, which is only instantiated when the Model supports asynch evals. The domain point is guaranteed to be compatible with data type specified by map_domain(...)

References COLINApplication::activeSet, Model::asynch_compute_response(), COLINApplication::colin_-request_to_dakota_request(), Model::evaluation_id(), and COLINApplication::iteratedModel.

43.12.2.3 bool evaluation_available () `[virtual]`

Check to see if there are any function values ready to be collected. Check to see if any asynchronous evaluations have finished. This is only called by COLIN's concurrent evaluator, which is only instantiated when the Model supports asynch evals.

References COLINApplication::dakota_responses, COLINApplication::iteratedModel, and Model::synchronize().

43.12.2.4 void perform_evaluation_impl (const utilib::Any & *domain*, const colin::AppRequest::request_map_t & *requests*, utilib::seed_t & *seed*, colin::AppResponse::response_map_t & *colin_responses*) `[virtual]`

Perform a function evaluation at t given point. Perform an evaluation at a specified domain point. Wait for and return the response. This is only called by COLIN's serial evaluator, which is only instantiated when the Model does not support asynch evals. The domain point is guaranteed to be compatible with data type specified by map_domain(...)

References COLINApplication::activeSet, COLINApplication::colin_request_to_dakota_request(), Model::compute_response(), Model::current_response(), COLINApplication::dakota_response_to_colin_-response(), and COLINApplication::iteratedModel.

43.12.2.5 utilib::Any collect_evaluation_impl (colin::AppResponse::response_map_t & *colin_responses*, utilib::seed_t & *seed*) `[virtual]`

Collect a completed evaluation from DAKOTA. Collect the next completed evaluation from DAKOTA. Always returns the evalid of the response returned.

References COLINApplication::dakota_response_to_colin_response(), and COLINApplication::dakota_-responses.

43.12.2.6 void colin_request_to_dakota_request (const utilib::Any & *domain*, const colin::AppRequest::request_map_t & *requests*, utilib::seed_t & *seed*) `[virtual]`

Helper function to convert evaluation request data from COLIN structures to DAKOTA structures. Map COLIN info requests to DAKOTA objectives and constraints.

References Model::continuous_variables(), Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Model::discrete_int_variables(), Model::discrete_real_variables(), Model::div(), Model::drv(), COLINApplication::iteratedModel, Model::num_functions(), and Dakota::set_index_to_value().

Referenced by COLINApplication::perform_evaluation_impl(), and COLINApplication::spawn_evaluation_impl().

43.12.2.7 void dakota_response_to_colin_response (const Response & *dakota_response*, colin::AppResponse::response_map_t & *colin_responses*) `[virtual]`

Gelper function to convert evaluation response data from DAKOTA structures to COLIN structures. Map DAKOTA objective and constraint values to COLIN response.

References Response::active_set_request_vector(), and Response::function_value().

Referenced by COLINApplication::collect_evaluation_impl(), and COLINApplication::perform_evaluation_impl().

43.12.2.8 bool map_domain (const utilib::Any & *src*, utilib::Any & *native*, bool *forward* = `true`) const `[virtual]`

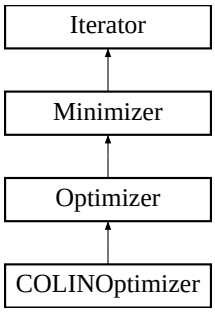
Map the domain point into data type desired by this application context. Map the domain point into data type desired by this application context (utilib::MixedIntVars). This data type can be exposed from the Any &domain presented to spawn and collect.

The documentation for this class was generated from the following files:

- COLINApplication.H
- COLINApplication.C

43.13 COLINOptimizer Class Reference

Wrapper class for optimizers defined using COLIN. Inheritance diagram for COLINOptimizer::



Public Member Functions

- COLINOptimizer (Model &model)

  constructor

- COLINOptimizer (Model &model, int seed)

  alternate constructor for on-the-fly instantiations

- COLINOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor for Iterator instantiations by name

- ~COLINOptimizer ()

  destructor

- void find_optimum ()

  iterates the COLIN solver to determine the optimal solution

- bool returns_multiple_points () const

  some COLIN methods can return multiple points

Protected Member Functions

- void solver_setup (Model &model)

  convenience function for setting up the particular COLIN solver and appropriate Application

- void set_rng (int seed)

  sets up the random number generator for stochastic methods

- void set_solver_parameters ()

sets construct-time options for specific methods based on user specifications, including calling method-specific set functions

- void post_run (std::ostream &s)

  Get the final set of points from the solver Look up responses and sort, first according to constraint violation, then according to function value.

- void resize_final_points (size_t newsize)

  resize bestVariablesArray

- void resize_final_responses (size_t newsize)

  resize bestResponseArray

Protected Attributes

- short solverType

  COLIN solver sub-type as enumerated in COLINOptimizer.C.

- colin::SolverHandle colinSolver

  handle to the COLIN solver

- std::pair< colin::ApplicationHandle, COLINApplication * > colinProblem

  handle and pointer to the COLINApplication object

- colin::EvaluationManager_Base * colinEvalMgr

  pointer to the COLIN evalutaion manager object

- utilib::RNG * rng

  random number generator pointer

- bool blockingSynch

  the `synchronization` *setting: true if* `blocking`*, false if* `nonblocking`

- Real constraint_penalty

  Buffer to hold problem constraint_penalty parameter.

- bool constant_penalty

  Buffer to hold problem constant_penalty parameter.

43.13.1 Detailed Description

Wrapper class for optimizers defined using COLIN. The COLINOptimizer class wraps COLIN, a Sandia-developed C++ optimization interface library. A variety of COLIN optimizers are defined in COLIN and its

associated libraries, including SCOLIB which contains the optimization components from the old COLINY (formerly SGOPT) library. COLIN contains optimizers such as genetic algorithms, pattern search methods, and other nongradient-based techniques. COLINOptimizer uses a COLINApplication object to perform the function evaluations.

The user input mappings are as follows: `max_iterations`, `max_function_evaluations`, `convergence_tolerance`, and `solution_accuracy` are mapped into COLIN's `max_iterations`, `max_function_evaluations_this_trial`, `function_value_tolerance`, `sufficient_objective_value` properties. An `outputLevel` is mapped to COLIN's `output_level` property and a setting of `debug` activates output of method initialization and sets the COLIN `debug` attribute to 10000 for the DEBUG output level. Refer to [Hart, W.E., 2006] for additional information on COLIN objects and controls.

43.13.2 Constructor & Destructor Documentation

43.13.2.1 COLINOptimizer (Model & *model*)

constructor Default constructor.

References ProblemDescDB::get_int(), Model::init_communicators(), Iterator::iteratedModel, Optimizer::localObjectiveRecast, Iterator::maxConcurrency, Iterator::probDescDB, Minimizer::scaleFlag, COLINOptimizer::set_rng(), COLINOptimizer::set_solver_parameters(), and COLINOptimizer::solver_setup().

43.13.2.2 COLINOptimizer (Model & *model*, int *seed*)

alternate constructor for on-the-fly instantiations Alternate constructor for on-the-fly instantiations.

References COLINOptimizer::set_rng(), COLINOptimizer::set_solver_parameters(), and COLINOptimizer::solver_setup().

43.13.2.3 COLINOptimizer (NoDBBaseConstructor, Model & *model*)

alternate constructor for Iterator instantiations by name Alternate constructor for Iterator instantiations by name.

References COLINOptimizer::set_solver_parameters(), and COLINOptimizer::solver_setup().

43.13.3 Member Function Documentation

43.13.3.1 void find_optimum () `[virtual]`

iterates the COLIN solver to determine the optimal solution find_optimum redefines the Optimizer virtual function to perform the optimization using COLIN. It first sets up the problem data, then executes optimize() on the COLIN solver and finally catalogues the results.

Implements Optimizer.

References Model::asynch_flag(), COLINOptimizer::colinEvalMgr, COLINOptimizer::colinProblem, COLINOptimizer::colinSolver, COLINOptimizer::constant_penalty, COLINOptimizer::constraint_penalty, Model::continuous_variables(), Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Model::discrete_int_variables(), Model::discrete_real_variables(), Model::evaluation_capacity(),

Iterator::iteratedModel, Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, Iterator::outputLevel, Dakota::set_value_to_index(), and COLINOptimizer::solverType.

43.13.3.2 bool returns_multiple_points () const [virtual]

some COLIN methods can return multiple points Designate which solvers can return multiple final points.

Reimplemented from Iterator.

References COLINOptimizer::solverType.

43.13.3.3 void solver_setup (Model & *model*) [protected]

convenience function for setting up the particular COLIN solver and appropriate Application This convenience function is called by the constructors in order to instantiate the solver.

References COLINOptimizer::colinProblem, COLINOptimizer::colinSolver, COLINOptimizer::constant_penalty, COLINOptimizer::constraint_penalty, ProblemDescDB::get_string(), Iterator::method_name(), Iterator::probDescDB, and COLINOptimizer::solverType.

Referenced by COLINOptimizer::COLINOptimizer().

43.13.3.4 void set_rng (int *seed*) [protected]

sets up the random number generator for stochastic methods Instantiate random number generator (RNG).

References COLINOptimizer::colinSolver, and COLINOptimizer::rng.

Referenced by COLINOptimizer::COLINOptimizer().

43.13.3.5 void set_solver_parameters () [protected]

sets construct-time options for specific methods based on user specifications, including calling method-specific set functions Sets solver properties based on user specifications. Called at construction time.

References Model::asynch_flag(), COLINOptimizer::blockingSynch, COLINOptimizer::colinSolver, COLINOptimizer::constant_penalty, COLINOptimizer::constraint_penalty, Iterator::convergenceTol, ProblemDescDB::get_bool(), ProblemDescDB::get_dsa(), ProblemDescDB::get_int(), ProblemDescDB::get_real(), ProblemDescDB::get_string(), ProblemDescDB::is_null(), Iterator::iteratedModel, Iterator::maxConcurrency, Iterator::maxFunctionEvals, Iterator::maxIterations, Iterator::numContinuousVars, Iterator::outputLevel, Iterator::probDescDB, and COLINOptimizer::solverType.

Referenced by COLINOptimizer::COLINOptimizer().

43.13.3.6 void post_run (std::ostream & *s*) [protected, virtual]

Get the final set of points from the solver Look up responses and sort, first according to constraint violation, then according to function value. This overrides Optimizer::post_run(). Do this because we need to unscale variables in order to look responses up in the database.

Reimplemented from Optimizer.

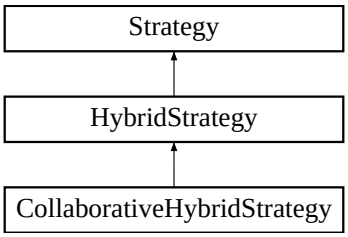
References Iterator::bestResponseArray, Iterator::bestVariablesArray, COLINOptimizer::colinProblem, COLINOptimizer::colinSolver, Variables::continuous_variables(), Response::copy(), Variables::copy(), Model::current_response(), Model::current_variables(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Dakota::data_pairs, Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Variables::discrete_int_variable(), Variables::discrete_real_variable(), Response::function_values(), Model::interface_id(), Iterator::iteratedModel, Optimizer::localObjectiveRecast, Dakota::lookup_by_val(), Minimizer::modify_s2n(), Model::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Model::num_nonlinear_eq_constraints(), Model::num_nonlinear_ineq_constraints(), Iterator::numContinuousVars, Iterator::numDiscreteIntVars, Iterator::numFinalSolutions, Iterator::numFunctions, Minimizer::numUserPrimaryFns, Minimizer::objective(), Model::primary_response_fn_weights(), COLINOptimizer::resize_final_points(), COLINOptimizer::resize_final_responses(), Minimizer::scaleFlag, Dakota::set_index_to_value(), Model::subordinate_model(), and Minimizer::varsScaleFlag.

The documentation for this class was generated from the following files:

- COLINOptimizer.H
- COLINOptimizer.C

43.14 CollaborativeHybridStrategy Class Reference

Strategy for hybrid minimization using multiple collaborating optimization and nonlinear least squares methods. Inheritance diagram for CollaborativeHybridStrategy::



Public Member Functions

- CollaborativeHybridStrategy (ProblemDescDB &problem_db)

  constructor

- ~CollaborativeHybridStrategy ()

  destructor

Protected Member Functions

- void run_strategy ()

  Performs the collaborative hybrid minimization strategy.

- const Variables & variables_results () const

  return the final solution from the collaborative minimization (variables)

- const Response & response_results () const

  return the final solution from the collaborative minimization (response)

Private Attributes

- String hybridCollabType

  abo or hops

- Variables bestVariables

  best variables found in minimization

- Response bestResponse

  best response found in minimization

43.14.1 Detailed Description

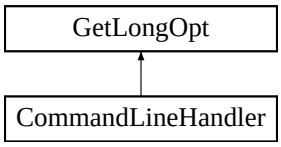
Strategy for hybrid minimization using multiple collaborating optimization and nonlinear least squares methods. This strategy has two approaches to hybrid minimization: (1) agent-based using the ABO framework; (2) nonagent-based using the HOPSPACK framework.

The documentation for this class was generated from the following files:

- CollaborativeHybridStrategy.H
- CollaborativeHybridStrategy.C

43.15 CommandLineHandler Class Reference

Utility class for managing command line inputs to DAKOTA. Inheritance diagram for CommandLineHandler::



Public Member Functions

- CommandLineHandler ()

  default constructor, requires check_usage() call for parsing

- CommandLineHandler (int argc, char **argv)

  constructor with parsing

- ~CommandLineHandler ()

  destructor

- void check_usage (int argc, char **argv)

  Verifies that DAKOTA is called with the correct command usage. Prints a descriptive message and exits the program if incorrect.

- int read_restart_evals () const

  Returns the number of evaluations to be read from the restart file (as specified on the DAKOTA command line) as an integer instead of a const char.*

- bool instantiate_flag () const

  Whether command line args dictate instantiation of objects for run.

Private Member Functions

- void initialize_options ()

  enrolls the supported command line inputs.

- void output_version (std::ostream &s) const

  outputs the DAKOTA version

43.15.1 Detailed Description

Utility class for managing command line inputs to DAKOTA. CommandLineHandler provides additional functionality that is specific to DAKOTA's needs for the definition and parsing of command line options. Inheritance is used to allow the class to have all the functionality of the base class, GetLongOpt.

43.15.2 Member Function Documentation

43.15.2.1 bool instantiate_flag () const [inline]

Whether command line args dictate instantiation of objects for run. Instantiate objects if not just getting help or version

References GetLongOpt::retrieve().

Referenced by main().

The documentation for this class was generated from the following files:

- CommandLineHandler.H
- CommandLineHandler.C

43.16 CommandShell Class Reference

Utility class which defines convenience operators for spawning processes with system calls.

Public Member Functions

- CommandShell (const std::string &work_dir)

  constructor

- ~CommandShell ()

  destructor

- CommandShell & operator<< (const char *cmd)

  appends cmd to sysCommand

- CommandShell & operator<< (const std::string &cmd)

  convenient operator: appends string to the commandString to be executed

- CommandShell & operator<< (CommandShell &(*f)(CommandShell &))

  allows passing of the flush function to the shell using <<

- CommandShell & flush ()

  "flushes" the shell; i.e. executes the sysCommand

- void asynch_flag (const bool flag)

  set the asynchFlag

- bool asynch_flag () const

  get the asynchFlag

- void suppress_output_flag (const bool flag)

  set the suppressOutputFlag

- bool suppress_output_flag () const

  get the suppressOutputFlag

Private Attributes

- const std::string & workDir

  To convey working directory when useWorkdir is true:.

- std::string sysCommand

  The command string that is constructed through one or more << insertions and then executed by flush.

- bool asynchFlag

  flags nonblocking operation (background system calls)

- bool suppressOutputFlag

  flags suppression of shell output (no command echo)

43.16.1 Detailed Description

Utility class which defines convenience operators for spawning processes with system calls. The CommandShell class wraps the C system() utility and defines convenience operators for building a command string and then passing it to the shell.

43.16.2 Member Function Documentation

43.16.2.1 CommandShell & operator<< (const char * *cmd*) `[inline]`

appends cmd to sysCommand convenient operator: appends string to the commandString to be executed

References CommandShell::sysCommand.

43.16.2.2 CommandShell & operator<< (CommandShell &(*)(CommandShell &) *f*) `[inline]`

allows passing of the flush function to the shell using << convenience operator: allows passing of the flush func to the shell via <<

43.16.2.3 CommandShell & flush ()

"flushes" the shell; i.e. executes the sysCommand Executes the sysCommand by passing it to system(). Appends an "&" if asynchFlag is set (background system call) and echos the sysCommand to Cout if suppressOutputFlag is not set.

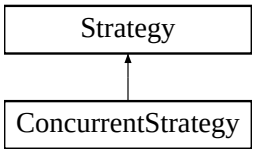
References Dakota::abort_handler(), CommandShell::asynchFlag, CommandShell::suppressOutputFlag, CommandShell::sysCommand, and CommandShell::workDir.

The documentation for this class was generated from the following files:

- CommandShell.H
- CommandShell.C

43.17 ConcurrentStrategy Class Reference

Strategy for multi-start iteration or pareto set optimization. Inheritance diagram for ConcurrentStrategy::



Public Member Functions

- ConcurrentStrategy (ProblemDescDB &problem_db)

  constructor

- ~ConcurrentStrategy ()

  destructor

Protected Member Functions

- void run_strategy ()

  Performs the concurrent strategy by executing selectedIterator on userDefinedModel multiple times in parallel for different settings within the iterator or model.

- void initialize_iterator (int job_index)

  initialize the iterator about to be executed within a parallel iterator scheduling function (serve_iterators() or static_schedule_iterators())

- void pack_parameters_buffer (MPIPackBuffer &send_buffer, int job_index)

  pack a send_buffer for assigning an iterator job to a server

- void unpack_parameters_buffer (MPIUnpackBuffer &recv_buffer)

  unpack a recv_buffer for accepting an iterator job from the scheduler

- void pack_results_buffer (MPIPackBuffer &send_buffer, int job_index)

  pack a send_buffer for returning iterator results from a server

- void unpack_results_buffer (MPIUnpackBuffer &recv_buffer, int job_index)

  unpack a recv_buffer for accepting iterator results from a server

- void update_local_results (int job_index)

  update local PRP results arrays with current iteration results

Private Member Functions

- void initialize_iterator (const RealVector &param_set)

  called by unpack_parameters_buffer(MPIUnpackBuffer) and initialize_iterator(int) to update userDefinedModel and selectedIterator

- void print_results () const

  prints the concurrent iteration results summary (called by run_strategy())

Private Attributes

- Model userDefinedModel

  the model used by the iterator

- Iterator selectedIterator

  the iterator used by the concurrent strategy

- bool multiStartFlag

  distinguishes multi-start from Pareto-set

- RealVector initialPt

  the initial continuous variables for restoring the starting point in the Pareto set strategy

- RealVectorArray parameterSets

  an array of parameter set vectors (either multistart variable sets or pareto multi-objective/least squares weighting sets) to be performed.

- PRPArray prpResults

  1-d array of ParamResponsePair results corresponding to numIteratorJobs

43.17.1 Detailed Description

Strategy for multi-start iteration or pareto set optimization. This strategy maintains two concurrent iterator capabilities. First, a general capability for running an iterator multiple times from different starting points is provided (often used for multi-start optimization, but not restricted to optimization). Second, a simple capability for mapping the "pareto frontier" (the set of optimal solutions in multiobjective formulations) is provided. This pareto set is mapped through running an optimizer multiple times for different sets of multiobjective weightings.

43.17.2 Member Function Documentation

43.17.2.1 void pack_parameters_buffer (MPIPackBuffer & *send_buffer*, int *job_index*) `[inline, protected, virtual]`

pack a send_buffer for assigning an iterator job to a server This virtual function redefinition is executed on the dedicated master processor for self scheduling. It is not used for peer partitions.

Reimplemented from Strategy.

References ConcurrentStrategy::parameterSets.

43.17.2.2 void unpack_parameters_buffer (MPIUnpackBuffer & *recv_buffer*) [inline, protected, virtual]

unpack a recv_buffer for accepting an iterator job from the scheduler This virtual function redefinition is executed on an iterator server for dedicated master self scheduling. It is not used for peer partitions.

Reimplemented from Strategy.

References ConcurrentStrategy::initialize_iterator().

43.17.2.3 void pack_results_buffer (MPIPackBuffer & *send_buffer*, int *job_index*) [inline, protected, virtual]

pack a send_buffer for returning iterator results from a server This virtual function redefinition is executed either on an iterator server for dedicated master self scheduling or on peers 2 through n for static scheduling.

Reimplemented from Strategy.

References ConcurrentStrategy::prpResults.

43.17.2.4 void unpack_results_buffer (MPIUnpackBuffer & *recv_buffer*, int *job_index*) [inline, protected, virtual]

unpack a recv_buffer for accepting iterator results from a server This virtual function redefinition is executed on an strategy master (either the dedicated master processor for self scheduling or peer 1 for static scheduling).

Reimplemented from Strategy.

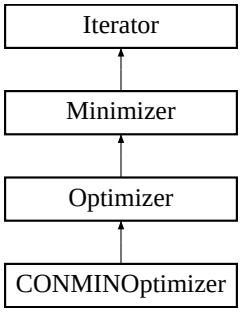
References ConcurrentStrategy::prpResults.

The documentation for this class was generated from the following files:

- ConcurrentStrategy.H
- ConcurrentStrategy.C

43.18 CONMINOptimizer Class Reference

Wrapper class for the CONMIN optimization library. Inheritance diagram for CONMINOptimizer::



Public Member Functions

- CONMINOptimizer (Model &model)

  standard constructor

- CONMINOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor

- ~CONMINOptimizer ()

  destructor

- void find_optimum ()

  Used within the optimizer branch for computing the optimal solution. Redefines the run virtual function for the optimizer branch.

Protected Member Functions

- void initialize_run ()

  performs run-time set up

Private Member Functions

- void initialize ()

  Shared constructor code.

- void allocate_workspace ()

  Allocates workspace for the optimizer.

- void deallocate_workspace ()

  Releases workspace memory.

- void allocate_constraints ()

  Allocates constraint mappings.

Private Attributes

- int conminInfo

  INFO from CONMIN manual.

- int printControl

  IPRINT from CONMIN manual (controls output verbosity).

- int optimizationType

  MINMAX from DOT manual (minimize or maximize).

- Real objFnValue

  value of the objective function passed to CONMIN

- RealVector constraintValues

  array of nonlinear constraint values passed to CONMIN

- int numConminNlnConstr

  total number of nonlinear constraints seen by CONMIN

- int numConminLinConstr

  total number of linear constraints seen by CONMIN

- int numConminConstr

  total number of linear and nonlinear constraints seen by CONMIN

- SizetArray constraintMappingIndices

  a container of indices for referencing the corresponding Response constraints used in computing the CONMIN constraints.

- RealArray constraintMappingMultipliers

  a container of multipliers for mapping the Response constraints to the CONMIN constraints.

- RealArray constraintMappingOffsets

  a container of offsets for mapping the Response constraints to the CONMIN constraints.

- int N1

  Size variable for CONMIN arrays. See CONMIN manual.

- int N2

  Size variable for CONMIN arrays. See CONMIN manual.

- int N3

  Size variable for CONMIN arrays. See CONMIN manual.

- int N4

  Size variable for CONMIN arrays. See CONMIN manual.

- int N5

  Size variable for CONMIN arrays. See CONMIN manual.

- int NFDG

  Finite difference flag.

- int IPRINT

  Flag to control amount of output data.

- int ITMAX

  Flag to specify the maximum number of iterations.

- double FDCH

  Relative finite difference step size.

- double FDCHM

  Absolute finite difference step size.

- double CT

  Constraint thickness parameter.

- double CTMIN

  Minimum absolute value of CT used during optimization.

- double CTL

  Constraint thickness parameter for linear and side constraints.

- double CTLMIN

  Minimum value of CTL used during optimization.

- double DELFUN

  Relative convergence criterion threshold.

- double DABFUN

  Absolute convergence criterion threshold.

- double * conminDesVars

Array of design variables used by CONMIN (length N1 = numdv+2).

- double * conminLowerBnds

  Array of lower bounds used by CONMIN (length N1 = numdv+2).

- double * conminUpperBnds

  Array of upper bounds used by CONMIN (length N1 = numdv+2).

- double * S

  Internal CONMIN array.

- double * G1

  Internal CONMIN array.

- double * G2

  Internal CONMIN array.

- double * B

  Internal CONMIN array.

- double * C

  Internal CONMIN array.

- int * MS1

  Internal CONMIN array.

- double * SCAL

  Internal CONMIN array.

- double * DF

  Internal CONMIN array.

- double * A

  Internal CONMIN array.

- int * ISC

  Internal CONMIN array.

- int * IC

  Internal CONMIN array.

43.18.1 Detailed Description

Wrapper class for the CONMIN optimization library. The CONMINOptimizer class provides a wrapper for CONMIN, a Public-domain Fortran 77 optimization library written by Gary Vanderplaats under contract to NASA Ames Research Center. The CONMIN User's Manual is contained in NASA Technical Memorandum X-62282, 1978. CONMIN uses a reverse communication mode, which avoids the static member function issues that arise with function pointer designs (see NPSOLOptimizer and SNLLOptimizer).

The user input mappings are as follows: `max_iterations` is mapped into CONMIN's `ITMAX` parameter, `max_function_evaluations` is implemented directly in the find_optimum() loop since there is no CONMIN parameter equivalent, `convergence_tolerance` is mapped into CONMIN's `DELFUN` and `DABFUN` parameters, `output` verbosity is mapped into CONMIN's `IPRINT` parameter (verbose: `IPRINT` = 4; quiet: `IPRINT` = 2), gradient mode is mapped into CONMIN's `NFDG` parameter, and finite difference step size is mapped into CONMIN's `FDCH` and `FDCHM` parameters. Refer to [Vanderplaats, 1978] for additional information on CONMIN parameters.

43.18.2 Member Data Documentation

43.18.2.1 int conminInfo [private]

INFO from CONMIN manual. Information requested by CONMIN: 1 = evaluate objective and constraints, 2 = evaluate gradients of objective and constraints.

Referenced by CONMINOptimizer::find_optimum(), and CONMINOptimizer::initialize().

43.18.2.2 int printControl [private]

IPRINT from CONMIN manual (controls output verbosity). Values range from 0 (nothing) to 4 (most output). 0 = nothing, 1 = initial and final function information, 2 = all of #1 plus function value and design vars at each iteration, 3 = all of #2 plus constraint values and direction vectors, 4 = all of #3 plus gradients of the objective function and constraints, 5 = all of #4 plus proposed design vector, plus objective and constraint functions from the 1-D search

Referenced by CONMINOptimizer::initialize().

43.18.2.3 int optimizationType [private]

MINMAX from DOT manual (minimize or maximize). Values of 0 or -1 (minimize) or 1 (maximize).

43.18.2.4 RealVector constraintValues [private]

array of nonlinear constraint values passed to CONMIN This array must be of nonzero length and must contain only one-sided inequality constraints which are <= 0 (which requires a transformation from 2-sided inequalities and equalities).

Referenced by CONMINOptimizer::allocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.5 SizetArray constraintMappingIndices [private]

a container of indices for referencing the corresponding Response constraints used in computing the CONMIN constraints. The length of the container corresponds to the number of CONMIN constraints, and each entry in the container points to the corresponding DAKOTA constraint.

Referenced by CONMINOptimizer::allocate_constraints(), and CONMINOptimizer::find_optimum().

43.18.2.6 RealArray constraintMappingMultipliers [private]

a container of multipliers for mapping the Response constraints to the CONMIN constraints. The length of the container corresponds to the number of CONMIN constraints, and each entry in the container stores a multiplier for the DAKOTA constraint identified with constraintMappingIndices. These multipliers are currently +1 or -1.

Referenced by CONMINOptimizer::allocate_constraints(), and CONMINOptimizer::find_optimum().

43.18.2.7 RealArray constraintMappingOffsets [private]

a container of offsets for mapping the Response constraints to the CONMIN constraints. The length of the container corresponds to the number of CONMIN constraints, and each entry in the container stores an offset for the DAKOTA constraint identified with constraintMappingIndices. These offsets involve inequality bounds or equality targets, since CONMIN assumes constraint allowables = 0.

Referenced by CONMINOptimizer::allocate_constraints(), and CONMINOptimizer::find_optimum().

43.18.2.8 int N1 [private]

Size variable for CONMIN arrays. See CONMIN manual. N1 = number of variables + 2

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::find_optimum(), and CONMINOptimizer::initialize_run().

43.18.2.9 int N2 [private]

Size variable for CONMIN arrays. See CONMIN manual. N2 = number of constraints + 2∗(number of variables)

Referenced by CONMINOptimizer::allocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.10 int N3 [private]

Size variable for CONMIN arrays. See CONMIN manual. N3 = Maximum possible number of active constraints.

Referenced by CONMINOptimizer::allocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.11 int N4 [private]

Size variable for CONMIN arrays. See CONMIN manual. N4 = Maximum(N3,number of variables)

Referenced by CONMINOptimizer::allocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.12 int N5 [private]

Size variable for CONMIN arrays. See CONMIN manual. N5 = 2∗(N4)

Referenced by CONMINOptimizer::allocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.13 double CT [private]

Constraint thickness parameter. The value of CT decreases in magnitude during optimization.

Referenced by CONMINOptimizer::find_optimum(), and CONMINOptimizer::initialize().

43.18.2.14 double∗ S [private]

Internal CONMIN array. Move direction in N-dimensional space.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.15 double∗ G1 [private]

Internal CONMIN array. Temporary storage of constraint values.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.16 double∗ G2 [private]

Internal CONMIN array. Temporary storage of constraint values.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.17 double∗ B [private]

Internal CONMIN array. Temporary storage for computations involving array S.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.18 double∗ C [private]

Internal CONMIN array. Temporary storage for use with arrays B and S.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.19 int* MS1 [private]

Internal CONMIN array. Temporary storage for use with arrays B and S.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.20 double* SCAL [private]

Internal CONMIN array. Vector of scaling parameters for design parameter values.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.21 double* DF [private]

Internal CONMIN array. Temporary storage for analytic gradient data.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.22 double* A [private]

Internal CONMIN array. Temporary 2-D array for storage of constraint gradients.

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), and CONMINOptimizer::find_optimum().

43.18.2.23 int* ISC [private]

Internal CONMIN array. Array of flags to identify linear constraints. (not used in this implementation of CONMIN)

Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), CONMINOptimizer::find_optimum(), and CONMINOptimizer::initialize_run().

43.18.2.24 int* IC [private]

Internal CONMIN array. Array of flags to identify active and violated constraints

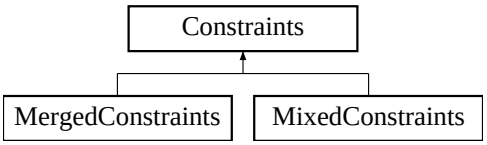
Referenced by CONMINOptimizer::allocate_workspace(), CONMINOptimizer::deallocate_workspace(), CONMINOptimizer::find_optimum(), and CONMINOptimizer::initialize_run().

The documentation for this class was generated from the following files:

- CONMINOptimizer.H
- CONMINOptimizer.C

43.19 Constraints Class Reference

Base class for the variable constraints class hierarchy. Inheritance diagram for Constraints::



Public Member Functions

- Constraints ()

  default constructor

- Constraints (const ProblemDescDB &prob_db, const SharedVariablesData &svd)

  standard constructor

- Constraints (const SharedVariablesData &svd)

  alternate constructor for instantiations on the fly

- Constraints (const Constraints &con)

  copy constructor

- virtual ~Constraints ()

  destructor

- Constraints operator= (const Constraints &con)

  assignment operator

- virtual void write (std::ostream &s) const

  write a variable constraints object to an std::ostream

- virtual void read (std::istream &s)

  read a variable constraints object from an std::istream

- virtual void reshape (const SizetArray &vc_totals)

  reshape the lower/upper bound arrays within the Constraints hierarchy

- const RealVector & continuous_lower_bounds () const

  return the active continuous variable lower bounds

- void continuous_lower_bounds (const RealVector &cl_bnds)

  set the active continuous variable lower bounds

- void continuous_lower_bound (const Real &cl_bnd, const size_t &i)
  set an active continuous variable lower bound
- const RealVector & continuous_upper_bounds () const
  return the active continuous variable upper bounds
- void continuous_upper_bounds (const RealVector &cu_bnds)
  set the active continuous variable upper bounds
- void continuous_upper_bound (const Real &cu_bnd, const size_t &i)
  set an active continuous variable upper bound
- const IntVector & discrete_int_lower_bounds () const
  return the active discrete variable lower bounds
- void discrete_int_lower_bounds (const IntVector &dil_bnds)
  set the active discrete variable lower bounds
- void discrete_int_lower_bound (const int &dil_bnd, const size_t &i)
  set an active discrete variable lower bound
- const IntVector & discrete_int_upper_bounds () const
  return the active discrete variable upper bounds
- void discrete_int_upper_bounds (const IntVector &diu_bnds)
  set the active discrete variable upper bounds
- void discrete_int_upper_bound (const int &diu_bnd, const size_t &i)
  set an active discrete variable upper bound
- const RealVector & discrete_real_lower_bounds () const
  return the active discrete variable lower bounds
- void discrete_real_lower_bounds (const RealVector &drl_bnds)
  set the active discrete variable lower bounds
- void discrete_real_lower_bound (const Real &drl_bnd, const size_t &i)
  set an active discrete variable lower bound
- const RealVector & discrete_real_upper_bounds () const
  return the active discrete variable upper bounds
- void discrete_real_upper_bounds (const RealVector &dru_bnds)
  set the active discrete variable upper bounds
- void discrete_real_upper_bound (const Real &dru_bnd, const size_t &i)

set an active discrete variable upper bound

- const RealVector & inactive_continuous_lower_bounds () const
  return the inactive continuous lower bounds
- void inactive_continuous_lower_bounds (const RealVector &icl_bnds)
  set the inactive continuous lower bounds
- const RealVector & inactive_continuous_upper_bounds () const
  return the inactive continuous upper bounds
- void inactive_continuous_upper_bounds (const RealVector &icu_bnds)
  set the inactive continuous upper bounds
- const IntVector & inactive_discrete_int_lower_bounds () const
  return the inactive discrete lower bounds
- void inactive_discrete_int_lower_bounds (const IntVector &idil_bnds)
  set the inactive discrete lower bounds
- const IntVector & inactive_discrete_int_upper_bounds () const
  return the inactive discrete upper bounds
- void inactive_discrete_int_upper_bounds (const IntVector &idiu_bnds)
  set the inactive discrete upper bounds
- const RealVector & inactive_discrete_real_lower_bounds () const
  return the inactive discrete lower bounds
- void inactive_discrete_real_lower_bounds (const RealVector &idrl_bnds)
  set the inactive discrete lower bounds
- const RealVector & inactive_discrete_real_upper_bounds () const
  return the inactive discrete upper bounds
- void inactive_discrete_real_upper_bounds (const RealVector &idru_bnds)
  set the inactive discrete upper bounds
- const RealVector & all_continuous_lower_bounds () const
  returns a single array with all continuous lower bounds
- void all_continuous_lower_bounds (const RealVector &acl_bnds)
  sets all continuous lower bounds using a single array
- void all_continuous_lower_bound (const Real &acl_bnd, const size_t &i)
  set a lower bound within the all continuous lower bounds array

- const RealVector & all_continuous_upper_bounds () const
  returns a single array with all continuous upper bounds
- void all_continuous_upper_bounds (const RealVector &acu_bnds)
  sets all continuous upper bounds using a single array
- void all_continuous_upper_bound (const Real &acu_bnd, const size_t &i)
  set an upper bound within the all continuous upper bounds array
- const IntVector & all_discrete_int_lower_bounds () const
  returns a single array with all discrete lower bounds
- void all_discrete_int_lower_bounds (const IntVector &adil_bnds)
  sets all discrete lower bounds using a single array
- void all_discrete_int_lower_bound (const int &adil_bnd, const size_t &i)
  set a lower bound within the all discrete lower bounds array
- const IntVector & all_discrete_int_upper_bounds () const
  returns a single array with all discrete upper bounds
- void all_discrete_int_upper_bounds (const IntVector &adiu_bnds)
  sets all discrete upper bounds using a single array
- void all_discrete_int_upper_bound (const int &adiu_bnd, const size_t &i)
  set an upper bound within the all discrete upper bounds array
- const RealVector & all_discrete_real_lower_bounds () const
  returns a single array with all discrete lower bounds
- void all_discrete_real_lower_bounds (const RealVector &adrl_bnds)
  sets all discrete lower bounds using a single array
- void all_discrete_real_lower_bound (const Real &adrl_bnd, const size_t &i)
  set a lower bound within the all discrete lower bounds array
- const RealVector & all_discrete_real_upper_bounds () const
  returns a single array with all discrete upper bounds
- void all_discrete_real_upper_bounds (const RealVector &adru_bnds)
  sets all discrete upper bounds using a single array
- void all_discrete_real_upper_bound (const Real &adru_bnd, const size_t &i)
  set an upper bound within the all discrete upper bounds array

- size_t num_linear_ineq_constraints () const

  return the number of linear inequality constraints

- size_t num_linear_eq_constraints () const

  return the number of linear equality constraints

- const RealMatrix & linear_ineq_constraint_coeffs () const

  return the linear inequality constraint coefficients

- void linear_ineq_constraint_coeffs (const RealMatrix &lin_ineq_coeffs)

  set the linear inequality constraint coefficients

- const RealVector & linear_ineq_constraint_lower_bounds () const

  return the linear inequality constraint lower bounds

- void linear_ineq_constraint_lower_bounds (const RealVector &lin_ineq_l_bnds)

  set the linear inequality constraint lower bounds

- const RealVector & linear_ineq_constraint_upper_bounds () const

  return the linear inequality constraint upper bounds

- void linear_ineq_constraint_upper_bounds (const RealVector &lin_ineq_u_bnds)

  set the linear inequality constraint upper bounds

- const RealMatrix & linear_eq_constraint_coeffs () const

  return the linear equality constraint coefficients

- void linear_eq_constraint_coeffs (const RealMatrix &lin_eq_coeffs)

  set the linear equality constraint coefficients

- const RealVector & linear_eq_constraint_targets () const

  return the linear equality constraint targets

- void linear_eq_constraint_targets (const RealVector &lin_eq_targets)

  set the linear equality constraint targets

- size_t num_nonlinear_ineq_constraints () const

  return the number of nonlinear inequality constraints

- size_t num_nonlinear_eq_constraints () const

  return the number of nonlinear equality constraints

- const RealVector & nonlinear_ineq_constraint_lower_bounds () const

  return the nonlinear inequality constraint lower bounds

- void nonlinear_ineq_constraint_lower_bounds (const RealVector &nln_ineq_l_bnds)

set the nonlinear inequality constraint lower bounds

- const RealVector & nonlinear_ineq_constraint_upper_bounds () const

  return the nonlinear inequality constraint upper bounds

- void nonlinear_ineq_constraint_upper_bounds (const RealVector &nln_ineq_u_bnds)

  set the nonlinear inequality constraint upper bounds

- const RealVector & nonlinear_eq_constraint_targets () const

  return the nonlinear equality constraint targets

- void nonlinear_eq_constraint_targets (const RealVector &nln_eq_targets)

  set the nonlinear equality constraint targets

- Constraints copy () const

  for use when a deep copy is needed (the representation is _not_ shared)

- void reshape (const size_t &num_nln_ineq_cons, const size_t &num_nln_eq_cons, const size_t &num_lin_ineq_cons, const size_t &num_lin_eq_cons, const SizetArray &vc_totals)

  reshape the linear/nonlinear/bound constraint arrays arrays within the Constraints hierarchy

- void reshape (const size_t &num_nln_ineq_cons, const size_t &num_nln_eq_cons, const size_t &num_lin_ineq_cons, const size_t &num_lin_eq_cons)

  reshape the linear/nonlinear constraint arrays within the Constraints hierarchy

- void inactive_view (short view2)

  sets the inactive view based on higher level (nested) context

- bool is_null () const

  function to check constraintsRep (does this envelope contain a letter)

Protected Member Functions

- Constraints (BaseConstructor, const ProblemDescDB &problem_db, const SharedVariablesData &svd)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- Constraints (BaseConstructor, const SharedVariablesData &svd)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- virtual void build_active_views ()

  construct active views of all variables bounds arrays

- virtual void build_inactive_views ()

construct inactive views of all variables bounds arrays

- void build_views ()

  construct active/inactive views of all variables arrays

- void manage_linear_constraints (const ProblemDescDB &problem_db)

  perform checks on user input, convert linear constraint coefficient input to matrices, and assign defaults

Protected Attributes

- SharedVariablesData sharedVarsData

  configuration data shared from a Variables instance

- RealVector allContinuousLowerBnds

  a continuous lower bounds array combining continuous design, uncertain, and continuous state variable types (all view).

- RealVector allContinuousUpperBnds

  a continuous upper bounds array combining continuous design, uncertain, and continuous state variable types (all view).

- IntVector allDiscreteIntLowerBnds

  a discrete lower bounds array combining discrete design and discrete state variable types (all view).

- IntVector allDiscreteIntUpperBnds

  a discrete upper bounds array combining discrete design and discrete state variable types (all view).

- RealVector allDiscreteRealLowerBnds

  a discrete lower bounds array combining discrete design and discrete state variable types (all view).

- RealVector allDiscreteRealUpperBnds

  a discrete upper bounds array combining discrete design and discrete state variable types (all view).

- size_t numNonlinearIneqCons

  number of nonlinear inequality constraints

- size_t numNonlinearEqCons

  number of nonlinear equality constraints

- RealVector nonlinearIneqConLowerBnds

  nonlinear inequality constraint lower bounds

- RealVector nonlinearIneqConUpperBnds

  nonlinear inequality constraint upper bounds

- RealVector nonlinearEqConTargets

  nonlinear equality constraint targets

- size_t numLinearIneqCons

  number of linear inequality constraints

- size_t numLinearEqCons

  number of linear equality constraints

- RealMatrix linearIneqConCoeffs

  linear inequality constraint coefficients

- RealMatrix linearEqConCoeffs

  linear equality constraint coefficients

- RealVector linearIneqConLowerBnds

  linear inequality constraint lower bounds

- RealVector linearIneqConUpperBnds

  linear inequality constraint upper bounds

- RealVector linearEqConTargets

  linear equality constraint targets

- RealVector continuousLowerBnds

  the active continuous lower bounds array view

- RealVector continuousUpperBnds

  the active continuous upper bounds array view

- IntVector discreteIntLowerBnds

  the active discrete lower bounds array view

- IntVector discreteIntUpperBnds

  the active discrete upper bounds array view

- RealVector discreteRealLowerBnds

  the active discrete lower bounds array view

- RealVector discreteRealUpperBnds

  the active discrete upper bounds array view

- RealVector inactiveContinuousLowerBnds

  the inactive continuous lower bounds array view

- RealVector inactiveContinuousUpperBnds

the inactive continuous upper bounds array view

- IntVector inactiveDiscreteIntLowerBnds

  the inactive discrete lower bounds array view

- IntVector inactiveDiscreteIntUpperBnds

  the inactive discrete upper bounds array view

- RealVector inactiveDiscreteRealLowerBnds

  the inactive discrete lower bounds array view

- RealVector inactiveDiscreteRealUpperBnds

  the inactive discrete upper bounds array view

Private Member Functions

- Constraints * get_constraints (const ProblemDescDB &problem_db, const SharedVariablesData &svd)

  Used only by the constructor to initialize constraintsRep to the appropriate derived type.

- Constraints * get_constraints (const SharedVariablesData &svd) const

  Used by copy() to initialize constraintsRep to the appropriate derived type.

Private Attributes

- Constraints * constraintsRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing constraintsRep

43.19.1 Detailed Description

Base class for the variable constraints class hierarchy. The Constraints class is the base class for the class hierarchy managing bound, linear, and nonlinear constraints. Using the variable lower and upper bounds arrays from the input specification, different derived classes define different views of this data. The linear and nonlinear constraint data is consistent in all views and is managed at the base class level. For memory efficiency and enhanced polymorphism, the variable constraints hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Constraints) serves as the envelope and one of the derived classes (selected in Constraints::get_constraints()) serves as the letter.

43.19.2 Constructor & Destructor Documentation

43.19.2.1 Constraints ()

default constructor The default constructor: constraintsRep is NULL in this case (a populated problem_db is needed to build a meaningful Constraints object). This makes it necessary to check for NULL in the copy constructor, assignment operator, and destructor.

43.19.2.2 Constraints (const ProblemDescDB & *problem_db*, const SharedVariablesData & *svd*)

standard constructor The envelope constructor only needs to extract enough data to properly execute get_constraints, since the constructor overloaded with BaseConstructor builds the actual base class data inherited by the derived classes.

References Dakota::abort_handler(), Constraints::constraintsRep, and Constraints::get_constraints().

43.19.2.3 Constraints (const SharedVariablesData & *svd*)

alternate constructor for instantiations on the fly Envelope constructor for instantiations on the fly. This constructor executes get_constraints(view), which invokes the default derived/base constructors, followed by a reshape() based on vars_comps.

References Dakota::abort_handler(), Constraints::constraintsRep, and Constraints::get_constraints().

43.19.2.4 Constraints (const Constraints & *con*)

copy constructor Copy constructor manages sharing of constraintsRep and incrementing of referenceCount.

References Constraints::constraintsRep, and Constraints::referenceCount.

43.19.2.5 ~Constraints () `[virtual]`

destructor Destructor decrements referenceCount and only deletes constraintsRep when referenceCount reaches zero.

References Constraints::constraintsRep, and Constraints::referenceCount.

43.19.2.6 Constraints (BaseConstructor, const ProblemDescDB & *problem_db*, const SharedVariablesData & *svd*) `[protected]`

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_constraints() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid recursion in the base class constructor calling get_constraints() again). Since the letter IS the representation, its rep pointer is set to NULL (an uninitialized pointer causes problems in ~Constraints).

43.19.2.7 Constraints (BaseConstructor, const SharedVariablesData & *svd*) [protected]

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_constraints() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid recursion in the base class constructor calling get_constraints() again). Since the letter IS the representation, its rep pointer is set to NULL (an uninitialized pointer causes problems in ∼Constraints).

43.19.3 Member Function Documentation

43.19.3.1 Constraints operator= (const Constraints & *con*)

assignment operator Assignment operator decrements referenceCount for old constraintsRep, assigns new constraintsRep, and increments referenceCount for new constraintsRep.

References Constraints::constraintsRep, and Constraints::referenceCount.

43.19.3.2 void reshape (const SizetArray & *vc_totals*) [virtual]

reshape the lower/upper bound arrays within the Constraints hierarchy Resizes the derived bounds arrays.

Reimplemented in MergedConstraints, and MixedConstraints.

References Constraints::constraintsRep, Constraints::continuousLowerBnds, Constraints::discreteIntLowerBnds, Constraints::discreteRealLowerBnds, Constraints::linearEqConCoeffs, Constraints::linearIneqConCoeffs, Constraints::numLinearEqCons, Constraints::numLinearIneqCons, and Constraints::reshape().

Referenced by DataFitSurrModel::DataFitSurrModel(), RecastModel::RecastModel(), and Constraints::reshape().

43.19.3.3 Constraints copy () const

for use when a deep copy is needed (the representation is _not_ shared) Deep copies are used for history mechanisms that catalogue permanent copies (should not change as the representation within userDefinedConstraints changes).

References Constraints::allContinuousLowerBnds, Constraints::allContinuousUpperBnds, Constraints::allDiscreteIntLowerBnds, Constraints::allDiscreteIntUpperBnds, Constraints::allDiscreteRealLowerBnds, Constraints::allDiscreteRealUpperBnds, Constraints::build_views(), Constraints::constraintsRep, Constraints::get_constraints(), Constraints::linearEqConCoeffs, Constraints::linearEqConTargets, Constraints::linearIneqConCoeffs, Constraints::linearIneqConLowerBnds, Constraints::linearIneqConUpperBnds, Constraints::nonlinearEqConTargets, Constraints::nonlinearIneqConLowerBnds, Constraints::nonlinearIneqConUpperBnds, Constraints::numLinearEqCons, Constraints::numLinearIneqCons, Constraints::numNonlinearEqCons, Constraints::numNonlinearIneqCons, and Constraints::sharedVarsData.

Referenced by SurrogateModel::force_rebuild(), and RecastModel::RecastModel().

43.19.3.4 void reshape (const size_t & *num_nln_ineq_cons*, const size_t & *num_nln_eq_cons*, const size_t & *num_lin_ineq_cons*, const size_t & *num_lin_eq_cons*)

reshape the linear/nonlinear constraint arrays within the Constraints hierarchy Resizes the linear and nonlinear constraint arrays at the base class. Does NOT currently resize the derived bounds arrays.

References Constraints::constraintsRep, Constraints::linearEqConTargets, Constraints::linearIneqConLowerBnds, Constraints::linearIneqConUpperBnds, Constraints::nonlinearEqConTargets, Constraints::nonlinearIneqConLowerBnds, Constraints::nonlinearIneqConUpperBnds, Constraints::numLinearEqCons, Constraints::numLinearIneqCons, Constraints::numNonlinearEqCons, Constraints::numNonlinearIneqCons, and Constraints::reshape().

43.19.3.5 void build_views () `[inline, protected]`

construct active/inactive views of all variables arrays

= EMPTY)

= EMPTY)

References Constraints::build_active_views(), Constraints::build_inactive_views(), Constraints::sharedVarsData, and SharedVariablesData::view().

Referenced by Constraints::copy(), MergedConstraints::MergedConstraints(), MixedConstraints::MixedConstraints(), MixedConstraints::reshape(), and MergedConstraints::reshape().

43.19.3.6 void manage_linear_constraints (const ProblemDescDB & *problem_db*) `[protected]`

perform checks on user input, convert linear constraint coefficient input to matrices, and assign defaults Convenience function called from derived class constructors. The number of variables active for applying linear constraints is currently defined to be the number of active continuous variables plus the number of active discrete variables (the most general case), even though very few optimizers can currently support mixed variable linear constraints.

References Dakota::abort_handler(), Constraints::continuousLowerBnds, Dakota::copy_data(), Constraints::discreteIntLowerBnds, Constraints::discreteRealLowerBnds, ProblemDescDB::get_rdv(), Constraints::linearEqConCoeffs, Constraints::linearEqConTargets, Constraints::linearIneqConCoeffs, Constraints::linearIneqConLowerBnds, Constraints::linearIneqConUpperBnds, Constraints::numLinearEqCons, and Constraints::numLinearIneqCons.

Referenced by MergedConstraints::MergedConstraints(), and MixedConstraints::MixedConstraints().

43.19.3.7 Constraints * get_constraints (const ProblemDescDB & *problem_db*, const SharedVariablesData & *svd*) `[private]`

Used only by the constructor to initialize constraintsRep to the appropriate derived type. Initializes constraintsRep to the appropriate derived type, as given by the variables view.

References SharedVariablesData::view().

Referenced by Constraints::Constraints(), and Constraints::copy().

43.19.3.8 Constraints * get_constraints (const SharedVariablesData & *svd*) const [private]

Used by copy() to initialize constraintsRep to the appropriate derived type. Initializes constraintsRep to the appropriate derived type, as given by the variables view. The default derived class constructors are invoked.

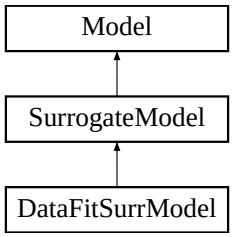
References SharedVariablesData::view().

The documentation for this class was generated from the following files:

- DakotaConstraints.H
- DakotaConstraints.C

43.20 DataFitSurrModel Class Reference

Derived model class within the surrogate model branch for managing data fit surrogates (global and local). Inheritance diagram for DataFitSurrModel::



Public Member Functions

- DataFitSurrModel (ProblemDescDB &problem_db)

  constructor

- DataFitSurrModel (Iterator &dace_iterator, Model &actual_model, const String &approx_type, const UShortArray &approx_order, short corr_type, short corr_order, short data_order, const String &point_reuse, short output_level=NORMAL_OUTPUT)

  alternate constructor for instantiations on the fly

- ~DataFitSurrModel ()

  destructor

- void total_points (int points)

  set pointsTotal and pointsManagement mode

Protected Member Functions

- void derived_compute_response (const ActiveSet &set)

  portion of compute_response() specific to DataFitSurrModel

- void derived_asynch_compute_response (const ActiveSet &set)

  portion of asynch_compute_response() specific to DataFitSurrModel

- const IntResponseMap & derived_synchronize ()

  portion of synchronize() specific to DataFitSurrModel

- const IntResponseMap & derived_synchronize_nowait ()

  portion of synchronize_nowait() specific to DataFitSurrModel

- Iterator & subordinate_iterator ()

return daceIterator

- Model & surrogate_model ()

  return this model instance

- Model & truth_model ()

  return actualModel

- void derived_subordinate_models (ModelList &ml, bool recurse_flag)

  return actualModel (and optionally its sub-models)

- void update_from_subordinate_model (bool recurse_flag=true)

  pass request to actualModel if recursing and then update from it

- Interface & interface ()

  return approxInterface

- void primary_response_fn_weights (const RealVector &wts, bool recurse_flag=true)

  set the relative weightings for multiple objective functions or least squares terms and optionally recurses into actualModel

- void surrogate_response_mode (short mode)

  set responseMode and pass any bypass request on to actualModel for any lower-level surrogates.

- void surrogate_function_indices (const IntSet &surr_fn_indices)

  (re)set the surrogate index set in SurrogateModel::surrogateFnIndices and ApproximationInterface::approxFnIndices

- void build_approximation ()

  Builds the local/multipoint/global approximation using daceIterator/actualModel to generate new data points.

- bool build_approximation (const Variables &vars, const IntResponsePair &response_pr)

  Builds the local/multipoint/global approximation using daceIterator/actualModel to generate new data points that augment the vars/response anchor point.

- void update_approximation (bool rebuild_flag)

  replaces the approximation data with daceIterator results and rebuilds the approximation if requested

- void update_approximation (const Variables &vars, const IntResponsePair &response_pr, bool rebuild_flag)

  replaces the anchor point, and rebuilds the approximation if requested

- void update_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map, bool rebuild_flag)

  replaces the current points array and rebuilds the approximation if requested

- void append_approximation (bool rebuild_flag)

appends daceIterator results to a global approximation and rebuilds it if requested

- void append_approximation (const Variables &vars, const IntResponsePair &response_pr, bool rebuild_flag)

  appends a point to a global approximation and rebuilds it if requested

- void append_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map, bool rebuild_flag)

  appends an array of points to a global approximation and rebuilds it if requested

- void pop_approximation (bool save_surr_data)

  remove approximation data added on previous append_approximation() call

- void restore_approximation ()

  restore a previous approximation data state

- bool restore_available ()

  query for whether a trial increment is restorable

- void finalize_approximation ()

  finalize data fit by applying all previous trial increments

- void store_approximation ()

  store the current data fit approximation for later combination

- void combine_approximation (short corr_type)

  combine the current data fit approximation with one previously stored

- std::vector< Approximation > & approximations ()

  retrieve the set of Approximations from approxInterface

- const RealVectorArray & approximation_coefficients ()

  return the approximation coefficients from each Approximation (request forwarded to approxInterface)

- void approximation_coefficients (const RealVectorArray &approx_coeffs)

  set the approximation coefficients within each Approximation (request forwarded to approxInterface)

- const RealVector & approximation_variances (const RealVector &c_vars)

  return the approximation variance from each Approximation (request forwarded to approxInterface)

- const Pecos::SurrogateData & approximation_data (size_t index)

  return the approximation data from a particular Approximation (request forwarded to approxInterface)

- void component_parallel_mode (short mode)

  update component parallel mode for supporting parallelism in actualModel

- void derived_init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set up actualModel for parallel operations

- void derived_init_serial ()

  set up actualModel for serial operations.

- void derived_set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set active parallel configuration within actualModel

- void derived_free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  deallocate communicator partitions for the DataFitSurrModel (request forwarded to actualModel)

- void serve ()

  Service actualModel job requests received from the master. Completes when a termination message is received from stop_servers().

- void stop_servers ()

  Executed by the master to terminate actualModel server operations when DataFitSurrModel iteration is complete.

- void inactive_view (short view, bool recurse_flag=true)

  update the Model's inactive view based on higher level (nested) context and optionally recurse into actualModel

- const String & interface_id () const

  return the approxInterface identifier

- int evaluation_id () const

  return the current evaluation id for the DataFitSurrModel

- void set_evaluation_reference ()

  set the evaluation counter reference points for the DataFitSurrModel (request forwarded to approxInterface and actualModel)

- void fine_grained_evaluation_counters ()

  request fine-grained evaluation reporting within approxInterface and actualModel

- void print_evaluation_summary (std::ostream &s, bool minimal_header=false, bool relative_count=true) const

  print the evaluation summary for the DataFitSurrModel (request forwarded to approxInterface and actualModel)

Private Member Functions

- void derived_synchronize_approx (const IntResponseMap &approx_resp_map, IntResponseMap &approx_resp_map_rekey)

  Common code for processing of approximate response maps shared by derived_synchronize() and derived_synchronize_nowait().

- void update_global ()

  Updates fit arrays for global approximations.

- void update_local_multipoint ()

  Updates fit arrays for local or multipoint approximations.

- void build_global ()

  Builds a global approximation using daceIterator.

- void build_local_multipoint ()

  Builds a local or multipoint approximation using actualModel.

- void update_actual_model ()

  update actualModel with data from current variables/labels/bounds/targets

- void update_from_actual_model ()

  update current variables/labels/bounds/targets with data from actualModel

- bool inside (const RealVector &c_vars, const IntVector &di_vars, const RealVector &dr_vars)

  test if c_vars and d_vars are within [c_l_bnds,c_u_bnds] and [d_l_bnds,d_u_bnds]

Private Attributes

- int surrModelEvalCntr

  number of calls to derived_compute_response()/ derived_asynch_compute_response()

- int pointsTotal

  total points the user specified to construct the surrogate

- short pointsManagement

  configuration for points management in build_global()

- String pointReuse

  type of point reuse for approximation builds: `all`, `region` (default if points file), or `none` (default if no points file)

- String pointReuseFile

  file name for `points_file` specification

- VariablesList reuseFileVars

  array of variables sets read from the `points_file`

- ResponseList reuseFileResponses

  array of response sets read from the `points_file`

- Interface approxInterface

  manages the building and subsequent evaluation of the approximations (required for both global and local)

- Model actualModel

  the truth model which provides evaluations for building the surrogate (optional for global, required for local)

- Iterator daceIterator

  selects parameter sets on which to evaluate actualModel in order to generate the necessary data for building global approximations (optional for global since restart data may also be used)

43.20.1 Detailed Description

Derived model class within the surrogate model branch for managing data fit surrogates (global and local). The DataFitSurrModel class manages global or local approximations (surrogates that involve data fits) that are used in place of an expensive model. The class contains an approxInterface (required for both global and local) which manages the approximate function evaluations, an actualModel (optional for global, required for local) which provides truth evaluations for building the surrogate, and a daceIterator (optional for global, not used for local) which selects parameter sets on which to evaluate actualModel in order to generate the necessary data for building global approximations.

43.20.2 Member Function Documentation

43.20.2.1 void derived_compute_response (const ActiveSet & *set*) `[protected, virtual]`

portion of compute_response() specific to DataFitSurrModel Compute the response synchronously using actualModel, approxInterface, or both (mixed case). For the approxInterface portion, build the approximation if needed, evaluate the approximate response, and apply correction (if active) to the results.

Reimplemented from Model.

References DiscrepancyCorrection::active(), Response::active_set(), DataFitSurrModel::actualModel, DiscrepancyCorrection::apply(), SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, SurrogateModel::asv_mapping(), DataFitSurrModel::build_approximation(), DataFitSurrModel::component_parallel_mode(), DiscrepancyCorrection::compute(), Model::compute_response(), Variables::continuous_variables(), Response::copy(), Model::current_response(), Model::currentResponse, Model::currentVariables, SurrogateModel::deltaCorr, SurrogateModel::force_rebuild(), Interface::map(), Model::outputLevel, ActiveSet::request_vector(), SurrogateModel::response_mapping(), SurrogateModel::responseMode, DataFitSurrModel::surrModelEvalCntr, Response::update(), and DataFitSurrModel::update_actual_model().

43.20.2.2 void derived_asynch_compute_response (const ActiveSet & *set*) `[protected, virtual]`

portion of asynch_compute_response() specific to DataFitSurrModel Compute the response asynchronously using actualModel, approxInterface, or both (mixed case). For the approxInterface portion, build the approximation if needed and evaluate the approximate response in a quasi-asynchronous approach (ApproximationInterface::map() performs the map synchronously and bookkeeps the results for return in derived_synchronize() below).

Reimplemented from Model.

References DataFitSurrModel::actualModel, SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, SurrogateModel::asv_mapping(), Model::asynch_compute_response(), DataFitSurrModel::build_approximation(), Variables::continuous_variables(), Dakota::copy_data(), Model::currentResponse, Model::currentVariables, Interface::evaluation_id(), Model::evaluation_id(), SurrogateModel::force_rebuild(), Interface::map(), SurrogateModel::rawCVarsMap, ActiveSet::request_vector(), SurrogateModel::responseMode, SurrogateModel::surrIdMap, DataFitSurrModel::surrModelEvalCntr, SurrogateModel::truthIdMap, and DataFitSurrModel::update_actual_model().

43.20.2.3 const IntResponseMap & derived_synchronize () [protected, virtual]

portion of synchronize() specific to DataFitSurrModel Blocking retrieval of asynchronous evaluations from actualModel, approxInterface, or both (mixed case). For the approxInterface portion, apply correction (if active) to each response in the array. derived_synchronize() is designed for the general case where derived_asynch_compute_response() may be inconsistent in its use of actual evaluations, approximate evaluations, or both.

Reimplemented from Model.

References DataFitSurrModel::actualModel, DataFitSurrModel::approxInterface, DataFitSurrModel::component_parallel_mode(), DiscrepancyCorrection::compute(), SurrogateModel::deltaCorr, DataFitSurrModel::derived_synchronize_approx(), Model::outputLevel, SurrogateModel::response_mapping(), SurrogateModel::responseMode, SurrogateModel::surrIdMap, SurrogateModel::surrResponseMap, Interface::synch(), Model::synchronize(), and SurrogateModel::truthIdMap.

43.20.2.4 const IntResponseMap & derived_synchronize_nowait () [protected, virtual]

portion of synchronize_nowait() specific to DataFitSurrModel Nonblocking retrieval of asynchronous evaluations from actualModel, approxInterface, or both (mixed case). For the approxInterface portion, apply correction (if active) to each response in the map. derived_synchronize_nowait() is designed for the general case where derived_asynch_compute_response() may be inconsistent in its use of actual evals, approx evals, or both.

Reimplemented from Model.

References Dakota::abort_handler(), DataFitSurrModel::actualModel, DataFitSurrModel::approxInterface, SurrogateModel::cachedApproxRespMap, DataFitSurrModel::component_parallel_mode(), DiscrepancyCorrection::compute(), SurrogateModel::deltaCorr, DataFitSurrModel::derived_synchronize_approx(), Model::outputLevel, SurrogateModel::response_mapping(), SurrogateModel::responseMode, SurrogateModel::surrIdMap, SurrogateModel::surrResponseMap, Interface::synch_nowait(), Model::synchronize_nowait(), and SurrogateModel::truthIdMap.

43.20.2.5 void build_approximation () [protected, virtual]

Builds the local/multipoint/global approximation using daceIterator/actualModel to generate new data points. This function constructs a new approximation, discarding any previous data. It constructs any required data for SurrogateData::{vars,resp}Data and does not define an anchor point for SurrogateData::anchor{Vars,Resp}.

Reimplemented from Model.

References DataFitSurrModel::actualModel, SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Interface::build_approximation(), DataFitSurrModel::build_global(),

DataFitSurrModel::build_local_multipoint(), Interface::clear_current(), Model::continuous_lower_bounds(), Constraints::continuous_lower_bounds(), Model::continuous_upper_bounds(), Constraints::continuous_upper_bounds(), Model::is_null(), Model::surrogateType, DataFitSurrModel::update_actual_model(), DataFitSurrModel::update_global(), DataFitSurrModel::update_local_multipoint(), and Model::userDefinedConstraints.

Referenced by DataFitSurrModel::derived_asynch_compute_response(), and DataFitSurrModel::derived_compute_response().

43.20.2.6 bool build_approximation (const Variables & *vars*, const IntResponsePair & *response_pr*) `[protected, virtual]`

Builds the local/multipoint/global approximation using daceIterator/actualModel to generate new data points that augment the vars/response anchor point. This function constructs a new approximation, discarding any previous data. It uses the passed data to populate SurrogateData::anchor{Vars,Resp} and constructs any required data points for SurrogateData::{vars,resp}Data.

Reimplemented from Model.

References DataFitSurrModel::actualModel, SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Interface::build_approximation(), DataFitSurrModel::build_global(), Interface::clear_current(), Model::continuous_lower_bounds(), Constraints::continuous_lower_bounds(), Model::continuous_upper_bounds(), Constraints::continuous_upper_bounds(), Model::is_null(), Model::surrogateType, DataFitSurrModel::update_actual_model(), Interface::update_approximation(), DataFitSurrModel::update_global(), DataFitSurrModel::update_local_multipoint(), and Model::userDefinedConstraints.

43.20.2.7 void update_approximation (bool *rebuild_flag*) `[protected, virtual]`

replaces the approximation data with daceIterator results and rebuilds the approximation if requested This function populates/replaces SurrogateData::anchor{Vars,Resp} and rebuilds the approximation, if requested. It does not clear other data (i.e., SurrogateData::{vars,resp}Data) and does not update the actualModel with revised bounds, labels, etc. Thus, it updates data from a previous call to build_approximation(), and is not intended to be used in isolation.

Reimplemented from Model.

References Iterator::all_responses(), Iterator::all_samples(), Iterator::all_variables(), SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Iterator::compact_mode(), DataFitSurrModel::daceIterator, Model::numFns, Interface::rebuild_approximation(), Model::surrogateType, and Interface::update_approximation().

43.20.2.8 void update_approximation (const Variables & *vars*, const IntResponsePair & *response_pr*, bool *rebuild_flag*) `[protected, virtual]`

replaces the anchor point, and rebuilds the approximation if requested This function populates/replaces SurrogateData::anchor{Vars,Resp} and rebuilds the approximation, if requested. It does not clear other data (i.e., SurrogateData::{vars,resp}Data) and does not update the actualModel with revised bounds, labels, etc. Thus, it updates data from a previous call to build_approximation(), and is not intended to be used in isolation.

Reimplemented from Model.

References SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Model::numFns, Interface::rebuild_approximation(), Model::surrogateType, and Interface::update_approximation().

43.20.2.9 void update_approximation (const VariablesArray & *vars_array*, const IntResponseMap & *resp_map*, bool *rebuild_flag*) [protected, virtual]

replaces the current points array and rebuilds the approximation if requested This function populates/replaces SurrogateData::{vars,resp}Data and rebuilds the approximation, if requested. It does not clear other data (i.e., SurrogateData::anchor{Vars,Resp}) and does not update the actualModel with revised bounds, labels, etc. Thus, it updates data from a previous call to build_approximation(), and is not intended to be used in isolation.

Reimplemented from Model.

References SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Model::numFns, Interface::rebuild_approximation(), Model::surrogateType, and Interface::update_approximation().

43.20.2.10 void append_approximation (bool *rebuild_flag*) [protected, virtual]

appends daceIterator results to a global approximation and rebuilds it if requested This function appends one point to SurrogateData::{vars,resp}Data and rebuilds the approximation, if requested. It does not modify other data (i.e., SurrogateData::anchor{Vars,Resp}) and does not update the actualModel with revised bounds, labels, etc. Thus, it appends to data from a previous call to build_approximation(), and is not intended to be used in isolation.

Reimplemented from Model.

References Iterator::all_responses(), Iterator::all_samples(), Iterator::all_variables(), Interface::append_approximation(), SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Iterator::compact_mode(), DataFitSurrModel::daceIterator, Model::numFns, Interface::rebuild_approximation(), and Model::surrogateType.

43.20.2.11 void append_approximation (const Variables & *vars*, const IntResponsePair & *response_pr*, bool *rebuild_flag*) [protected, virtual]

appends a point to a global approximation and rebuilds it if requested This function appends one point to SurrogateData::{vars,resp}Data and rebuilds the approximation, if requested. It does not modify other data (i.e., SurrogateData::anchor{Vars,Resp}) and does not update the actualModel with revised bounds, labels, etc. Thus, it appends to data from a previous call to build_approximation(), and is not intended to be used in isolation.

Reimplemented from Model.

References Interface::append_approximation(), SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Model::numFns, Interface::rebuild_approximation(), and Model::surrogateType.

43.20.2.12 void append_approximation (const VariablesArray & *vars_array*, const IntResponseMap & *resp_map*, bool *rebuild_flag*) [protected, virtual]

appends an array of points to a global approximation and rebuilds it if requested This function appends multiple points to SurrogateData::{vars,resp}Data and rebuilds the approximation, if requested. It does not modify other data (i.e., SurrogateData::anchor{Vars,Resp}) and does not update the actualModel with revised bounds, labels,

etc. Thus, it appends to data from a previous call to build_approximation(), and is not intended to be used in isolation.

Reimplemented from Model.

References Interface::append_approximation(), SurrogateModel::approxBuilds, DataFitSurrModel::approxInterface, Model::numFns, Interface::rebuild_approximation(), and Model::surrogateType.

43.20.2.13 void derived_init_communicators (const int & *max_iterator_concurrency*, bool *recurse_flag* = true) [inline, protected, virtual]

set up actualModel for parallel operations asynchronous flags need to be initialized for the sub-models. In addition, max_iterator_concurrency is the outer level iterator concurrency, not the DACE concurrency that actualModel will see, and recomputing the message_lengths on the sub-model is probably not a bad idea either. Therefore, recompute everything on actualModel using init_communicators.

Reimplemented from Model.

References DataFitSurrModel::actualModel, DataFitSurrModel::approxInterface, DataFitSurrModel::daceIterator, Model::derivative_concurrency(), Model::init_communicators(), Iterator::is_null(), Model::is_null(), Iterator::maximum_concurrency(), and Interface::minimum_points().

43.20.2.14 int evaluation_id () const [inline, protected, virtual]

return the current evaluation id for the DataFitSurrModel return the DataFitSurrModel evaluation count. Due to possibly intermittent use of surrogate bypass, this is not the same as either the approxInterface or actualModel model evaluation counts. It also does not distinguish duplicate evals.

Reimplemented from Model.

References DataFitSurrModel::surrModelEvalCntr.

43.20.2.15 void build_global () [private]

Builds a global approximation using daceIterator. Determine points to use in building the approximation and then evaluate them on actualModel using daceIterator. Any changes to the bounds should be performed by setting them at a higher level (e.g., SurrBasedOptStrategy).

References Dakota::abort_handler(), Iterator::active_set(), DataFitSurrModel::actualModel, Iterator::all_responses(), Iterator::all_samples(), Iterator::all_variables(), Interface::append_approximation(), Interface::approximation_data(), DataFitSurrModel::approxInterface, SurrogateModel::asv_mapping(), Iterator::compact_mode(), DataFitSurrModel::component_parallel_mode(), Variables::continuous_variables(), Model::currentVariables, Model::cv(), Variables::cv(), DataFitSurrModel::daceIterator, Dakota::data_pairs, Variables::discrete_int_variables(), Variables::discrete_real_variables(), Model::div(), Variables::div(), Model::drv(), Variables::drv(), DataFitSurrModel::inside(), Model::interface_id(), Iterator::is_null(), Model::is_null(), Interface::minimum_points(), Iterator::num_samples(), Model::outputLevel, DataFitSurrModel::pointReuse, DataFitSurrModel::pointReuseFile, DataFitSurrModel::pointsManagement, DataFitSurrModel::pointsTotal, Interface::recommended_points(), DataFitSurrModel::reuseFileResponses, DataFitSurrModel::reuseFileVars, Iterator::run_iterator(), Iterator::sampling_reset(), and SurrogateModel::surrogateFnIndices.

Referenced by DataFitSurrModel::build_approximation().

43.20.2.16 void build_local_multipoint () [private]

Builds a local or multipoint approximation using actualModel. Evaluate the value, gradient, and possibly Hessian needed for a local or multipoint approximation using actualModel.

References Response::active_set(), DataFitSurrModel::actualModel, DataFitSurrModel::approxInterface, SurrogateModel::asv_mapping(), String::begins(), DataFitSurrModel::component_parallel_mode(), Model::compute_response(), Model::continuous_variable_ids(), Model::current_response(), Model::current_variables(), Model::evaluation_id(), Model::hessian_type(), Model::numFns, ActiveSet::request_vector(), Model::surrogateType, and Interface::update_approximation().

Referenced by DataFitSurrModel::build_approximation().

43.20.2.17 void update_actual_model () [private]

update actualModel with data from current variables/labels/bounds/targets Update variables and constraints data within actualModel using values and labels from currentVariables and bound/linear/nonlinear constraints from userDefinedConstraints.

References Dakota::abort_handler(), DataFitSurrModel::actualModel, Model::all_continuous_lower_bounds(), Constraints::all_continuous_lower_bounds(), Model::all_continuous_upper_bounds(), Constraints::all_continuous_upper_bounds(), Model::all_continuous_variable_labels(), Variables::all_continuous_variable_labels(), Model::all_continuous_variables(), Variables::all_continuous_variables(), Model::all_discrete_int_lower_bounds(), Constraints::all_discrete_int_lower_bounds(), Model::all_discrete_int_upper_bounds(), Constraints::all_discrete_int_upper_bounds(), Model::all_discrete_int_variable_labels(), Variables::all_discrete_int_variable_labels(), Model::all_discrete_int_variables(), Variables::all_discrete_int_variables(), Model::all_discrete_real_lower_bounds(), Constraints::all_discrete_real_lower_bounds(), Model::all_discrete_real_upper_bounds(), Constraints::all_discrete_real_upper_bounds(), Model::all_discrete_real_variable_labels(), Variables::all_discrete_real_variable_labels(), Model::all_discrete_real_variables(), Variables::all_discrete_real_variables(), SurrogateModel::approxBuilds, Constraints::continuous_lower_bounds(), Model::continuous_lower_bounds(), Constraints::continuous_upper_bounds(), Model::continuous_upper_bounds(), Variables::continuous_variable_labels(), Model::continuous_variable_labels(), Variables::continuous_variables(), Model::continuous_variables(), Model::current_variables(), Model::currentResponse, Model::currentVariables, Model::cv(), Variables::cv(), Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Constraints::discrete_int_lower_bounds(), Model::discrete_int_lower_bounds(), Constraints::discrete_int_upper_bounds(), Model::discrete_int_upper_bounds(), Variables::discrete_int_variable_labels(), Model::discrete_int_variable_labels(), Variables::discrete_int_variables(), Model::discrete_int_variables(), Constraints::discrete_real_lower_bounds(), Model::discrete_real_lower_bounds(), Constraints::discrete_real_upper_bounds(), Model::discrete_real_upper_bounds(), Variables::discrete_real_variable_labels(), Model::discrete_real_variable_labels(), Variables::discrete_real_variables(), Model::discrete_real_variables(), Model::discrete_state_set_int_values(), Model::discrete_state_set_real_values(), Model::discreteDesignSetIntValues, Model::discreteDesignSetRealValues, Model::discreteStateSetIntValues, Model::discreteStateSetRealValues, Model::distParams, Model::distribution_parameters(), Model::div(), Variables::div(), Model::drv(), Variables::drv(), Response::function_labels(), Variables::inactive_continuous_variable_labels(), Model::inactive_continuous_variable_labels(), Variables::inactive_discrete_int_variable_labels(), Model::inactive_discrete_int_variable_labels(), Variables::inactive_discrete_real_variable_labels(), Model::inactive_discrete_real_variable_labels(), Model::is_null(), Constraints::linear_eq_constraint_coeffs(), Model::linear_eq_constraint_coeffs(), Constraints::linear_eq_constraint_targets(), Model::linear_eq_constraint_targets(), Constraints::linear_ineq_constraint_coeffs(), Model::linear_ineq_constraint_coeffs(), Constraints::linear_ineq_constraint_lower_bounds(), Model::linear_-

ineq_constraint_lower_bounds(), Constraints::linear_ineq_constraint_upper_bounds(), Model::linear_ineq_constraint_upper_bounds(), Constraints::nonlinear_eq_constraint_targets(), Model::nonlinear_eq_constraint_targets(), Constraints::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_lower_bounds(), Constraints::nonlinear_ineq_constraint_upper_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Constraints::num_linear_eq_constraints(), Constraints::num_linear_ineq_constraints(), Constraints::num_nonlinear_eq_constraints(), Constraints::num_nonlinear_ineq_constraints(), Model::response_labels(), Model::userDefinedConstraints, and Variables::view().

Referenced by DataFitSurrModel::build_approximation(), DataFitSurrModel::derived_asynch_compute_response(), and DataFitSurrModel::derived_compute_response().

43.20.2.18 void update_from_actual_model () [private]

update current variables/labels/bounds/targets with data from actualModel Update values and labels in currentVariables and bound/linear/nonlinear constraints in userDefinedConstraints from variables and constraints data within actualModel.

References Dakota::abort_handler(), DataFitSurrModel::actualModel, Model::all_continuous_lower_bounds(), Constraints::all_continuous_lower_bounds(), Model::all_continuous_upper_bounds(), Constraints::all_continuous_upper_bounds(), Model::all_continuous_variable_labels(), Variables::all_continuous_variable_labels(), Model::all_continuous_variables(), Variables::all_continuous_variables(), Model::all_discrete_int_lower_bounds(), Constraints::all_discrete_int_lower_bounds(), Model::all_discrete_int_upper_bounds(), Constraints::all_discrete_int_upper_bounds(), Model::all_discrete_int_variable_labels(), Variables::all_discrete_int_variable_labels(), Model::all_discrete_int_variables(), Variables::all_discrete_int_variables(), Model::all_discrete_real_lower_bounds(), Constraints::all_discrete_real_lower_bounds(), Model::all_discrete_real_upper_bounds(), Constraints::all_discrete_real_upper_bounds(), Model::all_discrete_real_variable_labels(), Variables::all_discrete_real_variable_labels(), Model::all_discrete_real_variables(), Variables::all_discrete_real_variables(), SurrogateModel::approxBuilds, Model::currentResponse, Model::currentVariables, Variables::cv(), Model::cv(), Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Model::discrete_state_set_int_values(), Model::discrete_state_set_real_values(), Model::discreteDesignSetIntValues, Model::discreteDesignSetRealValues, Model::discreteStateSetIntValues, Model::discreteStateSetRealValues, Model::distParams, Model::distribution_parameters(), Variables::div(), Model::div(), Variables::drv(), Model::drv(), Response::function_labels(), Model::linear_eq_constraint_coeffs(), Constraints::linear_eq_constraint_coeffs(), Model::linear_eq_constraint_targets(), Constraints::linear_eq_constraint_targets(), Model::linear_ineq_constraint_coeffs(), Constraints::linear_ineq_constraint_coeffs(), Model::linear_ineq_constraint_lower_bounds(), Constraints::linear_ineq_constraint_lower_bounds(), Model::linear_ineq_constraint_upper_bounds(), Constraints::linear_ineq_constraint_upper_bounds(), Model::nonlinear_eq_constraint_targets(), Constraints::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Constraints::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Constraints::nonlinear_ineq_constraint_upper_bounds(), Model::num_linear_eq_constraints(), Model::num_linear_ineq_constraints(), Model::num_nonlinear_eq_constraints(), Model::num_nonlinear_ineq_constraints(), Model::response_labels(), and Model::userDefinedConstraints.

Referenced by DataFitSurrModel::DataFitSurrModel(), and DataFitSurrModel::update_from_subordinate_model().

43.20.3 Member Data Documentation

43.20.3.1 Model actualModel [private]

the truth model which provides evaluations for building the surrogate (optional for global, required for local) actualModel is unrestricted in type; arbitrary nestings are possible.

Referenced by DataFitSurrModel::build_approximation(), DataFitSurrModel::build_global(), DataFitSurrModel::build_local_multipoint(), DataFitSurrModel::component_parallel_mode(), DataFitSurrModel::DataFitSurrModel(), DataFitSurrModel::derived_asynch_compute_response(), DataFitSurrModel::derived_compute_response(), DataFitSurrModel::derived_free_communicators(), DataFitSurrModel::derived_init_communicators(), DataFitSurrModel::derived_init_serial(), DataFitSurrModel::derived_set_communicators(), DataFitSurrModel::derived_subordinate_models(), DataFitSurrModel::derived_synchronize(), DataFitSurrModel::derived_synchronize_nowait(), DataFitSurrModel::fine_grained_evaluation_counters(), DataFitSurrModel::inactive_view(), DataFitSurrModel::inside(), DataFitSurrModel::primary_response_fn_weights(), DataFitSurrModel::print_evaluation_summary(), DataFitSurrModel::serve(), DataFitSurrModel::stop_servers(), DataFitSurrModel::surrogate_response_mode(), DataFitSurrModel::truth_model(), DataFitSurrModel::update_actual_model(), DataFitSurrModel::update_from_actual_model(), DataFitSurrModel::update_from_subordinate_model(), DataFitSurrModel::update_global(), and DataFitSurrModel::update_local_multipoint().

The documentation for this class was generated from the following files:

- DataFitSurrModel.H
- DataFitSurrModel.C

43.21 DataInterface Class Reference

Handle class for interface specification data.

Public Member Functions

- DataInterface ()

  constructor

- DataInterface (const DataInterface &)

  copy constructor

- ~DataInterface ()

  destructor

- DataInterface & operator= (const DataInterface &)

  assignment operator

- void write (std::ostream &s) const

  write a DataInterface object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataInterface object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataInterface object to a packed MPI buffer

Static Public Member Functions

- static bool id_compare (const DataInterface &di, const std::string &id)

  compares the idInterface attribute of DataInterface objects

Private Attributes

- DataInterfaceRep * dataIfaceRep

  pointer to the body (handle-body idiom)

Friends

- class **ProblemDescDB**
- class **NIDRProblemDescDB**

- void run_dakota_data ()

  library_mode default data initializer

43.21.1 Detailed Description

Handle class for interface specification data. The DataInterface class is used to provide a memory management handle for the data in DataInterfaceRep. It is populated by IDRProblemDescDB::interface_kwhandler() and is queried by the ProblemDescDB::get_<datatype>() functions. A list of DataInterface objects is maintained in ProblemDescDB::dataInterfaceList, one for each interface specification in an input file.

The documentation for this class was generated from the following files:

- DataInterface.H
- DataInterface.C

43.22 DataMethod Class Reference

Handle class for method specification data.

Public Member Functions

- DataMethod ()

  constructor

- DataMethod (const DataMethod &)

  copy constructor

- ~DataMethod ()

  destructor

- DataMethod & operator= (const DataMethod &)

  assignment operator

- void write (std::ostream &s) const

  write a DataMethod object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataMethod object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataMethod object to a packed MPI buffer

Static Public Member Functions

- static bool id_compare (const DataMethod &dm, const std::string &id)

  compares the idMethod attribute of DataMethod objects

Private Attributes

- DataMethodRep * dataMethodRep

  pointer to the body (handle-body idiom)

Friends

- class **ProblemDescDB**
- class **NIDRProblemDescDB**

- void run_dakota_data ()

  library_mode default data initializer

43.22.1 Detailed Description

Handle class for method specification data. The DataMethod class is used to provide a memory management handle for the data in DataMethodRep. It is populated by IDRProblemDescDB::method_kwhandler() and is queried by the ProblemDescDB::get_<datatype>() functions. A list of DataMethod objects is maintained in ProblemDescDB::dataMethodList, one for each method specification in an input file.

The documentation for this class was generated from the following files:

- DataMethod.H
- DataMethod.C

43.23 DataMethodRep Class Reference

Body class for method specification data.

Public Attributes

- String idMethod

  string identifier for the method specification data set (from the `id_method` *specification in* **MethodIndControl***)*

- String modelPointer

  string pointer to the model specification to be used by this method (from the `model_pointer` *specification in* **MethodIndControl***)*

- short methodOutput

  method verbosity control: {SILENT,QUIET,NORMAL,VERBOSE,DEBUG}_OUTPUT (from the `output` *specification in* **MethodIndControl***)*

- int maxIterations

  maximum number of iterations allowed for the method (from the `max_iterations` *specification in* **MethodIndControl***)*

- int maxFunctionEvaluations

  maximum number of function evaluations allowed for the method (from the `max_function_evaluations` *specification in* **MethodIndControl***)*

- bool speculativeFlag

  flag for use of speculative gradient approaches for maintaining parallel load balance during the line search portion of optimization algorithms (from the `speculative` *specification in* **MethodIndControl***)*

- bool methodUseDerivsFlag

  flag for usage of derivative data to enhance the computation of surrogate models (PCE/SC expansions, GP models for EGO/EGRA/EGIE) based on the `use_derivatives` *specification*

- Real convergenceTolerance

  iteration convergence tolerance for the method (from the `convergence_tolerance` *specification in* **MethodIndControl***)*

- Real constraintTolerance

  tolerance for controlling the amount of infeasibility that is allowed before an active constraint is considered to be violated (from the `constraint_tolerance` *specification in* **MethodIndControl***)*

- bool methodScaling

  flag indicating scaling status (from the `scaling` *specification in* **MethodIndControl***)*

- size_t numFinalSolutions

  number of final solutions returned from the iterator

- RealVector linearIneqConstraintCoeffs

  coefficient matrix for the linear inequality constraints (from the `linear_inequality_constraint_matrix` *specification in* **MethodIndControl***)*

- RealVector linearIneqLowerBnds

  lower bounds for the linear inequality constraints (from the `linear_inequality_lower_bounds` *specification in* **MethodIndControl***)*

- RealVector linearIneqUpperBnds

  upper bounds for the linear inequality constraints (from the `linear_inequality_upper_bounds` *specification in* **MethodIndControl***)*

- StringArray linearIneqScaleTypes

  scaling types for the linear inequality constraints (from the `linear_inequality_scale_types` *specification in* **MethodIndControl***)*

- RealVector linearIneqScales

  scaling factors for the linear inequality constraints (from the `linear_inequality_scales` *specification in* **MethodIndControl***)*

- RealVector linearEqConstraintCoeffs

  coefficient matrix for the linear equality constraints (from the `linear_equality_constraint_matrix` *specification in* **MethodIndControl***)*

- RealVector linearEqTargets

  targets for the linear equality constraints (from the `linear_equality_targets` *specification in* **MethodIndControl***)*

- StringArray linearEqScaleTypes

  scaling types for the linear equality constraints (from the `linear_equality_scale_types` *specification in* **MethodIndControl***)*

- RealVector linearEqScales

  scaling factors for the linear equality constraints (from the `linear_equality_scales` *specification in* **MethodIndControl***)*

- String methodName

  the method selection: one of the optimizer, least squares, nond, dace, or parameter study methods

- String subMethodName

  string identifier for a sub-method within a multi-option method specification (e.g., from `sub_method_name` *in SBL/SBG,* `dace` *option, or* `richardson_extrap` *option)*

- String subMethodPointer

  string pointer for a sub-method specification used by a multi-component method (from the `sub_method_pointer` *specification in SBL/SBG)*

- int surrBasedLocalSoftConvLimit

number of consecutive iterations with change less than convergenceTolerance required to trigger convergence within the surrogate-based local method (from the `soft_convergence_limit` *specification in* **MethodSBL***)*

- bool surrBasedLocalLayerBypass

  flag to indicate user-specification of a bypass of any/all layerings in evaluating truth response values in SBL.

- Real surrBasedLocalTRInitSize

  initial trust region size in the surrogate-based local method (from the `initial_size` *specification in* **MethodSBL***) note: this is a relative value, e.g., 0.1 = 10% of global bounds distance (upper bound - lower bound) for each variable*

- Real surrBasedLocalTRMinSize

  minimum trust region size in the surrogate-based local method (from the `minimum_size` *specification in* **MethodSBL***), if the trust region size falls below this threshold the SBL iterations are terminated (note: if kriging is used with SBL, the min trust region size is set to 1.0e-3 in attempt to avoid ill-conditioned matrixes that arise in kriging over small trust regions)*

- Real surrBasedLocalTRContractTrigger

  trust region minimum improvement level (ratio of actual to predicted decrease in objective fcn) in the surrogate-based local method (from the `contract_threshold` *specification in* **MethodSBL***), the trust region shrinks or is rejected if the ratio is below this value ("eta_1" in the Conn-Gould-Toint trust region book)*

- Real surrBasedLocalTRExpandTrigger

  trust region sufficient improvement level (ratio of actual to predicted decrease in objective fn) in the surrogate-based local method (from the `expand_threshold` *specification in* **MethodSBL***), the trust region expands if the ratio is above this value ("eta_2" in the Conn-Gould-Toint trust region book)*

- Real surrBasedLocalTRContract

  trust region contraction factor in the surrogate-based local method (from the `contraction_factor` *specification in* **MethodSBL***)*

- Real surrBasedLocalTRExpand

  trust region expansion factor in the surrogate-based local method (from the `expansion_factor` *specification in* **MethodSBL***)*

- short surrBasedLocalSubProbObj

  SBL approximate subproblem objective: ORIGINAL_PRIMARY, SINGLE_OBJECTIVE, LAGRANGIAN_OBJECTIVE, or AUGMENTED_LAGRANGIAN_OBJECTIVE.

- short surrBasedLocalSubProbCon

  SBL approximate subproblem constraints: NO_CONSTRAINTS, LINEARIZED_CONSTRAINTS, or ORIGINAL_CONSTRAINTS.

- short surrBasedLocalMeritFn

  SBL merit function type: BASIC_PENALTY, ADAPTIVE_PENALTY, BASIC_LAGRANGIAN, or AUGMENTED_LAGRANGIAN.

- short surrBasedLocalAcceptLogic

SBL iterate acceptance logic: TR_RATIO or FILTER.

- short surrBasedLocalConstrRelax

  SBL constraint relaxation method: NO_RELAX or HOMOTOPY.

- bool surrBasedGlobalReplacePts

  user-specified method for adding points to the set upon which the next surrogate is based in the `surrogate_based_global` *strategy.*

- String minMaxType

  the `optimization_type` *specification in* **MethodDOTDC**

- String dlDetails

  string of options for a dynamically linked solver

- void * dlLib

  handle to dynamically loaded library

- int verifyLevel

  the `verify_level` *specification in* **MethodNPSOLDC**

- Real functionPrecision

  the `function_precision` *specification in* **MethodNPSOLDC**

- Real lineSearchTolerance

  the `linesearch_tolerance` *specification in* **MethodNPSOLDC**

- Real absConvTol

  absolute function convergence tolerance

- Real xConvTol

  x-convergence tolerance

- Real singConvTol

  singular convergence tolerance

- Real singRadius

  radius for singular convergence test

- Real falseConvTol

  false-convergence tolerance

- Real initTRRadius

  initial trust radius

- int covarianceType

kind of covariance required

- bool regressDiag

  whether to print the regression diagnostic vector

- String searchMethod

  the `search_method` *specification for Newton and nonlinear interior-point methods in* **MethodOPTPPDC**

- Real gradientTolerance

  the `gradient_tolerance` *specification in* **MethodOPTPPDC**

- Real maxStep

  the `max_step` *specification in* **MethodOPTPPDC**

- String meritFn

  the `merit_function` *specification for nonlinear interior-point methods in* **MethodOPTPPDC**

- String centralPath

  the `central_path` *specification for nonlinear interior-point methods in* **MethodOPTPPDC**

- Real stepLenToBoundary

  the `steplength_to_boundary` *specification for nonlinear interior-point methods in* **MethodOPTPPDC**

- Real centeringParam

  the `centering_parameter` *specification for nonlinear interior-point methods in* **MethodOPTPPDC**

- int searchSchemeSize

  the `search_scheme_size` *specification for PDS methods in* **MethodOPTPPDC**

- Real initStepLength

  the `initStepLength` *choice for nonlinearly constrained APPS in* **MethodAPPSDC**

- Real contractStepLength

  the `contractStepLength` *choice for nonlinearly constrained APPS in* **MethodAPPSDC**

- Real threshStepLength

  the `threshStepLength` *choice for nonlinearly constrained APPS in* **MethodAPPSDC**

- String evalSynchronize

  the `synchronization` *choice for nonlinearly constrained APPS in* **MethodAPPSDC**

- String meritFunction

  the `meritFunction` *choice for nonlinearly constrained APPS in* **MethodAPPSDC**

- Real constrPenalty

  the `constrPenalty` *choice for nonlinearly constrained APPS in* **MethodAPPSDC**

- Real smoothFactor

  the initial `smoothFactor` *value for nonlinearly constrained APPS in* **MethodAPPSDC**

- String evalSynchronization

  the `synchronization` *setting for parallel pattern search methods in MethodCOLINYPS and* **MethodAPPS**

- Real constraintPenalty

  the initial `constraint_penalty` *for COLINY methods in* **MethodAPPS**, *MethodCOLINYDIR, MethodCOLINYPS, MethodCOLINYSW and MethodCOLINYEA*

- bool constantPenalty

  the `constant_penalty` *flag for COLINY methods in MethodCOLINYPS and MethodCOLINYSW*

- Real globalBalanceParam

  the `global_balance_parameter` *for the DIRECT method in MethodCOLINYDIR*

- Real localBalanceParam

  the `local_balance_parameter` *for the DIRECT method in MethodCOLINYDIR*

- Real maxBoxSize

  the `max_boxsize_limit` *for the DIRECT method in MethodCOLINYDIR*

- Real minBoxSize

  the `min_boxsize_limit` *for the DIRECT method in MethodCOLINYDIR and* **MethodNCSUDC**

- String boxDivision

  the `division` *setting (*`major_dimension` *or* `all_dimensions`*) for the DIRECT method in MethodCOLINYDIR*

- bool mutationAdaptive

  the `non_adaptive` *specification for the coliny_ea method in MethodCOLINYEA*

- bool showMiscOptions

  the `show_misc_options` *specification in MethodCOLINYDC*

- StringArray miscOptions

  the `misc_options` *specification in MethodCOLINYDC*

- Real solnTarget

  the `solution_target` *specification in MethodCOLINYDC*

- Real crossoverRate

  the `crossover_rate` *specification for EA methods in MethodCOLINYEA*

- Real mutationRate

the `mutation_rate` *specification for EA methods in MethodCOLINYEA*

- Real mutationScale

  the `mutation_scale` *specification for EA methods in MethodCOLINYEA*

- Real mutationMinScale

  the `min_scale` *specification for mutation in EA methods in MethodCOLINYEA*

- Real initDelta

  the `initial_delta` *specification for APPS/COBYLA/PS/SW methods in* **MethodAPPS**, *MethodCOLINYCOB, MethodCOLINYPS, and MethodCOLINYSW*

- Real threshDelta

  the `threshold_delta` *specification for APPS/COBYLA/PS/SW methods in* **MethodAPPS**, *MethodCOLINYCOB, MethodCOLINYPS, and MethodCOLINYSW*

- Real contractFactor

  the `contraction_factor` *specification for APPS/PS/SW methods in* **MethodAPPS**, *MethodCOLINYPS, and MethodCOLINYSW*

- int newSolnsGenerated

  the `new_solutions_generated` *specification for GA/EPSA methods in MethodCOLINYEA*

- int numberRetained

  the integer assignment to random, chc, or elitist in the `replacement_type` *specification for GA/EPSA methods in MethodCOLINYEA*

- bool expansionFlag

  the `no_expansion` *specification for APPS/PS/SW methods in* **MethodAPPS**, *MethodCOLINYPS, and MethodCOLINYSW*

- int expandAfterSuccess

  the `expand_after_success` *specification for PS/SW methods in MethodCOLINYPS and MethodCOLINYSW*

- int contractAfterFail

  the `contract_after_failure` *specification for the SW method in MethodCOLINYSW*

- int mutationRange

  the `mutation_range` *specification for the pga_int method in MethodCOLINYEA*

- int totalPatternSize

  the `total_pattern_size` *specification for PS methods in MethodCOLINYPS*

- bool randomizeOrderFlag

  the `stochastic` *specification for the PS method in MethodCOLINYPS*

- String selectionPressure

the `fitness_type` *specification for EA methods in MethodCOLINYEA*

- String replacementType

  the `replacement_type` *specification for EA methods in MethodCOLINYEA*

- String crossoverType

  the `crossover_type` *specification for EA methods in MethodCOLINYEA*

- String mutationType

  the `mutation_type` *specification for EA methods in MethodCOLINYEA*

- String exploratoryMoves

  the `exploratory_moves` *specification for the PS method in MethodCOLINYPS*

- String patternBasis

  the `pattern_basis` *specification for APPS/PS methods in* **MethodAPPS** *and MethodCOLINYPS*

- size_t numCrossPoints

  The number of crossover points or multi-point schemes.

- size_t numParents

  The number of parents to use in a crossover operation.

- size_t numOffspring

  The number of children to produce in a crossover operation.

- String fitnessType

  the fitness assessment operator to use.

- String convergenceType

  The means by which this JEGA should converge.

- Real percentChange

  The minimum percent change before convergence for a fitness tracker converger.

- size_t numGenerations

  The number of generations over which a fitness tracker converger should track.

- Real fitnessLimit

  The cutoff value for survival in fitness limiting selectors (e.g., below_limit selector).

- Real shrinkagePercent

  The minimum percentage of the requested number of selections that must take place on each call to the selector (0, 1).

- String nichingType

The niching type.

- RealVector nicheVector

  The discretization percentage along each objective.

- String postProcessorType

  The post processor type.

- RealVector distanceVector

  The discretization percentage along each objective.

- String initializationType

  The means by which the JEGA should initialize the population.

- String flatFile

  The filename to use for initialization.

- String logFile

  The filename to use for logging.

- int populationSize

  the `population_size` *specification for GA methods in MethodCOLINYEA*

- bool printPopFlag

  The `print_each_pop` *flag to set the printing of the population at each generation.*

- Real volBoxSize

  the `volume_boxsize_limit` *for the DIRECT method in* **MethodNCSUDC**

- int numSymbols

  the `symbols` *specification for DACE methods*

- bool mainEffectsFlag

  the `main_effects` *specification for sampling methods in* **MethodDDACE***)*

- bool latinizeFlag

  the `latinize` *specification for FSU QMC and CVT methods in* **MethodFSUDACE**

- bool volQualityFlag

  the `quality_metrics` *specification for sampling methods (FSU QMC and CVT methods in* **MethodFSUDACE***)*

- IntVector sequenceStart

  the `sequenceStart` *specification in* **MethodFSUDACE**

- IntVector sequenceLeap

the `sequenceLeap` *specification in* **MethodFSUDACE**

- IntVector primeBase

  the `primeBase` *specification in* **MethodFSUDACE**

- int numTrials

  the `numTrials` *specification in* **MethodFSUDACE**

- String trialType

  the `trial_type` *specification in* **MethodFSUDACE**

- int randomSeed

  the `seed` *specification for COLINY, NonD, & DACE methods*

- int numSamples

  the `samples` *specification for NonD & DACE methods*

- bool fixedSeedFlag

  flag for fixing the value of the seed among different NonD/DACE sample sets. This results in the use of the same sampling stencil/pattern throughout a strategy with repeated sampling.

- bool fixedSequenceFlag

  flag for fixing the sequence for Halton or Hammersley QMC sample sets. This results in the use of the same sampling stencil/pattern throughout a strategy with repeated sampling.

- int previousSamples

  the number of previous samples when augmenting a LHS sample

- bool vbdFlag

  the `var_based_decomp` *specification for a variety of sampling methods*

- Real vbdDropTolerance

  the `var_based_decomp` *tolerance for omitting index output*

- short vbdControl

  a sub-specification of vbdFlag: {NO,UNIVARIATE,ALL}_VBD. When vbdFlag is on, controls granularity of calculation/output of main/interaction/total effects

- String rngName

  the `basic` *random-number generator for NonD*

- short refinementType

  refinement type for stochastic expansions from dimension refinement keyword group

- short refinementControl

  refinement control for stochastic expansions from dimension refinement keyword group

- short nestingOverride

  override for default point nesting policy: NO_NESTING_OVERRIDE, NESTED, or NON_NESTED

- short growthOverride

  override for default point growth restriction policy: NO_GROWTH_OVERRIDE, RESTRICTED, or UNRESTRICTED

- short expansionType

  enumeration for u-space type that defines u-space variable targets for probability space transformations: EXTENDED_U (default), ASKEY_U, STD_NORMAL_U, or STD_UNIFORM_U

- bool piecewiseBasis

  boolean indicating presence of `piecewise` *keyword*

- short piecewiseBasisType

  enumeration for type of basis in piecewise interpolants: NODAL_INTERPOLANT or HIERARCHICAL_INTERPOLANT

- int expansionTerms

  the `expansion_terms` *specification in* **MethodNonDPCE**

- UShortArray expansionOrder

  the `expansion_order` *specification in* **MethodNonDPCE**

- int expansionSamples

  the `expansion_samples` *specification in* **MethodNonDPCE**

- String expansionSampleType

  allows for incremental PCE construction using the `incremental_lhs` *specification in* **MethodNonDPCE**

- UShortArray quadratureOrder

  the `quadrature_order` *specification in* **MethodNonDPCE** *and* **MethodNonDSC**

- UShortArray sparseGridLevel

  the `sparse_grid_level` *specification in* **MethodNonDPCE**, **MethodNonDSC**, *and other stochastic expansion-enabled methods*

- RealVector anisoGridDimPref

  the `dimension_preference` *specification for tensor and sparse grids in* **MethodNonDPCE** *and* **MethodNonDSC**

- unsigned short cubIntOrder

  the `cubature_integrand` *specification in* **MethodNonDPCE**

- int collocationPoints

  the `collocation_points` *specification in* **MethodNonDPCE**

- Real collocationRatio

  the `collocation_ratio` *specification in* **MethodNonDPCE**

- Real collocRatioTermsOrder

  order applied to the number of expansion terms when applying or computing the collocation ratio within regression PCE; based on the `ratio_order` *specification in* **MethodNonDPCE**

- String collocPtReuse

  allows for incremental PCE construction using the `reuse_points` *specification in* **MethodNonDPCE**

- bool probCollocFlag

  flag for usage of a filtered set of tensor-product grid points within regression PCE; based on the `tensor_grid` *specification in* **MethodNonDPCE**

- String expansionImportFile

  the `expansion_import_file` *specification in* **MethodNonDPCE**

- String sampleType

  the `sample_type` *specification in* **MethodNonDMC**, **MethodNonDPCE**, *and* **MethodNonDSC**

- String reliabilitySearchType

  the type of limit state search in **MethodNonDLocalRel** *(*`x_taylor_mean`, `x_taylor_mpp`, `x_two_point`, `u_taylor_mean`, `u_taylor_mpp`, `u_two_point`, *or* `no_approx`*) or* **MethodNonDGlobalRel** *(*`x_gaussian_process` *or* `u_gaussian_process`*)*

- String reliabilityIntegration

  the `first_order` *or* `second_order` *integration selection in* **MethodNonDLocalRel**

- String integrationRefine

  the `import`, `adapt_import`, *or* `mm_adapt_import` *integration refinement selection in* **MethodNonDLocalRel**, **MethodNonDPCE**, *and* **MethodNonDSC**

- String nondOptAlgorithm

  the algorithm selection `sqp` *or* `nip` *used for computing the MPP in* **MethodNonDLocalRel** *or the interval in* **MethodNonDLocalIntervalEst**

- short distributionType

  the `distribution` `cumulative` *or* `complementary` *specification in* **MethodNonD**

- short responseLevelTarget

  the `compute` `probabilities`, `reliabilities`, *or* `gen_reliabilities` *specification in* **MethodNonD**

- short responseLevelTargetReduce

  the `system` `series` *or* `parallel` *specification in* **MethodNonD**

- RealVectorArray responseLevels

  the `response_levels` *specification in* **MethodNonD**

- RealVectorArray probabilityLevels

  the `probability_levels` *specification in* **MethodNonD**

- RealVectorArray reliabilityLevels

  the `reliability_levels` *specification in* **MethodNonD**

- RealVectorArray genReliabilityLevels

  the `gen_reliability_levels` *specification in* **MethodNonD**

- bool allVarsFlag

  the `all_variables` *specification in* **MethodNonD**

- int emulatorSamples

  *the number of samples to construct a GP emulator for Bayesian calibration methods (***MethodNonDBayesCalib***)*

- short emulatorType

  the `emulator` *specification in* **MethodNonDBayesCalib**

- String rejectionType

  the `rejection` *type specification in* **MethodNonDBayesCalib**

- String metropolisType

  the `metropolis` *type specification in* **MethodNonDBayesCalib**

- Real proposalCovScale

  the `proposal` *covariance scale factor in* **MethodNonDBayesCalib**

- Real likelihoodScale

  the `likelihood` *scale factor in* **MethodNonDBayesCalib**

- RealVector finalPoint

  the `final_point` *specification in* **MethodPSVPS**

- RealVector stepVector

  the `step_vector` *specification in* **MethodPSVPS** *and* **MethodPSCPS**

- int numSteps

  the `num_steps` *specification in* **MethodPSVPS**

- IntVector stepsPerVariable

  the `deltas_per_variable` *specification in* **MethodPSCPS**

- RealVector listOfPoints

  the `list_of_points` *specification in* **MethodPSLPS**

- UShortArray varPartitions

  the `partitions` specification for PStudy method in **MethodPSMPS**

- Real refinementRate

  rate of mesh refinement in Richardson extrapolation

Private Member Functions

- DataMethodRep ()

  constructor

- ~DataMethodRep ()

  destructor

- void write (std::ostream &s) const

  write a DataInterfaceRep object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataInterfaceRep object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataInterfaceRep object to a packed MPI buffer

Private Attributes

- int referenceCount

  number of handle objects sharing this dataMethodRep

Friends

- class DataMethod

  the handle class can access attributes of the body class directly

43.23.1 Detailed Description

Body class for method specification data. The DataMethodRep class is used to contain the data from a method keyword specification. Default values are managed in the DataMethodRep constructor. Data is public to avoid maintaining set/get functions, but is still encapsulated within ProblemDescDB since ProblemDescDB::dataMethodList is private.

The documentation for this class was generated from the following files:

- DataMethod.H
- DataMethod.C

43.24 DataModel Class Reference

Handle class for model specification data.

Public Member Functions

- DataModel ()

  constructor

- DataModel (const DataModel &)

  copy constructor

- ~DataModel ()

  destructor

- DataModel & operator= (const DataModel &)

  assignment operator

- void write (std::ostream &s) const

  write a DataModel object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataModel object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataModel object to a packed MPI buffer

Static Public Member Functions

- static bool id_compare (const DataModel &dm, const std::string &id)

  compares the idModel attribute of DataModel objects

Private Attributes

- DataModelRep * dataModelRep

  pointer to the body (handle-body idiom)

Friends

- class **ProblemDescDB**
- class **NIDRProblemDescDB**

43.24.1 Detailed Description

Handle class for model specification data. The DataModel class is used to provide a memory management handle for the data in DataModelRep. It is populated by IDRProblemDescDB::model_kwhandler() and is queried by the ProblemDescDB::get_<datatype>() functions. A list of DataModel objects is maintained in ProblemDescDB::dataModelList, one for each model specification in an input file.

The documentation for this class was generated from the following files:

- DataModel.H
- DataModel.C

43.25 DataModelRep Class Reference

Body class for model specification data.

Public Attributes

- String idModel

  string identifier for the model specification data set (from the `id_model` *specification in* **ModelIndControl***)*

- String modelType

  model type selection: single, surrogate, or nested (from the model type specification in **ModelIndControl***)*

- String variablesPointer

  string pointer to the variables specification to be used by this model (from the `variables_pointer` *specification in* **ModelIndControl***)*

- String interfacePointer

  string pointer to the interface specification to be used by this model (from the `interface_pointer` *specification in* **ModelSingle** *and the* `optional_interface_pointer` *specification in* **ModelNested***)*

- String responsesPointer

  string pointer to the responses specification to be used by this model (from the `responses_pointer` *specification in* **ModelIndControl***)*

- String subMethodPointer

  pointer to a sub-iterator used for global approximations (from the `dace_method_pointer` *specification in* **ModelSurrG***) or by nested models (from the* `sub_method_pointer` *specification in* **ModelNested***)*

- IntSet surrogateFnIndices

  array specifying the response function set that is approximated

- String surrogateType

  the selected surrogate type: local_taylor, multipoint_tana, global_(neural_network,mars,orthogonal_-polynomial,gaussian, polynomial,kriging), or hierarchical

- String truthModelPointer

  pointer to the model specification for constructing the truth model used in building local, multipoint, and hierarchical approximations (from the `actual_model_pointer` *specification in* **ModelSurrL** *and* **ModelSurrMP** *and the* `high_fidelity_model_pointer` *specification in* **ModelSurrH***)*

- String lowFidelityModelPointer

  pointer to the low fidelity model specification used in hierarchical approximations (from the `low_fidelity_-model_pointer` *specification in* **ModelSurrH***)*

- int pointsTotal

  user-specified lower bound on total points with which to build the model (if reuse_points < pointsTotal, new samples will make up the difference)

- short pointsManagement

  points management configuration for DataFitSurrModel: DEFAULT_POINTS, MINIMUM_POINTS, or RECOMMENDED_POINTS

- String approxPointReuse

  sample reuse selection for building global approximations: none, all, region, or file (from the `reuse_samples` *specification in* **ModelSurrG***)*

- String approxPointReuseFile

  the file name for the "file" setting for the `reuse_samples` *specification in* **ModelSurrG**

- bool approxPointFileAnnotated

  whether the point reuse file is annotated (default true)

- short approxCorrectionType

  correction type for global and hierarchical approximations: NO_CORRECTION, ADDITIVE_CORRECTION, MULTIPLICATIVE_CORRECTION, or COMBINED_CORRECTION (from the `correction` *specification in* **ModelSurrG** *and* **ModelSurrH***)*

- short approxCorrectionOrder

  correction order for global and hierarchical approximations: 0, 1, or 2 (from the `correction` *specification in* **ModelSurrG** *and* **ModelSurrH***)*

- bool modelUseDerivsFlag

  flags the use of derivatives in building global approximations (from the `use_derivatives` *specification in* **ModelSurrG***)*

- short polynomialOrder

  scalar integer indicating the order of the polynomial approximation (1=linear, 2=quadratic, 3=cubic; from the `polynomial` *specification in* **ModelSurrG***)*

- RealVector krigingCorrelations

  vector of correlations used in building a kriging approximation (from the `correlations` *specification in* **ModelSurrG***)*

- String krigingOptMethod

  optimization method to use in finding optimal correlation parameters: none, sampling, local, global

- short krigingMaxTrials

  maximum number of trials in optimization of kriging correlations

- RealVector krigingMaxCorrelations

  upper bound on kriging correlation vector

- RealVector krigingMinCorrelations

  lower bound on kriging correlation vector

- short mlsPolyOrder

  polynomial order for moving least squares approximation

- short mlsWeightFunction

  weight function for moving least squares approximation

- short rbfBases

  bases for radial basis function approximation

- short rbfMaxPts

  maximum number of points for radial basis function approximation

- short rbfMaxSubsets

  maximum number of subsets for radial basis function approximation

- short rbfMinPartition

  minimum partition for radial basis function approximation

- short marsMaxBases

  maximum number of bases for MARS approximation

- String marsInterpolation

  interpolation type for MARS approximation

- short annRandomWeight

  random weight for artificial neural network approximation

- short annNodes

  number of nodes for artificial neural network approximation

- Real annRange

  range for artificial neural network approximation

- String trendOrder

  scalar integer indicating the order of the Gaussian process mean (0= constant, 1=linear, 2=quadratic, 3=cubic); from the `gaussian_process` *specification in* **ModelSurrG***)*

- bool pointSelection

  flag indicating the use of point selection in the Gaussian process

- StringArray diagMetrics

  List of diagnostic metrics the user requests to assess the goodness of fit for a surrogate model.

- String optionalInterfRespPointer

string pointer to the responses specification used by the optional interface in nested models (from the `optional_interface_responses_pointer` *specification in* **ModelNested***)*

- StringArray primaryVarMaps

  the primary variable mappings used in nested models for identifying the lower level variable targets for inserting top level variable values (from the `primary_variable_mapping` *specification in* **ModelNested***)*

- StringArray secondaryVarMaps

  the secondary variable mappings used in nested models for identifying the (distribution) parameter targets within the lower level variables for inserting top level variable values (from the `secondary_variable_mapping` *specification in* **ModelNested***)*

- RealVector primaryRespCoeffs

  the primary response mapping matrix used in nested models for weighting contributions from the sub-iterator responses in the top level (objective) functions (from the `primary_response_mapping` *specification in* **ModelNested***)*

- RealVector secondaryRespCoeffs

  the secondary response mapping matrix used in nested models for weighting contributions from the sub-iterator responses in the top level (constraint) functions (from the `secondary_response_mapping` *specification in* **ModelNested***)*

Private Member Functions

- DataModelRep ()

  constructor

- ~DataModelRep ()

  destructor

- void write (std::ostream &s) const

  write a DataModelRep object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataModelRep object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataModelRep object to a packed MPI buffer

Private Attributes

- int referenceCount

  number of handle objects sharing this dataModelRep

Friends

- class DataModel

  the handle class can access attributes of the body class directly

43.25.1 Detailed Description

Body class for model specification data. The DataModelRep class is used to contain the data from a model keyword specification. Default values are managed in the DataModelRep constructor. Data is public to avoid maintaining set/get functions, but is still encapsulated within ProblemDescDB since ProblemDescDB::dataModelList is private.

The documentation for this class was generated from the following files:

- DataModel.H
- DataModel.C

43.26 DataResponses Class Reference

Handle class for responses specification data.

Public Member Functions

- DataResponses ()

  constructor

- DataResponses (const DataResponses &)

  copy constructor

- ~DataResponses ()

  destructor

- DataResponses & operator= (const DataResponses &)

  assignment operator

- void write (std::ostream &s) const

  write a DataResponses object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataResponses object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataResponses object to a packed MPI buffer

Static Public Member Functions

- static bool id_compare (const DataResponses &dr, const std::string &id)

  compares the idResponses attribute of DataResponses objects

Private Attributes

- DataResponsesRep * dataRespRep

  pointer to the body (handle-body idiom)

Friends

- class **ProblemDescDB**
- class **NIDRProblemDescDB**

- void run_dakota_data ()

  library_mode default data initializer

43.26.1 Detailed Description

Handle class for responses specification data. The DataResponses class is used to provide a memory management handle for the data in DataResponsesRep. It is populated by IDRProblemDescDB::responses_kwhandler() and is queried by the ProblemDescDB::get_<datatype>() functions. A list of DataResponses objects is maintained in ProblemDescDB::dataResponsesList, one for each responses specification in an input file.

The documentation for this class was generated from the following files:

- DataResponses.H
- DataResponses.C

43.27 DataResponsesRep Class Reference

Body class for responses specification data.

Public Attributes

- size_t numObjectiveFunctions

  number of objective functions (from the `num_objective_functions` *specification in* **RespFnOpt***)*

- size_t numNonlinearIneqConstraints

  number of nonlinear inequality constraints (from the `num_nonlinear_inequality_constraints` *specification in* **RespFnOpt***)*

- size_t numNonlinearEqConstraints

  number of nonlinear equality constraints (from the `num_nonlinear_equality_constraints` *specification in* **RespFnOpt***)*

- size_t numLeastSqTerms

  number of least squares terms (from the `num_least_squares_terms` *specification in* **RespFnLS***)*

- size_t numResponseFunctions

  number of generic response functions (from the `num_response_functions` *specification in* **RespFnGen***)*

- StringArray primaryRespFnScaleTypes

  vector of primary response function scaling types (from the `objective_function_scale_types` *specification in* **RespFnOpt** *and the* `least_squares_term_scale_types` *specification in* **RespFnLS***)*

- RealVector primaryRespFnScales

  vector of primary response function scaling factors (from the `objective_function_scales` *specification in* **RespFnOpt** *and the* `least_squares_term_scales` *specification in* **RespFnLS***)*

- RealVector primaryRespFnWeights

  vector of weightings for multiobjective optimization or weighted nonlinear least squares (from the `multi_objective_weights` *specification in* **RespFnOpt** *and the* `least_squares_weights` *specification in* **RespFnLS***)*

- RealVector expConfigVars

  list of num_experiments x num_config_vars configuration variable values

- RealVector expObservations

  list of num_calibration_terms observation data

- RealVector expStdDeviations

  list of 1 or num_calibration_terms observation standard deviations

- String expDataFileName

name of experimental data file containing response data (with optional state variable and sigma data) to read

- bool expDataFileAnnotated

  whether the experimental data is in annotated format

- size_t numExperiments

  number of rows of experimental data (replicates or distinct experiments)

- size_t numExpConfigVars

  number of experimental configuration vars (state variables) in each row of data

- size_t numExpStdDeviations

  whether to read num_responses standard deviations from each row of data file

- RealVector nonlinearIneqLowerBnds

  vector of nonlinear inequality constraint lower bounds (from the `nonlinear_inequality_lower_bounds` *specification in* **RespFnOpt***)*

- RealVector nonlinearIneqUpperBnds

  vector of nonlinear inequality constraint upper bounds (from the `nonlinear_inequality_upper_bounds` *specification in* **RespFnOpt***)*

- StringArray nonlinearIneqScaleTypes

  vector of nonlinear inequality constraint scaling types (from the `nonlinear_inequality_scale_types` *specification in* **RespFnOpt***)*

- RealVector nonlinearIneqScales

  vector of nonlinear inequality constraint scaling factors (from the `nonlinear_inequality_scales` *specification in* **RespFnOpt***)*

- RealVector nonlinearEqTargets

  vector of nonlinear equality constraint targets (from the `nonlinear_equality_targets` *specification in* **RespFnOpt***)*

- StringArray nonlinearEqScaleTypes

  vector of nonlinear equality constraint scaling types (from the `nonlinear_equality_scale_types` *specification in* **RespFnOpt***)*

- RealVector nonlinearEqScales

  vector of nonlinear equality constraint scaling factors (from the `nonlinear_equality_scales` *specification in* **RespFnOpt***)*

- String gradientType

  gradient type: none, numerical, analytic, or mixed (from the `no_gradients`*,* `numerical_gradients`*,* `analytic_gradients`*, and* `mixed_gradients` *specifications in* **RespGrad***)*

- String hessianType

Hessian type: none, numerical, quasi, analytic, or mixed (from the `no_hessians`*,* `numerical_hessians`*,* `quasi_hessians`*,* `analytic_hessians`*, and* `mixed_hessians` *specifications in* **RespHess***).*

- bool ignoreBounds

  option to ignore bounds when doing finite differences (default is to honor bounds)

- bool centralHess

  Temporary(?) option to use old 2nd-order diffs when computing finite-difference Hessians; default is forward differences.

- String quasiHessianType

  quasi-Hessian type: bfgs, damped_bfgs, or sr1 (from the `bfgs` *and* `sr1` *specifications in* **RespHess***)*

- String methodSource

  numerical gradient method source: dakota or vendor (from the `method_source` *specification in* **RespGradNum** *and* **RespGradMixed***)*

- String intervalType

  numerical gradient interval type: forward or central (from the `interval_type` *specification in* **RespGradNum** *and* **RespGradMixed***)*

- RealVector fdGradStepSize

  vector of finite difference step sizes for numerical gradients, one step size per active continuous variable, used in computing 1st-order forward or central differences (from the `fd_gradient_step_size` *specification in* **RespGradNum** *and* **RespGradMixed***)*

- RealVector fdHessStepSize

  vector of finite difference step sizes for numerical Hessians, one step size per active continuous variable, used in computing 1st-order gradient-based differences and 2nd-order function-based differences (from the `fd_hessian_step_size` *specification in* **RespHessNum** *and* **RespHessMixed***)*

- IntList idNumericalGrads

  mixed gradient numerical identifiers (from the `id_numerical_gradients` *specification in* **RespGradMixed***)*

- IntList idAnalyticGrads

  mixed gradient analytic identifiers (from the `id_analytic_gradients` *specification in* **RespGradMixed***)*

- IntList idNumericalHessians

  mixed Hessian numerical identifiers (from the `id_numerical_hessians` *specification in* **RespHessMixed***)*

- IntList idQuasiHessians

  mixed Hessian quasi identifiers (from the `id_quasi_hessians` *specification in* **RespHessMixed***)*

- IntList idAnalyticHessians

  mixed Hessian analytic identifiers (from the `id_analytic_hessians` *specification in* **RespHessMixed***)*

- String idResponses

string identifier for the responses specification data set (from the `id_responses` specification in **RespSetId***)*

- StringArray responseLabels

  the response labels array (from the `response_descriptors` specification in **RespLabels***)*

Private Member Functions

- DataResponsesRep ()

  constructor

- ~DataResponsesRep ()

  destructor

- void write (std::ostream &s) const

  write a DataResponsesRep object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataResponsesRep object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataResponsesRep object to a packed MPI buffer

Private Attributes

- int referenceCount

  number of handle objects sharing this dataResponsesRep

Friends

- class DataResponses

  the handle class can access attributes of the body class directly

43.27.1 Detailed Description

Body class for responses specification data. The DataResponsesRep class is used to contain the data from a responses keyword specification. Default values are managed in the DataResponsesRep constructor. Data is public to avoid maintaining set/get functions, but is still encapsulated within ProblemDescDB since ProblemDescDB::dataResponsesList is private.

The documentation for this class was generated from the following files:

- DataResponses.H

- DataResponses.C

43.28 DataStrategy Class Reference

Handle class for strategy specification data.

Public Member Functions

- DataStrategy ()
  constructor
- DataStrategy (const DataStrategy &)
  copy constructor
- ~DataStrategy ()
  destructor
- DataStrategy & operator= (const DataStrategy &)
  assignment operator
- void write (std::ostream &s) const
  write a DataStrategy object to an std::ostream
- void read (MPIUnpackBuffer &s)
  read a DataStrategy object from a packed MPI buffer
- void write (MPIPackBuffer &s) const
  write a DataStrategy object to a packed MPI buffer

Private Attributes

- DataStrategyRep * dataStratRep
  pointer to the body (handle-body idiom)

Friends

- class **ProblemDescDB**
- class **NIDRProblemDescDB**

43.28.1 Detailed Description

Handle class for strategy specification data. The DataStrategy class is used to provide a memory management handle for the data in DataStrategyRep. It is populated by IDRProblemDescDB::strategy_kwhandler() and is queried by the ProblemDescDB::get_<datatype>() functions. A single DataStrategy object is maintained in ProblemDescDB::strategySpec.

The documentation for this class was generated from the following files:

- DataStrategy.H
- DataStrategy.C

43.29 DataStrategyRep Class Reference

Body class for strategy specification data.

Public Attributes

- String strategyType

  the strategy selection: hybrid, multi_start, pareto_set, or single_method

- bool graphicsFlag

  flags use of graphics by the strategy (from the `graphics` *specification in* **StratIndControl***)*

- bool tabularDataFlag

  flags tabular data collection by the strategy (from the tabular_graphics_data specification in **StratIndControl***)*

- String tabularDataFile

  the filename used for tabular data collection by the strategy (from the tabular_graphics_file specification in **StratIndControl***)*

- int outputPrecision

  output precision for tabular and screen output

- int iteratorServers

  number of servers for concurrent iterator parallelism (from the iterator_servers specification in **StratIndControl***)*

- String iteratorScheduling

  type of scheduling (self or static) used in concurrent iterator parallelism (from the `iterator_self_scheduling` *and* `iterator_static_scheduling` *specifications in* **StratIndControl***)*

- String methodPointer

  method identifier for the strategy (from the `opt_method_pointer` *specifications in* **StratParetoSet** *and* `method_pointer` *specifications in* **StratSingle** *and* **StratMultiStart***)*

- StringArray hybridMethodList

  array of methods for the sequential and collaborative hybrid optimization strategies (from the `method_list` *specification in* **StratHybrid***)*

- String hybridType

  the type of hybrid optimization strategy: collaborative, embedded, sequential, or sequential_adaptive (from the `collaborative`*,* `embedded`*, and* `sequential` *specifications in* **StratHybrid***)*

- String hybridGlobalMethodPointer

  global method pointer for embedded hybrids (from the `global_method_pointer` *specification in* **StratHybrid***)*

- String hybridLocalMethodPointer

local method pointer for embedded hybrids (from the `local_method_pointer` *specification in* **StratHybrid***)*

- Real hybridLSProb

  local search probability for embedded hybrids (from the `local_search_probability` *specification in* **StratHybrid***)*

- int concurrentRandomJobs

  number of random jobs to perform in the concurrent strategy (from the `random_starts` *and* `random_weight_sets` *specifications in* **StratMultiStart** *and* **StratParetoSet***)*

- int concurrentSeed

  seed for the selected random jobs within the concurrent strategy (from the `seed` *specification in* **StratMultiStart** *and* **StratParetoSet***)*

- RealVector concurrentParameterSets

  user-specified (i.e., nonrandom) parameter sets to evaluate in the concurrent strategy (from the `starting_points` *and* `multi_objective_weight_sets` *specifications in* **StratMultiStart** *and* **StratParetoSet***)*

Private Member Functions

- DataStrategyRep ()

  constructor

- ~DataStrategyRep ()

  destructor

- void write (std::ostream &s) const

  write a DataStrategyRep object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataStrategyRep object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataStrategyRep object to a packed MPI buffer

Private Attributes

- int referenceCount

  number of handle objects sharing this dataStrategyRep

Friends

- class DataStrategy

  the handle class can access attributes of the body class directly

43.29.1 Detailed Description

Body class for strategy specification data. The DataStrategyRep class is used to contain the data from the strategy keyword specification. Default values are managed in the DataStrategyRep constructor. Data is public to avoid maintaining set/get functions, but is still encapsulated within ProblemDescDB since ProblemDescDB::strategySpec is private.

The documentation for this class was generated from the following files:

- DataStrategy.H
- DataStrategy.C

43.30 DataVariables Class Reference

Handle class for variables specification data.

Public Member Functions

- DataVariables ()

  constructor

- DataVariables (const DataVariables &)

  copy constructor

- ~DataVariables ()

  destructor

- DataVariables operator= (const DataVariables &)

  assignment operator

- bool operator== (const DataVariables &)

  equality operator

- void write (std::ostream &s) const

  write a DataVariables object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataVariables object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataVariables object to a packed MPI buffer

- size_t design ()

  return total number of design variables

- size_t aleatory_uncertain ()

  return total number of aleatory uncertain variables

- size_t epistemic_uncertain ()

  return total number of epistemic uncertain variables

- size_t uncertain ()

  return total number of uncertain variables

- size_t state ()

  return total number of state variables

- size_t continuous_variables ()

  return total number of continuous variables

- size_t discrete_variables ()

  return total number of discrete variables

- size_t total_variables ()

  return total number of variables

Static Public Member Functions

- static bool id_compare (const DataVariables &dv, const std::string &id)

  compares the idVariables attribute of DataVariables objects

Private Attributes

- DataVariablesRep * dataVarsRep

  pointer to the body (handle-body idiom)

Friends

- class **ProblemDescDB**
- class **NIDRProblemDescDB**
- void run_dakota_data ()

  library_mode default data initializer

43.30.1 Detailed Description

Handle class for variables specification data. The DataVariables class is used to provide a memory management handle for the data in DataVariablesRep. It is populated by IDRProblemDescDB::variables_kwhandler() and is queried by the ProblemDescDB::get_<datatype>() functions. A list of DataVariables objects is maintained in ProblemDescDB::dataVariablesList, one for each variables specification in an input file.

The documentation for this class was generated from the following files:

- DataVariables.H
- DataVariables.C

43.31 DataVariablesRep Class Reference

Body class for variables specification data.

Public Attributes

- String idVariables

  string identifier for the variables specification data set (from the `id_variables` *specification in* **VarSetId***)*

- size_t numContinuousDesVars

  number of continuous design variables (from the `continuous_design` *specification in* **VarDV***)*

- size_t numDiscreteDesRangeVars

  number of discrete design variables defined by an integer range (from the `discrete_design_range` *specification in* **VarDV***)*

- size_t numDiscreteDesSetIntVars

  number of discrete design variables defined by a set of integers (from the `discrete_design_set_integer` *specification in* **VarDV***)*

- size_t numDiscreteDesSetRealVars

  number of discrete design variables defined by a set of reals (from the `discrete_design_set_real` *specification in* **VarDV***)*

- size_t numNormalUncVars

  number of normal uncertain variables (from the `normal_uncertain` *specification in* **VarAUV***)*

- size_t numLognormalUncVars

  number of lognormal uncertain variables (from the `lognormal_uncertain` *specification in* **VarAUV***)*

- size_t numUniformUncVars

  number of uniform uncertain variables (from the `uniform_uncertain` *specification in* **VarAUV***)*

- size_t numLoguniformUncVars

  number of loguniform uncertain variables (from the `loguniform_uncertain` *specification in* **VarAUV***)*

- size_t numTriangularUncVars

  number of triangular uncertain variables (from the `triangular_uncertain` *specification in* **VarAUV***)*

- size_t numExponentialUncVars

  number of exponential uncertain variables (from the `exponential_uncertain` *specification in* **VarAUV***)*

- size_t numBetaUncVars

  number of beta uncertain variables (from the `beta_uncertain` *specification in* **VarAUV***)*

- size_t numGammaUncVars

number of gamma uncertain variables (from the `gamma_uncertain` *specification in* **VarAUV***)*

- size_t numGumbelUncVars

  number of gumbel uncertain variables (from the `gumbel_uncertain` *specification in* **VarAUV***)*

- size_t numFrechetUncVars

  number of frechet uncertain variables (from the `frechet_uncertain` *specification in* **VarAUV***)*

- size_t numWeibullUncVars

  number of weibull uncertain variables (from the `weibull_uncertain` *specification in* **VarAUV***)*

- size_t numHistogramBinUncVars

  number of histogram bin uncertain variables (from the `histogram_bin_uncertain` *specification in* **VarAUV***)*

- size_t numPoissonUncVars

  number of Poisson uncertain variables (from the `poisson_uncertain` *specification in* **VarAUV***)*

- size_t numBinomialUncVars

  number of binomial uncertain variables (from the `binomial_uncertain` *specification in* **VarAUV***)*

- size_t numNegBinomialUncVars

  number of negative binomial uncertain variables (from the `negative_binomial_uncertain` *specification in* **VarAUV***)*

- size_t numGeometricUncVars

  number of geometric uncertain variables (from the `geometric_uncertain` *specification in* **VarAUV**

- size_t numHyperGeomUncVars

  number of hypergeometric uncertain variables (from the `hypergeometric_uncertain` *specification in* **VarAUV***))*

- size_t numHistogramPtUncVars

  number of histogram point uncertain variables (from the `histogram_point_uncertain` *specification in* **VarAUV***)*

- size_t numIntervalUncVars

  number of interval uncertain variables (from the `interval_uncertain` *specification in* **VarEUV***)*

- size_t numContinuousStateVars

  number of continuous state variables (from the `continuous_state` *specification in* **VarSV***)*

- size_t numDiscreteStateRangeVars

  number of discrete state variables defined by an integer range (from the `discrete_state_range` *specification in* **VarDV***)*

- size_t numDiscreteStateSetIntVars

number of discrete state variables defined by a set of integers (from the `discrete_state_set_integer` *specification in* **VarDV***)*

- size_t numDiscreteStateSetRealVars

  number of discrete state variables defined by a set of reals (from the `discrete_state_set_real` *specification in* **VarDV***)*

- RealVector continuousDesignVars

  initial values for the continuous design variables array (from the `continuous_design` `initial_point` *specification in* **VarDV***)*

- RealVector continuousDesignLowerBnds

  lower bounds array for the continuous design variables (from the `continuous_design` `lower_bounds` *specification in* **VarDV***)*

- RealVector continuousDesignUpperBnds

  upper bounds array for the continuous design variables (from the `continuous_design` `upper_bounds` *specification in* **VarDV***)*

- StringArray continuousDesignScaleTypes

  scale types array for the continuous design variables (from the `continuous_design` `scale_types` *specification in* **VarDV***)*

- RealVector continuousDesignScales

  scales array for the continuous design variables (from the `continuous_design` `scales` *specification in* **VarDV***)*

- IntVector discreteDesignRangeVars

  initial values for the discrete design variables defined by an integer range (from the `discrete_design_range` `initial_point` *specification in* **VarDV***)*

- IntVector discreteDesignRangeLowerBnds

  lower bounds array for the discrete design variables defined by an integer range (from the `discrete_design_range` `lower_bounds` *specification in* **VarDV***)*

- IntVector discreteDesignRangeUpperBnds

  upper bounds array for the discrete design variables defined by an integer range(from the `discrete_design_range` `upper_bounds` *specification in* **VarDV***)*

- IntVector discreteDesignSetIntVars

  initial values for the discrete design variables defined by an integer set (from the `discrete_design_set_integer` `initial_point` *specification in* **VarDV***)*

- RealVector discreteDesignSetRealVars

  initial values for the discrete design variables defined by a real set (from the `discrete_design_set_real` `initial_point` *specification in* **VarDV***)*

- IntSetArray discreteDesignSetInt

complete set of admissible values for each of the discrete design variables defined by an integer set (from the `discrete_design_set_integer` `set_values` *specification in* **VarDV***)*

- RealSetArray discreteDesignSetReal

  complete set of admissible values for each of the discrete design variables defined by a real set (from the `discrete_design_set_real` `set_values` *specification in* **VarDV***)*

- StringArray continuousDesignLabels

  labels array for the continuous design variables (from the `continuous_design` `descriptors` *specification in* **VarDV***)*

- StringArray discreteDesignRangeLabels

  labels array for the discrete design variables defined by an integer range (from the `discrete_design_range` `descriptors` *specification in* **VarDV***)*

- StringArray discreteDesignSetIntLabels

  labels array for the discrete design variables defined by an integer set (from the `discrete_design_range` `descriptors` *specification in* **VarDV***)*

- StringArray discreteDesignSetRealLabels

  labels array for the discrete design variables defined by a real set (from the `discrete_design_range` `descriptors` *specification in* **VarDV***)*

- RealVector normalUncMeans

  means of the normal uncertain variables (from the `nuv_means` *specification in* **VarAUV***)*

- RealVector normalUncStdDevs

  standard deviations of the normal uncertain variables (from the `nuv_std_deviations` *specification in* **VarAUV***)*

- RealVector normalUncLowerBnds

  distribution lower bounds for the normal uncertain variables (from the `nuv_lower_bounds` *specification in* **VarAUV***)*

- RealVector normalUncUpperBnds

  distribution upper bounds for the normal uncertain variables (from the `nuv_upper_bounds` *specification in* **VarAUV***)*

- RealVector lognormalUncLambdas

  lambdas (means of the corresponding normals) of the lognormal uncertain variables (from the `lnuv_lambdas` *specification in* **VarAUV***)*

- RealVector lognormalUncZetas

  zetas (standard deviations of the corresponding normals) of the lognormal uncertain variables (from the `lnuv_zetas` *specification in* **VarAUV***)*

- RealVector lognormalUncMeans

  means of the lognormal uncertain variables (from the `lnuv_means` *specification in* **VarAUV***)*

- RealVector lognormalUncStdDevs

  standard deviations of the lognormal uncertain variables (from the `lnuv_std_deviations` *specification in* **VarAUV***)*

- RealVector lognormalUncErrFacts

  error factors for the lognormal uncertain variables (from the `lnuv_error_factors` *specification in* **VarAUV***)*

- RealVector lognormalUncLowerBnds

  distribution lower bounds for the lognormal uncertain variables (from the `lnuv_lower_bounds` *specification in* **VarAUV***)*

- RealVector lognormalUncUpperBnds

  distribution upper bounds for the lognormal uncertain variables (from the `lnuv_upper_bounds` *specification in* **VarAUV***)*

- RealVector uniformUncLowerBnds

  distribution lower bounds for the uniform uncertain variables (from the `uuv_lower_bounds` *specification in* **VarAUV***)*

- RealVector uniformUncUpperBnds

  distribution upper bounds for the uniform uncertain variables (from the `uuv_upper_bounds` *specification in* **VarAUV***)*

- RealVector loguniformUncLowerBnds

  distribution lower bounds for the loguniform uncertain variables (from the `luuv_lower_bounds` *specification in* **VarAUV***)*

- RealVector loguniformUncUpperBnds

  distribution upper bounds for the loguniform uncertain variables (from the `luuv_upper_bounds` *specification in* **VarAUV***)*

- RealVector triangularUncModes

  modes of the triangular uncertain variables (from the `tuv_modes` *specification in* **VarAUV***)*

- RealVector triangularUncLowerBnds

  distribution lower bounds for the triangular uncertain variables (from the `tuv_lower_bounds` *specification in* **VarAUV***)*

- RealVector triangularUncUpperBnds

  distribution upper bounds for the triangular uncertain variables (from the `tuv_upper_bounds` *specification in* **VarAUV***)*

- RealVector exponentialUncBetas

  beta factors for the exponential uncertain variables (from the `euv_betas` *specification in* **VarAUV***)*

- RealVector betaUncAlphas

alpha factors for the beta uncertain variables (from the `buv_means` *specification in* **VarAUV***)*

- RealVector betaUncBetas

  beta factors for the beta uncertain variables (from the `buv_std_deviations` *specification in* **VarAUV***)*

- RealVector betaUncLowerBnds

  distribution lower bounds for the beta uncertain variables (from the `buv_lower_bounds` *specification in* **VarAUV***)*

- RealVector betaUncUpperBnds

  distribution upper bounds for the beta uncertain variables (from the `buv_upper_bounds` *specification in* **VarAUV***)*

- RealVector gammaUncAlphas

  alpha factors for the gamma uncertain variables (from the `gauv_alphas` *specification in* **VarAUV***)*

- RealVector gammaUncBetas

  beta factors for the gamma uncertain variables (from the `gauv_betas` *specification in* **VarAUV***)*

- RealVector gumbelUncAlphas

  alpha factors for the gumbel uncertain variables (from the `guuv_alphas` *specification in* **VarAUV***)*

- RealVector gumbelUncBetas

  beta factors for of the gumbel uncertain variables (from the `guuv_betas` *specification in* **VarAUV***)*

- RealVector frechetUncAlphas

  alpha factors for the frechet uncertain variables (from the `fuv_alphas` *specification in* **VarAUV***)*

- RealVector frechetUncBetas

  beta factors for the frechet uncertain variables (from the `fuv_betas` *specification in* **VarAUV***)*

- RealVector weibullUncAlphas

  alpha factors for the weibull uncertain variables (from the `wuv_alphas` *specification in* **VarAUV***)*

- RealVector weibullUncBetas

  beta factors for the weibull uncertain variables (from the `wuv_betas` *specification in* **VarAUV***)*

- RealVectorArray histogramUncBinPairs

  an array containing a vector of (x,c) pairs for each bin-based histogram uncertain variable (see continuous linear histogram in LHS manual; from the `histogram_bin_uncertain` *specification in* **VarAUV***). (x,y) ordinate specifications are converted to (x,c) counts within NIDR.*

- RealVector poissonUncLambdas

  lambdas (rate parameter) for the poisson uncertain variables (from the `lambdas` *specification in* **VarAUV***)*

- RealVector binomialUncProbPerTrial

probabilities per each trial (p) for the binomial uncertain variables from the `prob_per_trial` *specification in* **VarAUV***)*

- IntVector binomialUncNumTrials

  Number of trials (N) for the binomial uncertain variables from the `num_trials` *specification in* **VarAUV***).*

- RealVector negBinomialUncProbPerTrial

  probabilities per each trial (p) for the negative binomial uncertain variables from the `prob_per_trial` *specification in* **VarAUV***)*

- IntVector negBinomialUncNumTrials

  Number of trials (N) for the negative binomial uncertain variables from the `num_trials` *specification in* **VarAUV***).*

- RealVector geometricUncProbPerTrial

  probabilities per each trial (p) for the geometric uncertain variables from the `prob_per_trial` *specification in* **VarAUV***)*

- IntVector hyperGeomUncTotalPop

  Size of total populations (N) for the hypergeometric uncertain variables from the `total_population` *specification in* **VarAUV***).*

- IntVector hyperGeomUncSelectedPop

  Size of selected populations for the hypergeometric uncertain variables from the `selected_population` *specification in* **VarAUV***).*

- IntVector hyperGeomUncNumDrawn

  Number failed in the selected populations for the hypergeometric variablesfrom the `num_drawn` *specification in* **VarAUV***).*

- RealVectorArray histogramUncPointPairs

  an array containing a vector of (x,c) pairs for each point-based histogram uncertain variable (see discrete histogram in LHS manual; from the `histogram_point_uncertain` *specification in* **VarAUV***)*

- RealVectorArray intervalUncBasicProbs

  Probability values per interval uncertain variable (from the `iuv_interval_probs` *specification in* **VarEUV***).*

- RealVectorArray intervalUncBounds

  Interval Bounds per interval uncertain variable (from the `iuv_interval_bounds` *specification in* **VarEUV***).*

- RealSymMatrix uncertainCorrelations

  correlation matrix for all uncertain variables (from the `uncertain_correlation_matrix` *specification in* **VarAUV***). This matrix specifies rank correlations for sampling methods (i.e., LHS) and correlation coefficients (rho_ij = normalized covariance matrix) for analytic reliability methods.*

- RealVector continuousStateVars

  initial values for the continuous state variables array (from the `continuous_state` `initial_point` *specification in* **VarSV***)*

- RealVector continuousStateLowerBnds

  lower bounds array for the continuous state variables (from the `continuous_state` `lower_bounds` *specification in* **VarSV***)*

- RealVector continuousStateUpperBnds

  upper bounds array for the continuous state variables (from the `continuous_state` `upper_bounds` *specification in* **VarSV***)*

- IntVector discreteStateRangeVars

  initial values for the discrete state variables defined by an integer range (from the `discrete_state_range` `initial_point` *specification in* **VarSV***)*

- IntVector discreteStateRangeLowerBnds

  lower bounds array for the discrete state variables defined by an integer range (from the `discrete_state_range` `lower_bounds` *specification in* **VarSV***)*

- IntVector discreteStateRangeUpperBnds

  upper bounds array for the discrete state variables defined by an integer range(from the `discrete_state_range` `upper_bounds` *specification in* **VarSV***)*

- IntVector discreteStateSetIntVars

  initial values for the discrete state variables defined by an integer set (from the `discrete_state_set_integer` `initial_point` *specification in* **VarSV***)*

- RealVector discreteStateSetRealVars

  initial values for the discrete state variables defined by a real set (from the `discrete_state_set_real` `initial_point` *specification in* **VarSV***)*

- IntSetArray discreteStateSetInt

  complete set of admissible values for each of the discrete state variables defined by an integer set (from the `discrete_state_set_integer` `set_values` *specification in* **VarSV***)*

- RealSetArray discreteStateSetReal

  complete set of admissible values for each of the discrete state variables defined by a real set (from the `discrete_state_set_real` `set_values` *specification in* **VarSV***)*

- StringArray continuousStateLabels

  labels array for the continuous state variables (from the `continuous_state` `descriptors` *specification in* **VarSV***)*

- StringArray discreteStateRangeLabels

  labels array for the discrete state variables defined by an integer range (from the `discrete_state_range` `descriptors` *specification in* **VarSV***)*

- StringArray discreteStateSetIntLabels

  labels array for the discrete state variables defined by an integer set (from the `discrete_state_range` `descriptors` *specification in* **VarSV***)*

- StringArray discreteStateSetRealLabels

  labels array for the discrete state variables defined by a real set (from the `discrete_state_range descriptors` *specification in* **VarSV***)*

- IntVector discreteDesignSetIntLowerBnds

  discrete design integer set lower bounds inferred from set values

- IntVector discreteDesignSetIntUpperBnds

  discrete design integer set upper bounds inferred from set values

- RealVector discreteDesignSetRealLowerBnds

  discrete design real set lower bounds inferred from set values

- RealVector discreteDesignSetRealUpperBnds

  discrete design real set upper bounds inferred from set values

- RealVector continuousAleatoryUncVars

  array of values for all continuous aleatory uncertain variables

- RealVector continuousAleatoryUncLowerBnds

  distribution lower bounds for all continuous aleatory uncertain variables (collected from `nuv_lower_bounds`, `lnuv_lower_bounds`, `uuv_lower_bounds`, `luuv_lower_bounds`, `tuv_lower_bounds`, *and* `buv_lower_bounds` *specifications in* **VarAUV***, and derived for gamma, gumbel, frechet, weibull and histogram bin specifications)*

- RealVector continuousAleatoryUncUpperBnds

  distribution upper bounds for all continuous aleatory uncertain variables (collected from `nuv_upper_bounds`, `lnuv_upper_bounds`, `uuv_upper_bounds`, `luuv_upper_bounds`, `tuv_lower_bounds`, *and* `buv_upper_bounds` *specifications in* **VarAUV***, and derived for gamma, gumbel, frechet, weibull and histogram bin specifications)*

- StringArray continuousAleatoryUncLabels

  labels for all continuous aleatory uncertain variables (collected from `nuv_descriptors`, `lnuv_descriptors`, `uuv_descriptors`, `luuv_descriptors`, `tuv_descriptors`, `buv_descriptors`, `gauv_descriptors`, `guuv_descriptors`, `fuv_descriptors`, `wuv_descriptors`, *and* `hbuv_descriptors` *specifications in* **VarAUV***)*

- IntVector discreteIntAleatoryUncVars

  array of values for all discrete integer aleatory uncertain variables

- IntVector discreteIntAleatoryUncLowerBnds

  distribution lower bounds for all discrete integer aleatory uncertain variables

- IntVector discreteIntAleatoryUncUpperBnds

  distribution upper bounds for all discrete integer aleatory uncertain variables

- StringArray discreteIntAleatoryUncLabels

  labels for all discrete integer aleatory uncertain variables

- RealVector discreteRealAleatoryUncVars

  array of values for all discrete real aleatory uncertain variables

- RealVector discreteRealAleatoryUncLowerBnds

  distribution lower bounds for all discrete real aleatory uncertain variables

- RealVector discreteRealAleatoryUncUpperBnds

  distribution upper bounds for all discrete real aleatory uncertain variables

- StringArray discreteRealAleatoryUncLabels

  labels for all discrete real aleatory uncertain variables

- RealVector continuousEpistemicUncVars

  array of values for all continuous epistemic uncertain variables

- RealVector continuousEpistemicUncLowerBnds

  distribution lower bounds for all continuous epistemic uncertain variables

- RealVector continuousEpistemicUncUpperBnds

  distribution upper bounds for all continuous epistemic uncertain variables

- StringArray continuousEpistemicUncLabels

  labels for all continuous epistemic uncertain variables

- IntVector discreteStateSetIntLowerBnds

  discrete state integer set lower bounds inferred from set values

- IntVector discreteStateSetIntUpperBnds

  discrete state integer set upper bounds inferred from set values

- RealVector discreteStateSetRealLowerBnds

  discrete state real set lower bounds inferred from set values

- RealVector discreteStateSetRealUpperBnds

  discrete state real set upper bounds inferred from set values

Private Member Functions

- DataVariablesRep ()

  default constructor

- ~DataVariablesRep ()

destructor

- void write (std::ostream &s) const

  write a DataVariablesRep object to an std::ostream

- void read (MPIUnpackBuffer &s)

  read a DataVariablesRep object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a DataVariablesRep object to a packed MPI buffer

Private Attributes

- int referenceCount

  number of handle objects sharing dataVarsRep

Friends

- class DataVariables

  the handle class can access attributes of the body class directly

43.31.1 Detailed Description

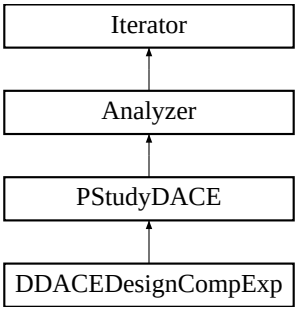
Body class for variables specification data. The DataVariablesRep class is used to contain the data from a variables keyword specification. Default values are managed in the DataVariablesRep constructor. Data is public to avoid maintaining set/get functions, but is still encapsulated within ProblemDescDB since ProblemDescDB::dataVariablesList is private.

The documentation for this class was generated from the following files:

- DataVariables.H
- DataVariables.C

43.32 DDACEDesignCompExp Class Reference

Wrapper class for the DDACE design of experiments library. Inheritance diagram for DDACEDesignCompExp::



Public Member Functions

- DDACEDesignCompExp (Model &model)

  primary constructor for building a standard DACE iterator

- DDACEDesignCompExp (Model &model, int samples, int symbols, int seed, const String &sampling_method)

  alternate constructor used for building approximations

- ~DDACEDesignCompExp ()

  destructor

- void pre_run ()

  pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori

- void extract_trends ()

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

- void post_input ()

  read tabular data for post-run mode

- void post_run (std::ostream &s)

  post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way

- int num_samples () const

  get the current number of samples

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)

  reset sampling iterator to use at least min_samples

- const String & sampling_scheme () const

  return sampling name

- void vary_pattern (bool pattern_flag)

  sets varyPattern in derived classes that support it

- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

Private Member Functions

- void compute_main_effects ()

  builds a DDaceMainEffects::OneWayANOVA if mainEffectsFlag is set

- void resolve_samples_symbols ()

  convenience function for resolving number of samples and number of symbols from input.

Static Private Member Functions

- static void copy_data (const std::vector< DDaceSamplePoint > &dspa, Real ∗ptr, const int ptr_len)

  copy DDACE point to RealVector

Private Attributes

- String daceMethod

  oas, lhs, oa_lhs, random, box_behnken, central_composite, or grid

- int samplesSpec

  initial specification of number of samples

- int symbolsSpec

  initial specification of number of symbols

- int numSamples

  current number of samples to be evaluated

- int numSymbols

  current number of symbols to be used in generating the sample set (inversely related to number of replications)

- const int seedSpec

  the user seed specification for the random number generator (allows repeatable results)

- int randomSeed

  current seed for the random number generator

- bool allDataFlag

  flag which triggers the update of allVars/allResponses for use by Iterator::all_variables() and Iterator::all_responses()

- size_t numDACERuns

  counter for number of run() executions for this object

- bool varyPattern

  flag for continuing the random number sequence from a previous run() execution (e.g., for surrogate-based optimization) so that multiple executions are repeatable but not correlated.

- bool mainEffectsFlag

  flag which specifies main effects

- std::vector< std::vector< int > > symbolMapping

  mapping of symbols for main effects calculations

43.32.1 Detailed Description

Wrapper class for the DDACE design of experiments library. The DDACEDesignCompExp class provides a wrapper for DDACE, a C++ design of experiments library from the Computational Sciences and Mathematics Research (CSMR) department at Sandia's Livermore CA site. This class uses design and analysis of computer experiments (DACE) methods to sample the design space spanned by the bounds of a Model. It returns all generated samples and their corresponding responses as well as the best sample found.

43.32.2 Constructor & Destructor Documentation

43.32.2.1 DDACEDesignCompExp (Model & *model*)

primary constructor for building a standard DACE iterator This constructor is called for a standard iterator built with data from probDescDB.

References Dakota::abort_handler(), DDACEDesignCompExp::daceMethod, DDACEDesignCompExp::mainEffectsFlag, Iterator::maxConcurrency, Iterator::numContinuousVars, and DDACEDesignCompExp::numSamples.

43.32.2.2 DDACEDesignCompExp (Model & *model*, int *samples*, int *symbols*, int *seed*, const String & *sampling_method*)

alternate constructor used for building approximations This alternate constructor is used for instantiations on-the-fly, using only the incoming data. No problem description database queries are used.

References Iterator::maxConcurrency, DDACEDesignCompExp::numSamples, and DDACEDesignCompExp::resolve_samples_symbols().

43.32.3 Member Function Documentation

43.32.3.1 void pre_run () [virtual]

pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori pre-run phase, which a derived iterator may optionally reimplement; when not present, pre-run is likely integrated into the derived run function. This is a virtual function; when re-implementing, a derived class must call its nearest parent's pre_run(), if implemented, typically _before_ performing its own implementation steps.

Reimplemented from Iterator.

References DDACEDesignCompExp::get_parameter_sets(), Iterator::iteratedModel, and PStudyDACE::varBasedDecompFlag.

43.32.3.2 void post_run (std::ostream & *s*) [virtual]

post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way Post-run phase, which a derived iterator may optionally reimplement; when not present, post-run is likely integrated into run. This is a virtual function; when re-implementing, a derived class must call its nearest parent's post_run(), typically _after_ performing its own implementation steps.

Reimplemented from Iterator.

References Analyzer::allResponses, Analyzer::allSamples, SensAnalysisGlobal::compute_correlations(), DDACEDesignCompExp::compute_main_effects(), DDACEDesignCompExp::mainEffectsFlag, PStudyDACE::pStudyDACESensGlobal, Iterator::subIteratorFlag, and PStudyDACE::varBasedDecompFlag.

43.32.3.3 int num_samples () const [inline, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References DDACEDesignCompExp::numSamples.

43.32.3.4 void resolve_samples_symbols () [private]

convenience function for resolving number of samples and number of symbols from input. This function must define a combination of samples and symbols that is acceptable for a particular sampling algorithm. Users provide requests for these quantities, but this function must enforce any restrictions imposed by the sampling algorithms.

References Dakota::abort_handler(), DDACEDesignCompExp::daceMethod, Iterator::numContinuousVars, DDACEDesignCompExp::numSamples, and DDACEDesignCompExp::numSymbols.

Referenced by DDACEDesignCompExp::DDACEDesignCompExp(), and DDACEDesignCompExp::get_parameter_sets().

43.32.3.5 void copy_data (const std::vector< DDaceSamplePoint > & *dspa*, Real * *ptr*, const int *ptr_len*) [static, private]

copy DDACE point to RealVector copy DDACE point array to RealVectorArray copy DDACE point array to Real*

References Dakota::abort_handler().

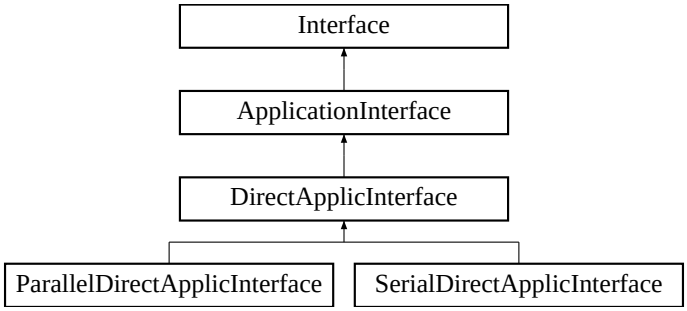
Referenced by DDACEDesignCompExp::get_parameter_sets().

The documentation for this class was generated from the following files:

- DDACEDesignCompExp.H
- DDACEDesignCompExp.C

43.33 DirectApplicInterface Class Reference

Derived application interface class which spawns simulation codes and testers using direct procedure calls. Inheritance diagram for DirectApplicInterface::



Public Member Functions

- DirectApplicInterface (const ProblemDescDB &problem_db)

  constructor

- ~DirectApplicInterface ()

  destructor

- void derived_map (const Variables &vars, const ActiveSet &set, Response &response, int fn_eval_id)

  Called by map() and other functions to execute the simulation in synchronous mode. The portion of performing an evaluation that is specific to a derived class.

- void derived_map_asynch (const ParamResponsePair &pair)

  Called by map() and other functions to execute the simulation in asynchronous mode. The portion of performing an asynchronous evaluation that is specific to a derived class.

- void derived_synch (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version waits for at least one completion.

- void derived_synch_nowait (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version is nonblocking and will return without any completions if none are immediately available.

- int derived_synchronous_local_analysis (const int &analysis_id)
- const StringArray & analysis_drivers () const

  retrieve the analysis drivers specification for application interfaces

Protected Member Functions

- virtual int derived_map_if (const Dakota::String &if_name)

  execute the input filter portion of a direct evaluation invocation

- virtual int derived_map_ac (const Dakota::String &ac_name)

  execute an analysis code portion of a direct evaluation invocation

- virtual int derived_map_of (const Dakota::String &of_name)

  execute the output filter portion of a direct evaluation invocation

- void set_local_data (const Variables &vars, const ActiveSet &set, const Response &response)

  convenience function for local test simulators which sets per-evaluation variable and response attributes

- void overlay_response (Response &response)

  convenience function for local test simulators which overlays response contributions from multiple analyses using MPI_Reduce

Protected Attributes

- String iFilterName

  name of the direct function input filter

- String oFilterName

  name of the direct function output filter

- driver_t iFilterType

  enum type of the direct function input filter

- driver_t oFilterType

  enum type of the direct function output filter

- bool gradFlag

  signals use of fnGrads in direct simulator functions

- bool hessFlag

  signals use of fnHessians in direct simulator functions

- size_t numFns

  number of functions in fnVals

- size_t numVars

  total number of continuous and discrete variables

- size_t numACV

total number of continuous variables

- size_t numADIV

  total number of discete integer variables

- size_t numADRV

  total number of discete real variables

- size_t numDerivVars

  number of active derivative variables

- unsigned short localDataView

  bit-wise record of which local data views are active; see enum local_data_t

- RealVector xC

  continuous variables used within direct simulator fns

- IntVector xDI

  discrete int variables used within direct simulator fns

- RealVector xDR

  discrete real variables used within direct simulator fns

- StringMultiArray xCLabels

  continuous variable labels

- StringMultiArray xDILabels

  discrete integer variable labels

- StringMultiArray xDRLabels

  discrete real variable labels

- std::map< String, var_t > varTypeMap

  map from variable label to enum

- std::map< String, driver_t > driverTypeMap

  map from driver name to enum

- std::map< var_t, Real > xCM

  map from var_t enum to continuous value

- std::map< var_t, int > xDIM

  map from var_t enum to discrete int value

- std::map< var_t, Real > xDRM

  map from var_t enum to discrete real value

- std::vector< var_t > varTypeDVV

  var_t enumerations corresponding to DVV components

- std::vector< var_t > xCMLabels

  var_t enumerations corresponding to continuous variable labels

- std::vector< var_t > xDIMLabels

  var_t enumerations corresponding to discrete integer variable labels

- std::vector< var_t > xDRMLabels

  var_t enumerations corresponding to discrete real variable labels

- ShortArray directFnASV

  class scope active set vector

- SizetArray directFnDVV

  class scope derivative variables vector

- RealVector fnVals

  response fn values within direct simulator fns

- RealMatrix fnGrads

  response fn gradients w/i direct simulator fns

- RealSymMatrixArray fnHessians

  response fn Hessians within direct fns

- StringArray analysisDrivers

  the set of analyses within each function evaluation (from the analysis_drivers interface specification)

- std::vector< driver_t > analysisDriverTypes

  conversion of analysisDrivers to driver_t

- size_t analysisDriverIndex

  the index of the active analysis driver within analysisDrivers

- String2DArray analysisComponents

  the set of optional analysis components used by the analysis drivers (from the analysis_components interface specification)

- engine * matlabEngine

  pointer to the MATLAB engine used for direct evaluations

Private Member Functions

- int cantilever ()

  scaled cantilever test function for optimization

- int mod_cantilever ()

  unscaled cantilever test function for UQ

- int cyl_head ()

  the cylinder head constrained optimization test fn

- int multimodal ()

  multimodal UQ test function

- int log_ratio ()

  the log_ratio UQ test function

- int short_column ()

  the short_column UQ/OUU test function

- int lf_short_column ()

  a low fidelity short_column test function

- int side_impact_cost ()

  the side_impact_cost UQ/OUU test function

- int side_impact_perf ()

  the side_impact_perf UQ/OUU test function

- int rosenbrock ()

  the Rosenbrock optimization and least squares test fn

- int generalized_rosenbrock ()

  n-dimensional Rosenbrock (Schittkowski)

- int extended_rosenbrock ()

  n-dimensional Rosenbrock (Nocedal/Wright)

- int lf_rosenbrock ()

  a low fidelity version of the Rosenbrock function

- int gerstner ()

  the isotropic/anisotropic Gerstner test function family

- int scalable_gerstner ()

  scalable versions of the Gerstner test family

- int steel_column_cost ()

  the steel_column_cost UQ/OUU test function

- int steel_column_perf ()

  the steel_column_perf UQ/OUU test function

- int sobol_rational ()

  Sobol SA rational test function.

- int sobol_g_function ()

  Sobol SA discontinuous test function.

- int sobol_ishigami ()

  Sobol SA transcendental test function.

- int text_book ()

  the text_book constrained optimization test function

- int text_book1 ()

  portion of text_book() evaluating the objective fn

- int text_book2 ()

  portion of text_book() evaluating constraint 1

- int text_book3 ()

  portion of text_book() evaluating constraint 2

- int text_book_ouu ()

  the text_book_ouu OUU test function

- int scalable_text_book ()

  scalable version of the text_book test function

- int scalable_monomials ()

  simple monomials for UQ exactness testing

- void herbie1D (size_t der_mode, Real xc_loc, std::vector< Real > &w_and_ders)

  1D components of herbie function

- void smooth_herbie1D (size_t der_mode, Real xc_loc, std::vector< Real > &w_and_ders)

  1D components of smooth_herbie function

- void shubert1D (size_t der_mode, Real xc_loc, std::vector< Real > &w_and_ders)

  1D components of shubert function

- int herbie ()

  returns the N-D herbie function

- int smooth_herbie ()

  returns the N-D smooth herbie function

- int shubert ()

  returns the N-D shubert function

- void separable_combine (Real mult_scale_factor, std::vector< Real > &w, std::vector< Real > &d1w, std::vector< Real > &d2w)

  utility to combine components of separable fns

- int salinas ()

  direct interface to the SALINAS structural dynamics code

- int mc_api_run ()

  direct interface to ModelCenter via API, HKIM 4/3/03

- int matlab_engine_run ()

  direct interface to Matlab via API, BMA 11/28/05

- int matlab_field_prep (mxArray *dakota_matlab, const char *field_name)

  check that the dakota_matlab strucutre has the specified field_name and add if necessary; free structure memory in preparation for new alloc

- int python_run ()

  direct interface to Python via API, BMA 07/02/07

- template<class ArrayT , class Size >
  bool python_convert_int (const ArrayT &src, Size size, PyObject **dst)

  convert arrays of integer types to Python list or numpy array

- bool python_convert (const RealVector &src, PyObject **dst)

  convert RealVector to Python list or numpy array

- bool python_convert (const RealVector &c_src, const IntVector &di_src, const RealVector &dr_src, PyObject **dst)

  convert RealVector + IntVector + RealVector to Python mixed list or numpy double array

- bool python_convert (const StringMultiArray &src, PyObject **dst)

  convert labels

- bool python_convert (const StringMultiArray &c_src, const StringMultiArray &di_src, const StringMultiArray &dr_src, PyObject **dst)

  convert all labels to single list

- bool python_convert (PyObject *pyv, RealVector &rv, const int &dim)

  convert python [list of int or float] or [numpy array of double] to RealVector (for fns)

- bool python_convert (PyObject *pyv, double *rv, const int &dim)

  convert python [list of int or float] or [numpy array of double] to double[], for use as helper in converting gradients

- bool python_convert (PyObject *pym, RealMatrix &rm)

  convert python [list of lists of int or float] or [numpy array of dbl] to RealMatrix (for gradients)

- bool python_convert (PyObject *pym, RealSymMatrix &rm)

  convert python [list of lists of int or float] or [numpy array of dbl] to RealMatrix (used as helper in Hessian conversion)

- bool python_convert (PyObject *pyma, RealSymMatrixArray &rma)

  convert python [list of lists of lists of int or float] or [numpy array of double] to RealSymMatrixArray (for Hessians)

Private Attributes

- bool userNumpyFlag

  whether the user requested numpy data structures

43.33.1 Detailed Description

Derived application interface class which spawns simulation codes and testers using direct procedure calls. DirectApplicInterface uses a few linkable simulation codes and several internal member functions to perform parameter to response mappings.

43.33.2 Member Function Documentation

43.33.2.1 int derived_synchronous_local_analysis (const int & *analysis_id*) `[inline, virtual]`

This code provides the derived function used by ApplicationInterface::serve_analyses_synch().

Reimplemented from ApplicationInterface.

References DirectApplicInterface::analysisDriverIndex, DirectApplicInterface::analysisDrivers, and DirectApplicInterface::derived_map_ac().

43.33.2.2 int derived_map_ac (const Dakota::String & *ac_name*) `[protected, virtual]`

execute an analysis code portion of a direct evaluation invocation When a direct analysis/filter is a member function, the (vars,set,response) data does not need to be passed through the API. If, however, non-member analysis/filter functions are added, then pass (vars,set,response) through to the non-member fns:

```
// API declaration
int sim(const Variables& vars, const ActiveSet& set, Response& response);
// use of API within derived_map_ac()
if (ac_name == "sim")
  fail_code = sim(directFnVars, directFnActSet, directFnResponse);
```

Reimplemented in ParallelDirectApplicInterface, and SerialDirectApplicInterface.

References Dakota::abort_handler(), ApplicationInterface::analysisServerId, DirectApplicInterface::cantilever(), DirectApplicInterface::cyl_head(), DirectApplicInterface::driverTypeMap, DirectApplicInterface::extended_rosenbrock(), DirectApplicInterface::generalized_rosenbrock(), DirectApplicInterface::gerstner(), DirectApplicInterface::herbie(), DirectApplicInterface::lf_rosenbrock(), DirectApplicInterface::lf_short_column(), DirectApplicInterface::log_ratio(), DirectApplicInterface::matlab_engine_run(), DirectApplicInterface::mc_api_run(), DirectApplicInterface::mod_cantilever(), DirectApplicInterface::multimodal(), DirectApplicInterface::python_run(), DirectApplicInterface::rosenbrock(), DirectApplicInterface::salinas(), DirectApplicInterface::scalable_gerstner(), DirectApplicInterface::scalable_monomials(), DirectApplicInterface::scalable_text_book(), DirectApplicInterface::short_column(), DirectApplicInterface::shubert(), DirectApplicInterface::side_impact_cost(), DirectApplicInterface::side_impact_perf(), DirectApplicInterface::smooth_herbie(), DirectApplicInterface::sobol_g_function(), DirectApplicInterface::sobol_ishigami(), DirectApplicInterface::sobol_rational(), DirectApplicInterface::steel_column_cost(), DirectApplicInterface::steel_column_perf(), DirectApplicInterface::text_book(), DirectApplicInterface::text_book1(), DirectApplicInterface::text_book2(), DirectApplicInterface::text_book3(), and DirectApplicInterface::text_book_ouu().

Referenced by DirectApplicInterface::derived_map(), and DirectApplicInterface::derived_synchronous_local_analysis().

43.33.2.3 void herbie1D (size_t *der_mode*, Real *xc_loc*, std::vector< Real > & *w_and_ders*) [private]

1D components of herbie function 1D Herbie function and its derivatives (apart from a multiplicative factor)

Referenced by DirectApplicInterface::herbie().

43.33.2.4 void smooth_herbie1D (size_t *der_mode*, Real *xc_loc*, std::vector< Real > & *w_and_ders*) [private]

1D components of smooth_herbie function 1D Smoothed Herbie= 1DHerbie minus the high frequency sine term, and its derivatives (apart from a multiplicative factor)

Referenced by DirectApplicInterface::smooth_herbie().

43.33.2.5 void shubert1D (size_t *der_mode*, Real *xc_loc*, std::vector< Real > & *w_and_ders*) [private]

1D components of shubert function 1D Shubert function and its derivatives (apart from a multiplicative factor)

Referenced by DirectApplicInterface::shubert().

43.33.2.6 int herbie () [private]

returns the N-D herbie function N-D Herbie function and its derivatives.

References DirectApplicInterface::directFnASV, DirectApplicInterface::directFnDVV, DirectApplicInterface::herbie1D(), DirectApplicInterface::numDerivVars, DirectApplicInterface::numVars, DirectApplicInterface::separable_combine(), and DirectApplicInterface::xC.

Referenced by DirectApplicInterface::derived_map_ac().

43.33.2.7 int smooth_herbie () [private]

returns the N-D smooth herbie function N-D Smoothed Herbie function and its derivatives.

References DirectApplicInterface::directFnASV, DirectApplicInterface::directFnDVV, DirectApplicInterface::numDerivVars, DirectApplicInterface::numVars, DirectApplicInterface::separable_combine(), DirectApplicInterface::smooth_herbie1D(), and DirectApplicInterface::xC.

Referenced by DirectApplicInterface::derived_map_ac().

43.33.2.8 void separable_combine (Real *mult_scale_factor*, std::vector< Real > & *w*, std::vector< Real > & *d1w*, std::vector< Real > & *d2w*) [private]

utility to combine components of separable fns this function combines N 1D functions and their derivatives to compute a N-D separable function and its derivatives, logic is general enough to support different 1D functions in different dimensions (can mix and match)

References DirectApplicInterface::directFnASV, DirectApplicInterface::directFnDVV, DirectApplicInterface::fnGrads, DirectApplicInterface::fnHessians, DirectApplicInterface::fnVals, DirectApplicInterface::numDerivVars, and DirectApplicInterface::numVars.

Referenced by DirectApplicInterface::herbie(), DirectApplicInterface::shubert(), and DirectApplicInterface::smooth_herbie().

43.33.2.9 bool python_convert_int (const ArrayT & *src*, Size *sz*, PyObject ** *dst*) [inline, private]

convert arrays of integer types to Python list or numpy array convert all integer array types including IntVector, ShortArray, and SizetArray to Python list of ints or numpy array of ints

References DirectApplicInterface::userNumpyFlag.

Referenced by DirectApplicInterface::python_run().

The documentation for this class was generated from the following files:

- DirectApplicInterface.H
- DirectApplicInterface.C

43.34 DiscrepancyCorrection Class Reference

Base class for discrepancy corrections.

Public Member Functions

- DiscrepancyCorrection ()

  default constructor

- DiscrepancyCorrection (Model &surr_model, const IntSet &surr_fn_indices, short corr_type, short corr_order)

  standard constructor

- DiscrepancyCorrection (const IntSet &surr_fn_indices, size_t num_fns, size_t num_vars, short corr_type, short corr_order)

  alternate constructor

- ~DiscrepancyCorrection ()

  destructor

- void initialize (Model &surr_model, const IntSet &surr_fn_indices, short corr_type, short corr_order)

  initialize the DiscrepancyCorrection data

- void initialize (const IntSet &surr_fn_indices, size_t num_fns, size_t num_vars, short corr_type, short corr_order)

  initialize the DiscrepancyCorrection data

- void compute (const RealVector &c_vars, const Response &truth_response, const Response &approx_response, bool quiet_flag=false)

  compute the correction required to bring approx_response into agreement with truth_response and store in {add,mult}Corrections

- void compute (const Response &truth_response, const Response &approx_response, Response &discrepancy_response, bool quiet_flag=false)

  compute the correction required to bring approx_response into agreement with truth_response and store in discrepancy_response

- void apply (const RealVector &c_vars, Response &approx_response, bool quiet_flag=false)

  apply the correction computed in compute() to approx_response

- bool active () const

  indicates an active correction via non-empty correctionType

- short correction_type () const

  return correctionType

- short correction_order () const

  return correctionOrder

- short data_order () const

  return dataOrder

- bool computed () const

  return correctionComputed

Protected Attributes

- IntSet surrogateFnIndices

  for mixed response sets, this array specifies the response function subset that is approximated

- short correctionType

  approximation correction approach to be used: NO_CORRECTION, ADDITIVE_CORRECTION, MULTIPLICATIVE_CORRECTION, or COMBINED_CORRECTION.

- short correctionOrder

  approximation correction order to be used: 0, 1, or 2

- short dataOrder

  order of correction data in 3-bit format: overlay of 1 (value), 2 (gradient), and 4 (Hessian)

- bool correctionComputed

  flag indicating whether or not a correction has been computed and is available for application

- size_t numFns

  total number of response functions (of which surrogateFnIndices may define a subset)

- size_t numVars

  number of continuous variables active in the correction

Private Member Functions

- void initialize_corrections ()

  internal convenience function shared by overloaded initialize() variants

- bool check_scaling (const RealVector &truth_fns, const RealVector &approx_fns)

  define badScalingFlag

- void compute_additive (const Response &truth_response, const Response &approx_response, int index, Real &discrep_fn, RealVector &discrep_grad, RealSymMatrix &discrep_hess)

internal convenience function for computing additive corrections between truth and approximate responses

- void compute_multiplicative (const Response &truth_response, const Response &approx_response, int index, Real &discrep_fn, RealVector &discrep_grad, RealSymMatrix &discrep_hess)

  internal convenience function for computing multiplicative corrections between truth and approximate responses

- void apply_additive (const RealVector &c_vars, Response &approx_response)

  internal convenience function for applying additive corrections to an approximate response

- void apply_multiplicative (const RealVector &c_vars, Response &approx_response)

  internal convenience function for applying multiplicative corrections to an approximate response

- void apply_additive (const RealVector &c_vars, RealVector &approx_fns)

  internal convenience function for applying additive corrections to a set of response functions

- void apply_multiplicative (const RealVector &c_vars, RealVector &approx_fns)

  internal convenience function for applying multiplicative corrections to a set of response functions

- const Response & search_db (const RealVector &c_vars, const ShortArray &search_asv)

  search data_pairs for missing approximation data

Private Attributes

- bool badScalingFlag

  flag used to indicate function values near zero for multiplicative corrections; triggers an automatic switch to additive corrections

- bool computeAdditive

  flag indicating the need for additive correction calculations

- bool computeMultiplicative

  flag indicating the need for multiplicative correction calculations

- std::vector< Approximation > addCorrections

  array of additive corrections; surrogate models of a model discrepancy function (formed from model differences)

- std::vector< Approximation > multCorrections

  array of multiplicative corrections; surrogate models of a model discrepancy function (formed from model ratios)

- Model surrModel

  shallow copy of the surrogate model instance as returned by Model::surrogate_model() (the DataFitSurrModel or HierarchSurrModel::lowFidelityModel instance)

- RealVector combineFactors

factors for combining additive and multiplicative corrections. Each factor is the weighting applied to the additive correction and 1.-factor is the weighting applied to the multiplicative correction. The factor value is determined by an additional requirement to match the high fidelity function value at the previous correction point (e.g., previous trust region center). This results in a multipoint correction instead of a strictly local correction.

- RealVector correctionPrevCenterPt

  copy of center point from the previous correction cycle

- RealVector truthFnsCenter

  truth function values at the current correction point

- RealVector approxFnsCenter

  Surrogate function values at the current correction point.

- RealMatrix approxGradsCenter

  Surrogate gradient values at the current correction point.

- RealVector truthFnsPrevCenter

  copy of truth function values at center of previous correction cycle

- RealVector approxFnsPrevCenter

  copy of approximate function values at center of previous correction cycle

43.34.1 Detailed Description

Base class for discrepancy corrections. The DiscrepancyCorrection class provides common functions for computing and applying corrections to approximations.

43.34.2 Member Function Documentation

43.34.2.1 void compute (const RealVector & *c_vars*, const Response & *truth_response*, const Response & *approx_response*, bool *quiet_flag* = `false`)

compute the correction required to bring approx_response into agreement with truth_response and store in {add,mult}Corrections Compute an additive or multiplicative correction that corrects the approx_response to have 0th-order consistency (matches values), 1st-order consistency (matches values and gradients), or 2nd-order consistency (matches values, gradients, and Hessians) with the truth_response at a single point (e.g., the center of a trust region). The 0th-order, 1st-order, and 2nd-order corrections use scalar values, linear scaling functions, and quadratic scaling functions, respectively, for each response function.

References Response::active_set(), DiscrepancyCorrection::addCorrections, DiscrepancyCorrection::apply(), DiscrepancyCorrection::apply_additive(), DiscrepancyCorrection::apply_multiplicative(), DiscrepancyCorrection::approxFnsCenter, DiscrepancyCorrection::approxFnsPrevCenter, DiscrepancyCorrection::approxGradsCenter, DiscrepancyCorrection::badScalingFlag, DiscrepancyCorrection::check_scaling(), DiscrepancyCorrection::combineFactors, DiscrepancyCorrection::compute_additive(),

DiscrepancyCorrection::compute_multiplicative(), DiscrepancyCorrection::computeAdditive, DiscrepancyCorrection::computeMultiplicative, Response::copy(), DiscrepancyCorrection::correctionComputed, DiscrepancyCorrection::correctionOrder, DiscrepancyCorrection::correctionPrevCenterPt, DiscrepancyCorrection::correctionType, DiscrepancyCorrection::dataOrder, Response::function_gradients(), Response::function_values(), Model::is_null(), DiscrepancyCorrection::multCorrections, DiscrepancyCorrection::numFns, DiscrepancyCorrection::numVars, ActiveSet::request_values(), DiscrepancyCorrection::surrModel, DiscrepancyCorrection::surrogateFnIndices, DiscrepancyCorrection::truthFnsCenter, and DiscrepancyCorrection::truthFnsPrevCenter.

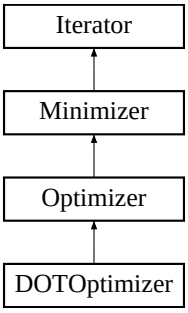
Referenced by HierarchSurrModel::derived_compute_response(), DataFitSurrModel::derived_compute_response(), HierarchSurrModel::derived_synchronize(), DataFitSurrModel::derived_synchronize(), HierarchSurrModel::derived_synchronize_nowait(), DataFitSurrModel::derived_synchronize_nowait(), and SurrBasedLocalMinimizer::minimize_surrogates().

The documentation for this class was generated from the following files:

- DiscrepancyCorrection.H
- DiscrepancyCorrection.C

43.35 DOTOptimizer Class Reference

Wrapper class for the DOT optimization library. Inheritance diagram for DOTOptimizer::



Public Member Functions

- DOTOptimizer (Model &model)

  standard constructor

- DOTOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor

- ~DOTOptimizer ()

  destructor

- void find_optimum ()

  Used within the optimizer branch for computing the optimal solution. Redefines the run virtual function for the optimizer branch.

Protected Member Functions

- void initialize_run ()

  performs run-time set up

Private Member Functions

- void initialize ()

  Shared constructor code.

- void allocate_workspace ()

  Allocates workspace for the optimizer.

- void allocate_constraints ()

  Allocates constraint mappings.

Private Attributes

- int dotInfo

  INFO from DOT manual.

- int dotFDSinfo

  internal DOT parameter NGOTOZ

- int dotMethod

  METHOD from DOT manual.

- int printControl

  IPRINT from DOT manual (controls output verbosity).

- int optimizationType

  MINMAX from DOT manual (minimize or maximize).

- RealArray realCntlParmArray

  RPRM from DOT manual.

- IntArray intCntlParmArray

  IPRM from DOT manual.

- RealVector designVars

  array of design variable values passed to DOT

- Real objFnValue

  value of the objective function passed to DOT

- RealVector constraintValues

  array of nonlinear constraint values passed to DOT

- int realWorkSpaceSize

  size of realWorkSpace

- int intWorkSpaceSize

  size of intWorkSpace

- RealArray realWorkSpace

  real work space for DOT

- IntArray intWorkSpace

int work space for DOT

- int numDotNlnConstr

  total number of nonlinear constraints seen by DOT

- int numDotLinConstr

  total number of linear constraints seen by DOT

- int numDotConstr

  total number of linear and nonlinear constraints seen by DOT

- SizetArray constraintMappingIndices

  a container of indices for referencing the corresponding Response constraints used in computing the DOT constraints.

- RealArray constraintMappingMultipliers

  a container of multipliers for mapping the Response constraints to the DOT constraints.

- RealArray constraintMappingOffsets

  a container of offsets for mapping the Response constraints to the DOT constraints.

43.35.1 Detailed Description

Wrapper class for the DOT optimization library. The DOTOptimizer class provides a wrapper for DOT, a commercial Fortran 77 optimization library from Vanderplaats Research and Development. It uses a reverse communication mode, which avoids the static member function issues that arise with function pointer designs (see NPSOLOptimizer and SNLLOptimizer).

The user input mappings are as follows: `max_iterations` is mapped into DOT's `ITMAX` parameter within its `IPRM` array, `max_function_evaluations` is implemented directly in the find_optimum() loop since there is no DOT parameter equivalent, `convergence_tolerance` is mapped into DOT's `DELOBJ` parameter (the relative convergence tolerance) within its `RPRM` array, `output` verbosity is mapped into DOT's `IPRINT` parameter within its function call parameter list (verbose: `IPRINT` = 7; quiet: `IPRINT` = 3), and `optimization_type` is mapped into DOT's `MINMAX` parameter within its function call parameter list. Refer to [Vanderplaats Research and Development, 1995] for information on `IPRM`, `RPRM`, and the DOT function call parameter list.

43.35.2 Member Data Documentation

43.35.2.1 int dotInfo [private]

INFO from DOT manual. Information requested by DOT: 0=optimization complete, 1=get values, 2=get gradients

Referenced by DOTOptimizer::find_optimum(), and DOTOptimizer::initialize_run().

43.35.2.2 int dotFDSinfo [private]

internal DOT parameter NGOTOZ the DOT parameter list has been modified to pass NGOTOZ, which signals whether DOT is finite-differencing (nonzero value) or performing the line search (zero value).

Referenced by DOTOptimizer::find_optimum().

43.35.2.3 int dotMethod [private]

METHOD from DOT manual. For nonlinear constraints: 0/1 = dot_mmfd, 2 = dot_slp, 3 = dot_sqp. For unconstrained: 0/1 = dot_bfgs, 2 = dot_frcg.

Referenced by DOTOptimizer::allocate_constraints(), DOTOptimizer::allocate_workspace(), DOTOptimizer::DOTOptimizer(), and DOTOptimizer::find_optimum().

43.35.2.4 int printControl [private]

IPRINT from DOT manual (controls output verbosity). Values range from 0 (least output) to 7 (most output).

Referenced by DOTOptimizer::DOTOptimizer(), and DOTOptimizer::find_optimum().

43.35.2.5 int optimizationType [private]

MINMAX from DOT manual (minimize or maximize). Values of 0 or -1 (minimize) or 1 (maximize).

Referenced by DOTOptimizer::DOTOptimizer(), and DOTOptimizer::find_optimum().

43.35.2.6 RealArray realCntlParmArray [private]

RPRM from DOT manual. Array of real control parameters.

Referenced by DOTOptimizer::find_optimum(), and DOTOptimizer::initialize().

43.35.2.7 IntArray intCntlParmArray [private]

IPRM from DOT manual. Array of integer control parameters.

Referenced by DOTOptimizer::find_optimum(), and DOTOptimizer::initialize().

43.35.2.8 RealVector constraintValues [private]

array of nonlinear constraint values passed to DOT This array must be of nonzero length and must contain only one-sided inequality constraints which are <= 0 (which requires a transformation from 2-sided inequalities and equalities).

Referenced by DOTOptimizer::allocate_constraints(), and DOTOptimizer::find_optimum().

43.35.2.9 SizetArray constraintMappingIndices [private]

a container of indices for referencing the corresponding Response constraints used in computing the DOT constraints. The length of the container corresponds to the number of DOT constraints, and each entry in the container points to the corresponding DAKOTA constraint.

Referenced by DOTOptimizer::allocate_constraints(), and DOTOptimizer::find_optimum().

43.35.2.10 RealArray constraintMappingMultipliers [private]

a container of multipliers for mapping the Response constraints to the DOT constraints. The length of the container corresponds to the number of DOT constraints, and each entry in the container stores a multiplier for the DAKOTA constraint identified with constraintMappingIndices. These multipliers are currently +1 or -1.

Referenced by DOTOptimizer::allocate_constraints(), and DOTOptimizer::find_optimum().

43.35.2.11 RealArray constraintMappingOffsets [private]

a container of offsets for mapping the Response constraints to the DOT constraints. The length of the container corresponds to the number of DOT constraints, and each entry in the container stores an offset for the DAKOTA constraint identified with constraintMappingIndices. These offsets involve inequality bounds or equality targets, since DOT assumes constraint allowables = 0.

Referenced by DOTOptimizer::allocate_constraints(), and DOTOptimizer::find_optimum().

The documentation for this class was generated from the following files:

- DOTOptimizer.H
- DOTOptimizer.C

43.36 Driver Class Reference

A subclass of the JEGA front end driver that exposes the individual protected methods to execute the algorithm.

Public Member Functions

- GeneticAlgorithm ∗ ExtractAllData (const AlgorithmConfig &algConfig)

  Reads all required data from the problem description database stored in the supplied algorithm config.

- DesignOFSortSet PerformIterations (GeneticAlgorithm ∗theGA)

  Performs the required iterations on the supplied GA.

- void DestroyAlgorithm (GeneticAlgorithm ∗theGA)

  Deletes the supplied GA.

- Driver (const ProblemConfig &probConfig)

  Default constructs a Driver.

43.36.1 Detailed Description

A subclass of the JEGA front end driver that exposes the individual protected methods to execute the algorithm. This is necessary because DAKOTA requires that all problem information be extracted from the problem description DB at the time of Optimizer construction and the front end does it all in the execute algorithm method which must be called in find_optimum.

43.36.2 Constructor & Destructor Documentation

43.36.2.1 Driver (const ProblemConfig & *probConfig*) `[inline]`

Default constructs a Driver.

Parameters:

probConfig The definition of the problem to be solved by this Driver whenever ExecuteAlgorithm is called.

The problem can be solved in multiple ways by multiple algorithms even using multiple different evaluators by issuing multiple calls to ExecuteAlgorithm with different AlgorithmConfigs.

43.36.3 Member Function Documentation

43.36.3.1 GeneticAlgorithm∗ ExtractAllData (const AlgorithmConfig & *algConfig*) `[inline]`

Reads all required data from the problem description database stored in the supplied algorithm config. The returned GA is fully configured and ready to be run. It must also be destroyed at some later time. You MUST call

DestroyAlgorithm for this purpose. Failure to do so could result in a memory leak and an eventual segmentation fault! Be sure to call DestroyAlgorithm prior to destroying the algorithm config that was used to create it!

This is just here to expose the base class method to users.

Parameters:

algConfig The fully loaded configuration object containing the database of parameters for the algorithm to be run on the known problem.

Returns:

The fully configured and loaded GA ready to be run using the PerformIterations method.

Referenced by JEGAOptimizer::find_optimum().

43.36.3.2 DesignOFSortSet PerformIterations (GeneticAlgorithm * *theGA*) `[inline]`

Performs the required iterations on the supplied GA. This includes the calls to AlgorithmInitialize and AlgorithmFinalize and logs some information if appropriate.

This is just here to expose the base class method to users.

Parameters:

theGA The GA on which to perform iterations. This parameter must be non-null.

Returns:

The final solutions reported by the supplied GA after all iterations and call to AlgorithmFinalize.

Referenced by JEGAOptimizer::find_optimum().

43.36.3.3 void DestroyAlgorithm (GeneticAlgorithm * *theGA*) `[inline]`

Deletes the supplied GA. Use this method to destroy a GA after all iterations have been run. This method knows if the log associated with the GA was created here and needs to be destroyed as well or not.

This is just here to expose the base class method to users.

Be sure to use this prior to destoying the algorithm config object which contains the target. The GA destructor needs the target to be in tact.

Parameters:

theGA The algorithm that is no longer needed and thus must be destroyed.

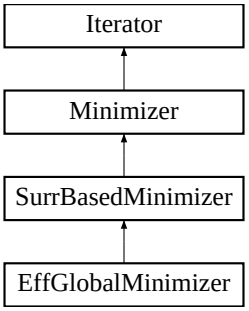
Referenced by JEGAOptimizer::find_optimum().

The documentation for this class was generated from the following file:

- JEGAOptimizer.C

43.37 EffGlobalMinimizer Class Reference

Implementation of Efficient Global Optimization/Least Squares algorithms. Inheritance diagram for EffGlobalMinimizer::



Public Member Functions

- EffGlobalMinimizer (Model &model)

  standard constructor

- ~EffGlobalMinimizer ()

  alternate constructor for instantiations "on the fly"

- void minimize_surrogates ()

  Used for computing the optimal solution using a surrogate-based approach. Redefines the Iterator::run() virtual function.

- const Model & algorithm_space_model () const

  return the result of any recasting or surrogate model recursion layered on top of iteratedModel by the derived Iterator ctor chain

Private Member Functions

- void minimize_surrogates_on_model ()

  called by minimize_surrogates for setUpType == "model"

- void get_best_sample ()

  called by minimize_surrogates for setUpType == "user_functions"

- Real expected_improvement (const RealVector &means, const RealVector &variances)

  expected improvement function for the GP

- RealVector expected_violation (const RealVector &means, const RealVector &variances)

  expected violation function for the constraint functions

- void update_penalty ()

  initialize and update the penaltyParameter

Static Private Member Functions

- static void EIF_objective_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in the Expected Improvement (EIF) problem formulation for PMA

Private Attributes

- String setUpType

  controls iteration mode: "model" (normal usage) or "user_functions" (user-supplied functions mode for "on the fly" instantiations).

- Model fHatModel

  GP model of response, one approximation per response function.

- Model eifModel

  recast model which assimilates mean and variance to solve the max(EIF) sub-problem

- Real meritFnStar

  minimum penalized response from among true function evaluations

- RealVector truthFnStar

  true function values corresponding to the minimum penalized response

- RealVector varStar

  point that corresponds to the optimal value meritFnStar

- short dataOrder

  order of the data used for surrogate construction, in ActiveSet request vector 3-bit format; user may override responses spec

Static Private Attributes

- static EffGlobalMinimizer * effGlobalInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.37.1 Detailed Description

Implementation of Efficient Global Optimization/Least Squares algorithms. The EffGlobalMinimizer class provides an implementation of the Efficient Global Optimization algorithm developed by Jones, Schonlau, & Welch as well as adaptation of the concept to nonlinear least squares.

43.37.2 Constructor & Destructor Documentation

43.37.2.1 ~EffGlobalMinimizer ()

alternate constructor for instantiations "on the fly" destructor

This is an alternate constructor for instantiations on the fly using a Model but no ProblemDescDB.

References SurrBasedMinimizer::approxSubProbMinimizer, EffGlobalMinimizer::eifModel, Model::free_communicators(), and Iterator::maximum_concurrency().

43.37.3 Member Function Documentation

43.37.3.1 void get_best_sample () [private]

called by minimize_surrogates for setUpType == "user_functions" determine best solution from among sample data for expected imporovement function

References Model::approximation_data(), SurrBasedMinimizer::augmented_lagrangian_merit(), Model::compute_response(), Model::continuous_variables(), Dakota::copy_data(), Model::current_response(), EffGlobalMinimizer::fHatModel, Response::function_values(), Iterator::iteratedModel, EffGlobalMinimizer::meritFnStar, Iterator::numFunctions, SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, Model::primary_response_fn_weights(), EffGlobalMinimizer::truthFnStar, and EffGlobalMinimizer::varStar.

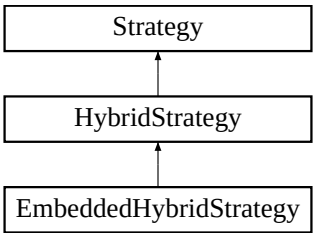
Referenced by EffGlobalMinimizer::minimize_surrogates_on_model().

The documentation for this class was generated from the following files:

- EffGlobalMinimizer.H
- EffGlobalMinimizer.C

43.38 EmbeddedHybridStrategy Class Reference

Strategy for closely-coupled hybrid minimization, typically involving the embedding of local search methods within global search methods. Inheritance diagram for EmbeddedHybridStrategy::



Public Member Functions

- EmbeddedHybridStrategy (ProblemDescDB &problem_db)

  constructor

- ~EmbeddedHybridStrategy ()

  destructor

Protected Member Functions

- void run_strategy ()

  Performs the hybrid minimization strategy by executing multiple iterators on different models of varying fidelity.

- const Variables & variables_results () const

  return the final solution from selectedIterators (variables)

- const Response & response_results () const

  return the final solution from selectedIterators (response)

Private Attributes

- Real localSearchProb

  the probability of running a local search refinement within phases of the global minimization for coupled hybrids

43.38.1 Detailed Description

Strategy for closely-coupled hybrid minimization, typically involving the embedding of local search methods within global search methods. This strategy uses multiple methods in close coordination, generally using a local

search minimizer repeatedly within a global minimizer (the local search minimizer refines candidate minima which are fed back to the global minimizer).

The documentation for this class was generated from the following files:

- EmbeddedHybridStrategy.H
- EmbeddedHybridStrategy.C

43.39 Evaluator Class Reference

An evaluator specialization that knows how to interact with Dakota.

Public Member Functions

- virtual bool Evaluate (DesignGroup &group)

  Does evaluation of each design in group.

- virtual bool Evaluate (Design &des)

  This method cannot be used!!

- virtual std::string GetName () const

  Returns the proper name of this operator.

- virtual std::string GetDescription () const

  Returns a full description of what this operator does and how.

- virtual GeneticAlgorithmOperator ∗ Clone (GeneticAlgorithm &algorithm) const

  Creates and returns a pointer to an exact duplicate of this operator.

- Evaluator (GeneticAlgorithm &algorithm, Model &model)

  Constructs a Evaluator for use by algorithm.

- Evaluator (const Evaluator &copy)

  Copy constructs a Evaluator.

- Evaluator (const Evaluator &copy, GeneticAlgorithm &algorithm, Model &model)

  Copy constructs a Evaluator for use by algorithm.

Static Public Member Functions

- static const std::string & Name ()

  Returns the proper name of this operator.

- static const std::string & Description ()

  Returns a full description of what this operator does and how.

Protected Member Functions

- void SeparateVariables (const Design &from, RealVector &intoCont, IntVector &intoDiscInt, RealVector &intoDiscReal) const

  This method fills intoCont, intoDiscInt and intoDiscReal appropriately using the values of from.

- void RecordResponses (const RealVector &from, Design &into) const

  Records the computed objective and constraint function values into into.

- std::size_t GetNumberNonLinearConstraints () const

  Returns the number of non-linear constraints for the problem.

- std::size_t GetNumberLinearConstraints () const

  Returns the number of linear constraints for the problem.

Private Member Functions

- Evaluator (GeneticAlgorithm &algorithm)

  This constructor has no implementation and cannot be used.

Private Attributes

- Model & _model

  The Model known by this evaluator.

43.39.1 Detailed Description

An evaluator specialization that knows how to interact with Dakota. This evaluator knows how to use the model to do evaluations both in synchronous and asynchronous modes.

43.39.2 Constructor & Destructor Documentation

43.39.2.1 Evaluator (GeneticAlgorithm & *algorithm*, Model & *model*) `[inline]`

Constructs a Evaluator for use by *algorithm*. The optimizer is needed for purposes of variable scaling.

Parameters:

algorithm The GA for which the new evaluator is to be used.

model The model through which evaluations will be done.

Referenced by Evaluator::Clone().

43.39.2.2 Evaluator (const Evaluator & *copy*) [inline]

Copy constructs a Evaluator.

Parameters:

copy The evaluator from which properties are to be duplicated into this.

43.39.2.3 Evaluator (const Evaluator & *copy*, GeneticAlgorithm & *algorithm*, Model & *model*) [inline]

Copy constructs a Evaluator for use by *algorithm*. The optimizer is needed for purposes of variable scaling.

Parameters:

copy The existing Evaluator from which to retrieve properties.

algorithm The GA for which the new evaluator is to be used.

model The model through which evaluations will be done.

43.39.2.4 Evaluator (GeneticAlgorithm & *algorithm*) [private]

This constructor has no implementation and cannot be used. This constructor can never be used. It is provided so that this operator can still be registered in an operator registry even though it can never be instantiated from there.

Parameters:

algorithm The GA for which the new evaluator is to be used.

43.39.3 Member Function Documentation

43.39.3.1 static const std::string& Name () [inline, static]

Returns the proper name of this operator.

Returns:

The string "DAKOTA JEGA Evaluator".

Referenced by Evaluator::GetName().

43.39.3.2 static const std::string& Description () [inline, static]

Returns a full description of what this operator does and how. The returned text is:

```
This evaluator uses Sandia's DAKOTA optimization
software to evaluate the passed in Designs.  This
makes it possible to take advantage of the fact that
DAKOTA is designed to run on massively parallel machines.
```

.

Returns:

A description of the operation of this operator.

Referenced by Evaluator::GetDescription().

43.39.3.3 void SeparateVariables (const Design & *from*, RealVector & *intoCont*, IntVector & *intoDiscInt*, RealVector & *intoDiscReal*) const `[protected]`

This method fills *intoCont*, *intoDiscInt* and *intoDiscReal* appropriately using the values of *from*. The discrete integer design variable values are placed in *intoDiscInt*, the discrete real design variable values are placed in *intoDiscReal*, and the continuum are placed into *intoCont*. The values are written into the vectors from the beginning so any previous contents of the vectors will be overwritten.

Parameters:

from The Design class object from which to extract the discrete design variable values.

intoDiscInt The vector into which to place the extracted discrete integer values.

intoDiscReal The vector into which to place the extracted discrete real values.

intoCont The vector into which to place the extracted continuous values.

References Evaluator::_model, Model::cv(), Model::discrete_design_set_int_values(), Model::discrete_design_-set_real_values(), Model::div(), and Model::drv().

Referenced by Evaluator::Evaluate().

43.39.3.4 void RecordResponses (const RealVector & *from*, Design & *into*) const `[protected]`

Records the computed objective and constraint function values into *into*. This method takes the response values stored in *from* and properly transfers them into the *into* design.

The response vector *from* is expected to contain values for each objective function followed by values for each non-linear constraint in the order in which the info objects were loaded into the target by the optimizer class.

Parameters:

from The vector of responses to install into *into*.

into The Design to which the responses belong and into which they must be written.

References Evaluator::GetNumberNonLinearConstraints().

Referenced by Evaluator::Evaluate().

43.39.3.5 std::size_t GetNumberNonLinearConstraints () const `[inline, protected]`

Returns the number of non-linear constraints for the problem. This is computed by adding the number of non-linear equality constraints to the number of non-linear inequality constraints. These values are obtained from the model.

Returns:

The total number of non-linear constraints.

References Evaluator::_model, Model::num_nonlinear_eq_constraints(), and Model::num_nonlinear_ineq_-constraints().

Referenced by Evaluator::Evaluate(), and Evaluator::RecordResponses().

43.39.3.6 std::size_t GetNumberLinearConstraints () const [inline, protected]

Returns the number of linear constraints for the problem. This is computed by adding the number of linear equality constraints to the number of linear inequality constraints. These values are obtained from the model.

Returns:

The total number of linear constraints.

References Evaluator::_model, Model::num_linear_eq_constraints(), and Model::num_linear_ineq_-constraints().

43.39.3.7 bool Evaluate (DesignGroup & *group*) [virtual]

Does evaluation of each design in *group*. This method uses the Model known by this class to get Designs evaluated. It properly formats the Design class information in a way that Dakota will understand and then interprets the Dakota results and puts them back into the Design class object. It respects the asynchronous flag in the Model so evaluations may occur synchronously or asynchronously.

Prior to evaluating a Design, this class checks to see if it is marked as already evaluated. If it is, then the evaluation of that Design is not carried out. This is not strictly necessary because Dakota keeps track of evaluated designs and does not re-evaluate. An exception is the case of a population read in from a file complete with responses where Dakota is unaware of the evaluations.

Parameters:

group The group of Design class objects to be evaluated.

Returns:

true if all evaluations completed and false otherwise.

References Evaluator::_model, Model::asynch_compute_response(), Model::asynch_flag(), Model::compute_-response(), Model::continuous_variables(), Model::current_response(), Model::discrete_int_variables(), Model::discrete_real_variables(), Response::function_values(), Evaluator::GetName(), Evaluator::GetNumberNonLinearConstraints(), Evaluator::RecordResponses(), Evaluator::SeparateVariables(), and Model::synchronize().

43.39.3.8 virtual bool Evaluate (Design & *des*) [inline, virtual]

This method cannot be used!! This method does nothing and cannot be called. This is because in the case of asynchronous evaluation, this method would be unable to conform. It would require that each evaluation be done in a synchronous fashion.

Parameters:

des A Design that would be evaluated if this method worked.

Returns:

Would return true if the Design were evaluated and false otherwise. Never actually returns here. Issues a fatal error. Otherwise, it would always return false.

References Evaluator::GetName().

43.39.3.9 virtual std::string GetName () const `[inline, virtual]`

Returns the proper name of this operator.

Returns:

See Name().

References Evaluator::Name().

Referenced by Evaluator::Evaluate().

43.39.3.10 virtual std::string GetDescription () const `[inline, virtual]`

Returns a full description of what this operator does and how.

Returns:

See Description().

References Evaluator::Description().

43.39.3.11 virtual GeneticAlgorithmOperator* Clone (GeneticAlgorithm & *algorithm*) const `[inline, virtual]`

Creates and returns a pointer to an exact duplicate of this operator.

Parameters:

algorithm The GA for which the clone is being created.

Returns:

A clone of this operator.

References Evaluator::_model, and Evaluator::Evaluator().

43.39.4 Member Data Documentation

43.39.4.1 Model& _model [private]

The Model known by this evaluator. It is through this model that evaluations will take place.

Referenced by Evaluator::Clone(), Evaluator::Evaluate(), Evaluator::GetNumberLinearConstraints(), Evaluator::GetNumberNonLinearConstraints(), and Evaluator::SeparateVariables().

The documentation for this class was generated from the following file:

- JEGAOptimizer.C

43.40 EvaluatorCreator Class Reference

A specialization of the JEGA::FrontEnd::EvaluatorCreator that creates a new instance of a Evaluator.

Public Member Functions

- virtual GeneticAlgorithmEvaluator ∗ CreateEvaluator (GeneticAlgorithm &alg)

  Overriden to return a newly created Evaluator.

- EvaluatorCreator (Model &theModel)

  Constructs an EvaluatorCreator using the supplied model.

Private Attributes

- Model & _theModel

  The user defined model to be passed to the constructor of the Evaluator.

43.40.1 Detailed Description

A specialization of the JEGA::FrontEnd::EvaluatorCreator that creates a new instance of a Evaluator.

43.40.2 Constructor & Destructor Documentation

43.40.2.1 EvaluatorCreator (Model & *theModel*) `[inline]`

Constructs an EvaluatorCreator using the supplied model.

Parameters:

theModel The Dakota::Model this creator will pass to the created evaluator.

43.40.3 Member Function Documentation

43.40.3.1 virtual GeneticAlgorithmEvaluator∗ CreateEvaluator (GeneticAlgorithm & *alg*) `[inline, virtual]`

Overriden to return a newly created Evaluator. The GA will assume ownership of the evaluator so we needn't worry about keeping track of it for destruction. The additional parameters needed by the Evaluator are stored as members of this class at construction time.

Parameters:

alg The GA for which the evaluator is to be created.

Returns:

A pointer to a newly created Evaluator.

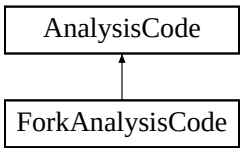
References EvaluatorCreator::_theModel.

The documentation for this class was generated from the following file:

- JEGAOptimizer.C

43.41 ForkAnalysisCode Class Reference

Derived class in the AnalysisCode class hierarchy which spawns simulations using forks. Inheritance diagram for ForkAnalysisCode::



Public Member Functions

- ForkAnalysisCode (const ProblemDescDB &problem_db)

  constructor

- ~ForkAnalysisCode ()

  destructor

- pid_t fork_program (const bool block_flag)

  spawn a child process using fork()/vfork()/execvp() and wait for completion using waitpid() if block_flag is true

- void check_status (const int status)

  check the exit status of a forked process and abort if an error code was returned

- void ifilter_argument_list ()

  set argList for execution of the input filter

- void ofilter_argument_list ()

  set argList for execution of the output filter

- void driver_argument_list (const int analysis_id)

  set argList for execution of the specified analysis driver

Private Attributes

- std::vector< std::string > argList

  an array of strings for use with execvp(const char ∗, char ∗ const ∗). These are converted to an array of const char∗'s in fork_program().

43.41.1 Detailed Description

Derived class in the AnalysisCode class hierarchy which spawns simulations using forks. ForkAnalysisCode creates a copy of the parent DAKOTA process using fork()/vfork() and then replaces the copy with a simulation process using execvp(). The parent process can then use waitpid() to wait on completion of the simulation process.

43.41.2 Member Function Documentation

43.41.2.1 void check_status (const int *status*)

check the exit status of a forked process and abort if an error code was returned Check to see if the process terminated abnormally (WIFEXITED(status)==0) or if either execvp or the application returned a status code of -1 (WIFEXITED(status)!=0 && (signed char)WEXITSTATUS(status)==-1). If one of these conditions is detected, output a failure message and abort. Note: the application code should not return a status code of -1 unless an immediate abort of dakota is wanted. If for instance, failure capturing is to be used, the application code should write the word "FAIL" to the appropriate results file and return a status code of 0 through exit().

References Dakota::abort_handler().

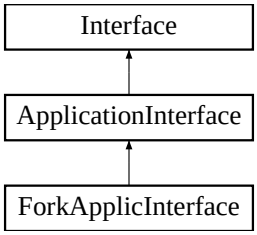
Referenced by ForkApplicInterface::asynchronous_local_analyses(), ForkApplicInterface::derived_synch(), ForkApplicInterface::derived_synch_nowait(), ForkAnalysisCode::fork_program(), and ForkApplicInterface::serve_analyses_asynch().

The documentation for this class was generated from the following files:

- ForkAnalysisCode.H
- ForkAnalysisCode.C

43.42 ForkApplicInterface Class Reference

Derived application interface class which spawns simulation codes using forks. Inheritance diagram for ForkApplicInterface::



Public Member Functions

- ForkApplicInterface (const ProblemDescDB &problem_db)

  constructor

- ~ForkApplicInterface ()

  destructor

- void derived_map (const Variables &vars, const ActiveSet &set, Response &response, int fn_eval_id)

  Called by map() and other functions to execute the simulation in synchronous mode. The portion of performing an evaluation that is specific to a derived class.

- void derived_map_asynch (const ParamResponsePair &pair)

  Called by map() and other functions to execute the simulation in asynchronous mode. The portion of performing an asynchronous evaluation that is specific to a derived class.

- void derived_synch (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version waits for at least one completion.

- void derived_synch_nowait (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version is nonblocking and will return without any completions if none are immediately available.

- int derived_synchronous_local_analysis (const int &analysis_id)
- const StringArray & analysis_drivers () const

  retrieve the analysis drivers specification for application interfaces

- const AnalysisCode * analysis_code () const

  return AnalysisCode::fileNameMap when defined for derived Interface class

Private Member Functions

- void derived_synch_kernel (PRPQueue &prp_queue, const pid_t pid)

  Convenience function for common code between derived_synch() & derived_synch_nowait().

- pid_t fork_application (const bool block_flag)

  perform the complete function evaluation by managing the input filter, analysis programs, and output filter

- void asynchronous_local_analyses (const int &start, const int &end, const int &step)

  execute analyses asynchronously on the local processor

- void synchronous_local_analyses (const int &start, const int &end, const int &step)

  execute analyses synchronously on the local processor

- void serve_analyses_asynch ()

  serve the analysis scheduler and execute analysis jobs asynchronously

Private Attributes

- ForkAnalysisCode forkSimulator

  ForkAnalysisCode provides convenience functions for forking individual programs and checking fork exit status.

- std::map< pid_t, int > processIdMap

  map of fork process id's to function evaluation id's for asynchronous evaluations

43.42.1 Detailed Description

Derived application interface class which spawns simulation codes using forks. ForkApplicInterface uses a ForkAnalysisCode object for performing simulation invocations.

43.42.2 Member Function Documentation

43.42.2.1 int derived_synchronous_local_analysis (const int & *analysis_id*) `[inline, virtual]`

This code provides the derived function used by ApplicationInterface:: serve_analyses_synch() as well as a convenience function for ForkApplicInterface::synchronous_local_analyses() below.

Reimplemented from ApplicationInterface.

References ForkAnalysisCode::driver_argument_list(), ForkAnalysisCode::fork_program(), and ForkApplicInterface::forkSimulator.

Referenced by ForkApplicInterface::synchronous_local_analyses().

43.42.2.2 pid_t fork_application (const bool *block_flag*) [private]

perform the complete function evaluation by managing the input filter, analysis programs, and output filter Manage the input filter, 1 or more analysis programs, and the output filter in blocking or nonblocking mode as governed by block_flag. In the case of a single analysis and no filters, a single fork is performed, while in other cases, an initial fork is reforked multiple times. Called from derived_map() with block_flag == BLOCK and from derived_map_-asynch() with block_flag == FALL_THROUGH. Uses ForkAnalysisCode::fork_program() to spawn individual program components within the function evaluation.

References Dakota::abort_handler(), ApplicationInterface::analysisServerId, Application-Interface::asynchLocalAnalysisConcurrency, ApplicationInterface::asynchLocalAnalysisFlag, ForkApplicInterface::asynchronous_local_analyses(), ParallelLibrary::barrier_e(), AnalysisCode::command_-line_arguments(), ForkAnalysisCode::driver_argument_list(), ApplicationInterface::eaDedMasterFlag, Applicationinterface::evalCommRank, ApplicationInterface::evalCommSize, ForkAnalysisCode::fork_program(), ForkApplicInterface::forkSimulator, ForkAnalysisCode::ifilter_argument_list(), AnalysisCode::input_filter_-name(), AnalysisCode::multiple_parameters_filenames(), ApplicationInterface::numAnalysisDrivers, Applicationinterface::numAnalysisServers, ForkAnalysisCode::ofilter_argument_list(), AnalysisCode::output_-filter_name(), Interface::outputLevel, ApplicationInterface::parallelLib, AnalysisCode::parameters_-filename(), AnalysisCode::program_names(), AnalysisCode::results_filename(), ApplicationInterface::self_-schedule_analyses(), ForkApplicInterface::serve_analyses_asynch(), ApplicationInterface::serve_-analyses_synch(), AnalysisCode::suppress_output_flag(), ApplicationInterface::suppressOutput, and ForkApplicInterface::synchronous_local_analyses().

Referenced by ForkApplicInterface::derived_map(), and ForkApplicInterface::derived_map_asynch().

43.42.2.3 void asynchronous_local_analyses (const int & *start*, const int & *end*, const int & *step*) [private]

execute analyses asynchronously on the local processor Schedule analyses asynchronously on the local processor using a self-scheduling approach (start to end in step increments). Concurrency is limited by asynchLocalAnalysisConcurrency. Modeled after ApplicationInterface::asynchronous_local_evaluations(). NOTE: This function should be elevated to ApplicationInterface if and when another derived interface class supports asynchronous local analyses.

References Dakota::abort_handler(), ApplicationInterface::asynchLocalAnalysisConcurrency, ForkAnalysisCode::check_status(), ForkAnalysisCode::driver_argument_list(), Dakota::find_-index(), ForkAnalysisCode::fork_program(), ForkApplicInterface::forkSimulator, ApplicationInterface::numAnalysisDrivers, and ForkApplicInterface::processIdMap.

Referenced by ForkApplicInterface::fork_application().

43.42.2.4 void synchronous_local_analyses (const int & *start*, const int & *end*, const int & *step*) [inline, private]

execute analyses synchronously on the local processor Execute analyses synchronously in succession on the local processor (start to end in step increments). Modeled after ApplicationInterface::synchronous_local_evaluations().

References ForkApplicInterface::derived_synchronous_local_analysis().

Referenced by ForkApplicInterface::fork_application().

43.42.2.5 void serve_analyses_asynch () [private]

serve the analysis scheduler and execute analysis jobs asynchronously This code runs multiple asynch analyses on each server. It is modeled after ApplicationInterface::serve_evaluations_asynch(). NOTE: This fn should be elevated to ApplicationInterface if and when another derived interface class supports hybrid analysis parallelism.

References Dakota::abort_handler(), ApplicationInterface::asynchLocalAnalysisConcurrency, ForkAnalysisCode::check_status(), ForkAnalysisCode::driver_argument_list(), Dakota::find_index(), ForkAnalysisCode::fork_program(), ForkApplicInterface::forkSimulator, ParallelLibrary::irecv_ea(), ApplicationInterface::numAnalysisDrivers, ApplicationInterface::parallelLib, ForkApplicInterface::processIdMap, ParallelLibrary::recv_ea(), ParallelLibrary::send_ea(), and ParallelLibrary::test().

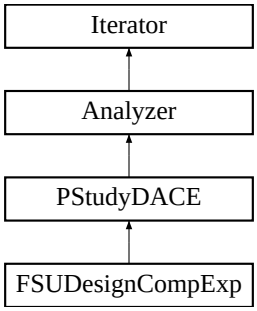
Referenced by ForkApplicInterface::fork_application().

The documentation for this class was generated from the following files:

- ForkApplicInterface.H
- ForkApplicInterface.C

43.43 FSUDesignCompExp Class Reference

Wrapper class for the FSUDace QMC/CVT library. Inheritance diagram for FSUDesignCompExp::



Public Member Functions

- FSUDesignCompExp (Model &model)

  primary constructor for building a standard DACE iterator

- FSUDesignCompExp (Model &model, int samples, int seed, const String &sampling_method)

  alternate constructor for building a DACE iterator on-the-fly

- ~FSUDesignCompExp ()

  destructor

- void pre_run ()

  pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori

- void extract_trends ()

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

- void post_input ()

  read tabular data for post-run mode

- void post_run (std::ostream &s)

  post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way

- int num_samples () const

  get the current number of samples

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)

  reset sampling iterator to use at least min_samples

- const String & sampling_scheme () const

  return sampling name

- void vary_pattern (bool pattern_flag)

  sets varyPattern in derived classes that support it

- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

Private Member Functions

- void enforce_input_rules ()

  enforce sanity checks/modifications for the user input specification

Private Attributes

- int samplesSpec

  initial specification of number of samples

- int numSamples

  current number of samples to be evaluated

- bool allDataFlag

  flag which triggers the update of allVars/allResponses for use by Iterator::all_variables() and Iterator::all_responses()

- size_t numDACERuns

  counter for number of run() executions for this object

- bool latinizeFlag

  flag which specifies latinization of QMC or CVT sample sets

- IntVector sequenceStart

  Integer vector defining a starting index into the sequence for random variable sampled. Default is 0 0 0 (e.g. for three random variables).

- IntVector sequenceLeap

  Integer vector defining the leap number for each sequence being generated. Default is 1 1 1 (e.g. for three random vars.).

- IntVector primeBase

  Integer vector defining the prime base for each sequence being generated. Default is 2 3 5 (e.g., for three random vars.).

- int seedSpec

  the user seed specification for the random number generator (allows repeatable results)

- int randomSeed

  current seed for the random number generator

- bool varyPattern

  flag for continuing the random number or QMC sequence from a previous run() execution (e.g., for surrogate-based optimization) so that multiple executions are repeatable but not identical.

- int numCVTTrials

  specifies the number of sample points taken at internal CVT iteration

- int trialType

  Trial type in CVT. Specifies where the points are placed for consideration relative to the centroids. Choices are grid (2), halton (1), uniform (0), or random (-1). Default is random.

43.43.1 Detailed Description

Wrapper class for the FSUDace QMC/CVT library. The FSUDesignCompExp class provides a wrapper for FSUDace, a C++ design of experiments library from Florida State University. This class uses quasi Monte Carlo (QMC) and Centroidal Voronoi Tesselation (CVT) methods to uniformly sample the parameter space spanned by the active bounds of the current Model. It returns all generated samples and their corresponding responses as well as the best sample found.

43.43.2 Constructor & Destructor Documentation

43.43.2.1 FSUDesignCompExp (Model & *model*)

primary constructor for building a standard DACE iterator This constructor is called for a standard iterator built with data from probDescDB.

References Dakota::abort_handler(), ProblemDescDB::get_bool(), ProblemDescDB::get_idv(), ProblemDescDB::get_int(), ProblemDescDB::get_string(), Iterator::maxConcurrency, Iterator::methodName, Iterator::numContinuousVars, FSUDesignCompExp::numCVTTrials, FSUDesignCompExp::numSamples, FSUDesignCompExp::primeBase, Iterator::probDescDB, FSUDesignCompExp::randomSeed, FSUDesignCompExp::seedSpec, FSUDesignCompExp::sequenceLeap, FSUDesignCompExp::sequenceStart, FSUDesignCompExp::trialType, and FSUDesignCompExp::varyPattern.

43.43.2.2 FSUDesignCompExp (Model & *model*, int *samples*, int *seed*, const String & *sampling_method*)

alternate constructor for building a DACE iterator on-the-fly This alternate constructor is used for instantiations on-the-fly, using only the incoming data. No problem description database queries are used.

References Dakota::abort_handler(), Iterator::maxConcurrency, Iterator::methodName, Iterator::numContinuousVars, FSUDesignCompExp::numCVTTrials, FSUDesignCompExp::numSamples, FSUDesignCompExp::primeBase, FSUDesignCompExp::randomSeed, FSUDesignCompExp::seedSpec, FSUDesignCompExp::sequenceLeap, FSUDesignCompExp::sequenceStart, and FSUDesignCompExp::trialType.

43.43.3 Member Function Documentation

43.43.3.1 void pre_run () [virtual]

pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori pre-run phase, which a derived iterator may optionally reimplement; when not present, pre-run is likely integrated into the derived run function. This is a virtual function; when re-implementing, a derived class must call its nearest parent's pre_run(), if implemented, typically _before_ performing its own implementation steps.

Reimplemented from Iterator.

References FSUDesignCompExp::get_parameter_sets(), Iterator::iteratedModel, and PStudyDACE::varBasedDecompFlag.

43.43.3.2 void post_run (std::ostream & *s*) [virtual]

post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way Post-run phase, which a derived iterator may optionally reimplement; when not present, post-run is likely integrated into run. This is a virtual function; when re-implementing, a derived class must call its nearest parent's post_run(), typically _after_ performing its own implementation steps.

Reimplemented from Iterator.

References Analyzer::allResponses, Analyzer::allSamples, SensAnalysisGlobal::compute_correlations(), PStudyDACE::pStudyDACESensGlobal, Iterator::subIteratorFlag, and PStudyDACE::varBasedDecompFlag.

43.43.3.3 int num_samples () const [inline, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References FSUDesignCompExp::numSamples.

43.43.3.4 void enforce_input_rules () [private]

enforce sanity checks/modifications for the user input specification Users may input a variety of quantities, but this function must enforce any restrictions imposed by the sampling algorithms.

References Dakota::abort_handler(), Iterator::methodName, Iterator::numContinuousVars, FSUDesignCompExp::numSamples, and FSUDesignCompExp::primeBase.

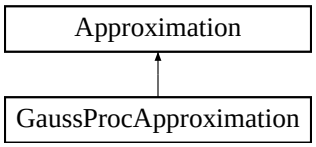
Referenced by FSUDesignCompExp::get_parameter_sets().

The documentation for this class was generated from the following files:

- FSUDesignCompExp.H
- FSUDesignCompExp.C

43.44 GaussProcApproximation Class Reference

Derived approximation class for Gaussian Process implementation. Inheritance diagram for GaussProcApproximation::



Public Member Functions

- GaussProcApproximation ()
  default constructor
- GaussProcApproximation (size_t num_vars, short data_order)
  alternate constructor
- GaussProcApproximation (const ProblemDescDB &problem_db, const size_t &num_acv)
  standard constructor
- ~GaussProcApproximation ()
  destructor

Protected Member Functions

- int min_coefficients () const
  return the minimum number of samples (unknowns) required to build the derived class approximation type in numVars dimensions
- int num_constraints () const
  return the number of constraints to be enforced via an anchor point
- void build ()
  find the covariance parameters governing the Gaussian process response
- Real get_value (const RealVector &x)
  retrieve the function value for a given parameter set x
- Real get_prediction_variance (const RealVector &x)
  retrieve the variance of the predicted value for a given parameter set x
- const RealVector & get_gradient (const RealVector &x)
  retrieve the function gradient at the predicted value for a given parameter set x

Private Member Functions

- void GPmodel_build ()

  Function to compute hyperparameters governing the GP.

- void GPmodel_apply (const RealVector &new_x, bool variance_flag, bool gradients_flag)

  Function returns a response value using the GP surface.

- void normalize_training_data ()

  Normalizes the initial inputs upon which the GP surface is based.

- void get_trend ()

  Gets the trend (basis) functions for the calculation of the mean of the GP If the order = 0, the trend is a constant, if the order = 1, trend is linear, if order = 2, trend is quadratic.

- void get_beta_coefficients ()

  Gets the beta coefficients for the calculation of the mean of the GP.

- int get_cholesky_factor ()

  Gets the Cholesky factorization of the covariance matrix, with error checking.

- void get_process_variance ()

  Gets the estimate of the process variance given the values of beta and the correlation lengthscales.

- void get_cov_matrix ()

  calculates the covariance matrix for a given set of input points

- void get_cov_vector ()

  calculates the covariance vector between a new point x and the set of inputs upon which the GP is based

- void optimize_theta_global ()

  sets up and performs the optimization of the negative log likelihood to determine the optimal values of the covariance parameters using NCSUDirect

- void optimize_theta_multipoint ()

  sets up and performs the optimization of the negative log likelihood to determine the optimal values of the covariance parameters using a gradient-based solver and multiple starting points

- void predict (bool variance_flag, bool gradients_flag)

  Calculates the predicted new response value for x in normalized space.

- Real calc_nll ()

  calculates the negative log likelihood function (based on covariance matrix)

- void calc_grad_nll ()

  Gets the gradient of the negative log likelihood function with respect to the correlation lengthscales, theta.

- void get_grad_cov_vector ()

  Calculate the derivatives of the covariance vector, with respect to each componeent of x.

- void run_point_selection ()

  Runs the point selection algorithm, which will choose a subset of the training set with which to construct the GP model, and estimate the necessary parameters.

- void initialize_point_selection ()

  Initializes the point selection routine by choosing a small initial subset of the training points.

- void pointsel_get_errors (RealArray &delta)

  Uses the current GP model to compute predictions at all of the training points and find the errors.

- int addpoint (int, IntArray &added_index)

  Adds a point to the effective training set. Returns 1 on success.

- int pointsel_add_sel (const RealArray &delta)

  Accepts a vector of unsorted prediction errors, determines which points should be added to the effective training set, and adds them.

- Real maxval (const RealArray &) const

  Return the maximum value of the elements in a vector.

- void pointsel_write_points ()

  Writes out the training set before and after point selection.

- void lhood_2d_grid_eval ()

  For problems with 2D input, evaluates the negative log likelihood on a grid.

- void writex (const char[ ])

  Writes out the current training set (in original units) to a specified file.

- void writeCovMat (char[ ])

  Writes out the covariance matrix to a specified file.

Static Private Member Functions

- static void negloglik (int mode, int n, const Teuchos::SerialDenseVector< int, double > &X, Real &fx, Teuchos::SerialDenseVector< int, double > &grad_x, int &result_mode)

  static function used by OPT++ as the objective function to optimize the hyperparameters in the covariance of the GP by minimizing the negative log likelihood

- static void constraint_eval (int mode, int n, const Teuchos::SerialDenseVector< int, double > &X, Teuchos::SerialDenseVector< int, double > &g, Teuchos::SerialDenseMatrix< int, double > &gradC, int &result_mode)

static function used by OPT++ as the constraint function in the optimization of the negative log likelihood. Currently this function is empty: it is an unconstrained optimization.

- static double negloglikNCSU (const RealVector &x)

  function used by NCSUOptimizer to optimize negloglik objective

Private Attributes

- Real approxValue

  value of the approximation returned by get_value()

- Real approxVariance

  value of the approximation returned by get_prediction_variance()

- RealMatrix trainPoints

  A 2-D array (num sample sites = rows, num vars = columns) used to create the Gaussian process.

- RealMatrix trainValues

  An array of response values; one response value per sample site.

- RealVector trainMeans

  The mean of the input columns of trainPoints.

- RealVector trainStdvs

  The standard deviation of the input columns of trainPoints.

- RealMatrix normTrainPoints

  Current working set of normalized points upon which the GP is based.

- RealMatrix trendFunction

  matrix to hold the trend function

- RealMatrix betaCoeffs

  matrix to hold the beta coefficients for the trend function

- RealSymMatrix covMatrix

  The covariance matrix where each element (i,j) is the covariance between points Xi and Xj in the initial set of samples.

- RealMatrix covVector

  The covariance vector where each element (j,0) is the covariance between a new point X and point Xj from the initial set of samples.

- RealMatrix approxPoint

  Point at which a prediction is requested. This is currently a single point, but it could be generalized to be a vector of points.

- RealMatrix gradNegLogLikTheta

  matrix to hold the gradient of the negative log likelihood with respect to the theta correlation terms

- Teuchos::SerialSpdDenseSolver< int, Real > covSlvr

  The global solver for all computations involving the inverse of the covariance matrix.

- RealMatrix gradCovVector

  A matrix, where each column is the derivative of the covVector with respect to a particular componenet of X.

- RealMatrix normTrainPointsAll

  Set of all original samples available.

- RealMatrix trainValuesAll

  All original samples available.

- RealMatrix trendFunctionAll

  Trend function values corresponding to all original samples.

- RealMatrix Rinv_YFb

  Matrix for storing inverse of correlation matrix Rinv∗(Y-FB).

- size_t numObs

  The number of observations on which the GP surface is built.

- size_t numObsAll

  The original number of observations.

- short trendOrder

  The number of variables in each X variable (number of dimensions of the problem).

- RealVector thetaParams

  Theta is the vector of covariance parameters for the GP. We determine the values of theta by optimization Currently, the covariance function is theta[0]∗exp(-0.5∗sume)+delta∗pow(sige,2). sume is the sum squared of weighted distances; it involves a sum of theta[1](Xi(1)-Xj(1))^2 + theta[2](Xi(2)-Xj(2))^2 + ... where Xi(1) is the first dimension value of multi-dimensional variable Xi. delta∗pow(sige,2) is a jitter term used to improve matrix computations. delta is zero for the covariance between different points and 1 for the covariance between the same point. sige is the underlying process error.

- Real procVar

  The process variance, the multiplier of the correlation matrix.

- IntArray pointsAddedIndex

  Used by the point selection algorithm, this vector keeps track all points which have been added.

- int cholFlag

  A global indicator for success of the Cholesky factorization.

- bool usePointSelection

  a flag to indicate the use of point selection

Static Private Attributes

- static GaussProcApproximation * GPinstance

  pointer to the active object instance used within the static evaluator

43.44.1 Detailed Description

Derived approximation class for Gaussian Process implementation. The GaussProcApproximation class provides a global approximation (surrogate) based on a Gaussian process. The Gaussian process is built after normalizing the function values, with zero mean. Opt++ is used to determine the optimal values of the covariance parameters, those which minimize the negative log likelihood function.

43.44.2 Constructor & Destructor Documentation

43.44.2.1 GaussProcApproximation () [inline]

default constructor alternate constructor used by EffGlobalOptimization and NonDGlobalReliability that does not use a problem database defaults here are no point selectinn and quadratic trend function.

43.44.3 Member Function Documentation

43.44.3.1 void GPmodel_apply (const RealVector & *new_x*, bool *variance_flag*, bool *gradients_flag*) [private]

Function returns a response value using the GP surface. The response value is computed at the design point specified by the RealVector function argument.

References Dakota::abort_handler(), GaussProcApproximation::approxPoint, GaussProcApproximation::get_cov_vector(), Approximation::numVars, GaussProcApproximation::predict(), GaussProcApproximation::trainMeans, and GaussProcApproximation::trainStdvs.

Referenced by GaussProcApproximation::get_gradient(), GaussProcApproximation::get_prediction_variance(), GaussProcApproximation::get_value(), and GaussProcApproximation::pointsel_get_errors().

43.44.4 Member Data Documentation

43.44.4.1 short trendOrder [private]

The number of variables in each X variable (number of dimensions of the problem). The order of the basis function for the mean of the GP If the order = 0, the trend is a constant, if the order = 1, trend is linear, if order =

2, trend is quadratic.

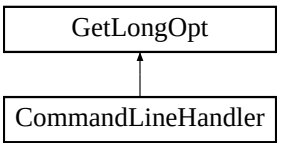
Referenced by GaussProcApproximation::GaussProcApproximation(), GaussProcApproximation::get_beta_coefficients(), GaussProcApproximation::get_trend(), GaussProcApproximation::GPmodel_build(), and GaussProcApproximation::predict().

The documentation for this class was generated from the following files:

- GaussProcApproximation.H
- GaussProcApproximation.C

43.45 GetLongOpt Class Reference

GetLongOpt is a general command line utility from S. Manoharan (Advanced Computer Research Institute, Lyon, France). Inheritance diagram for GetLongOpt::



Public Types

- enum OptType { Valueless, OptionalValue, MandatoryValue }

  enum for different types of values associated with command line options.

Public Member Functions

- GetLongOpt (const char optmark= '-')

  Constructor.

- ~GetLongOpt ()

  Destructor.

- int parse (int argc, char *const *argv)

  parse the command line args (argc, argv).

- int parse (char *const str, char *const p)

  parse a string of options (typically given from the environment).

- int enroll (const char *const opt, const OptType t, const char *const desc, const char *const val)

  Add an option to the list of valid command options.

- const char * retrieve (const char *const opt) const

  Retrieve value of option.

- void usage (std::ostream &outfile=Cout) const

  Print usage information to outfile.

- void usage (const char *str)

  Change header of usage output to str.

- void store (const char *name, const char *value)

  Store a specified option value.

Private Member Functions

- char ∗ basename (char ∗const p) const

  extract the base name from a string as delimited by '/'

- int setcell (Cell ∗c, char ∗valtoken, char ∗nexttoken, const char ∗p)

  internal convenience function for setting Cell::value

Private Attributes

- Cell ∗ table

  option table

- const char ∗ ustring

  usage message

- char ∗ pname

  program basename

- char optmarker

  option marker

- int enroll_done

  finished enrolling

- Cell ∗ last

  last entry in option table

43.45.1 Detailed Description

GetLongOpt is a general command line utility from S. Manoharan (Advanced Computer Research Institute, Lyon, France). GetLongOpt manages the definition and parsing of "long options." Command line options can be abbreviated as long as there is no ambiguity. If an option requires a value, the value should be separated from the option either by whitespace or an "=".

43.45.2 Member Enumeration Documentation

43.45.2.1 enum OptType

enum for different types of values associated with command line options.

Enumerator:

Valueless option that may never have a value

OptionalValue option with optional value

MandatoryValue option with required value

43.45.3 Constructor & Destructor Documentation

43.45.3.1 GetLongOpt (const char *optmark* = '-')

Constructor. Constructor for GetLongOpt takes an optional argument: the option marker. If unspecified, this defaults to '-', the standard (?) Unix option marker.

References GetLongOpt::enroll_done, GetLongOpt::last, GetLongOpt::optmarker, GetLongOpt::table, and GetLongOpt::ustring.

43.45.4 Member Function Documentation

43.45.4.1 int parse (int *argc*, char *const * *argv*)

parse the command line args (argc, argv). A return value < 1 represents a parse error. Appropriate error messages are printed when errors are seen. parse returns the the optind (see getopt(3)) if parsing is successful.

References GetLongOpt::basename(), GetLongOpt::enroll_done, GetLongOpt::optmarker, GetLongOpt::pname, GetLongOpt::setcell(), and GetLongOpt::table.

Referenced by CommandLineHandler::check_usage().

43.45.4.2 int parse (char *const *str*, char *const *p*)

parse a string of options (typically given from the environment). A return value < 1 represents a parse error. Appropriate error messages are printed when errors are seen. parse takes two strings: the first one is the string to be parsed and the second one is a string to be prefixed to the parse errors.

References GetLongOpt::enroll_done, GetLongOpt::optmarker, GetLongOpt::setcell(), and GetLongOpt::table.

43.45.4.3 int enroll (const char *const *opt*, const OptType *t*, const char *const *desc*, const char *const *val*)

Add an option to the list of valid command options. enroll adds option specifications to its internal database. The first argument is the option sting. The second is an enum saying if the option is a flag (Valueless), if it requires a mandatory value (MandatoryValue) or if it takes an optional value (OptionalValue). The third argument is a string giving a brief description of the option. This description will be used by GetLongOpt::usage. GetLongOpt, for usage-printing, uses {$val} to represent values needed by the options. {< $val>="">} is a mandatory value and {[$val]} is an optional value. The final argument to enroll is the default string to be returned if the option is not specified. For flags (options with Valueless), use "" (empty string, or in fact any arbitrary string) for specifying TRUE and 0 (null pointer) to specify FALSE.

References GetLongOpt::enroll_done, GetLongOpt::last, and GetLongOpt::table.

Referenced by CommandLineHandler::initialize_options().

43.45.4.4 const char ∗ retrieve (const char ∗const *opt*) const

Retrieve value of option. The values of the options that are enrolled in the database can be retrieved using retrieve. This returns a string and this string should be converted to whatever type you want. See atoi, atof, atol, etc. If a "parse" is not done before retrieving all you will get are the default values you gave while enrolling! Ambiguities while retrieving (may happen when options are abbreviated) are resolved by taking the matching option that was enrolled last. For example, -{v} will expand to {-verify}. If you try to retrieve something you didn't enroll, you will get a warning message.

References GetLongOpt::optmarker, and GetLongOpt::table.

Referenced by CommandLineHandler::check_usage(), CommandLineHandler::instantiate_flag(), main(), ProblemDescDB::manage_inputs(), ParallelLibrary::manage_run_modes(), CommandLineHandler::read_restart_evals(), and ParallelLibrary::specify_outputs_restart().

43.45.4.5 void usage (const char ∗ *str*) [inline]

Change header of usage output to str. GetLongOpt::usage is overloaded. If passed a string "str", it sets the internal usage string to "str". Otherwise it simply prints the command usage.

References GetLongOpt::ustring.

The documentation for this class was generated from the following files:

- CommandLineHandler.H
- CommandLineHandler.C

43.46 Graphics Class Reference

The Graphics class provides a single interface to 2D (motif) and 3D (PLPLOT) graphics as well as tabular cataloguing of data for post-processing with Matlab, Tecplot, etc.

Public Member Functions

- Graphics ()

  constructor

- ~Graphics ()

  destructor

- void create_plots_2d (const Variables &vars, const Response &response)

  creates the 2d graphics window and initializes the plots

- void create_tabular_datastream (const Variables &vars, const Response &response, const std::string &tabular_data_file)

  opens the tabular data file stream and prints the headings

- void add_datapoint (const Variables &vars, const Response &response)

  adds data to each window in the 2d graphics and adds a row to the tabular data file based on the results of a model evaluation

- void add_datapoint (int i, double x, double y)

  adds data to a single window in the 2d graphics

- void new_dataset (int i)

  creates a separate line graphic for subsequent data points for a single window in the 2d graphics

- void close ()

  close graphics windows and tabular datastream

- void set_x_labels2d (const char *x_label)

  set x label for each plot equal to x_label

- void set_y_labels2d (const char *y_label)

  set y label for each plot equal to y_label

- void set_x_label2d (int i, const char *x_label)

  set x label for ith plot equal to x_label

- void set_y_label2d (int i, const char *y_label)

  set y label for ith plot equal to y_label

- void graphics_counter (int cntr)

set graphicsCntr equal to cntr

- int graphics_counter () const

  return graphicsCntr

- void tabular_counter_label (const std::string &label)

  set tabularCntrLabel equal to label

Private Attributes

- Graphics2D * graphics2D

  pointer to the 2D graphics object

- bool win2dOn

  flag to indicate if 2D graphics window is active

- bool tabularDataFlag

  flag to indicate if tabular data stream is active

- int graphicsCntr

  used for x axis values in 2D graphics and for 1st column in tabular data

- std::string tabularCntrLabel

  label for counter used in first line comment w/i the tabular data file

- std::ofstream tabularDataFStream

  file stream for tabulation of graphics data within compute_response

43.46.1 Detailed Description

The Graphics class provides a single interface to 2D (motif) and 3D (PLPLOT) graphics as well as tabular cataloguing of data for post-processing with Matlab, Tecplot, etc. There is only one Graphics object (dakotaGraphics) and it is global (for convenient access from strategies, models, and approximations).

43.46.2 Member Function Documentation

43.46.2.1 void create_plots_2d (const Variables & *vars*, const Response & *response*)

creates the 2d graphics window and initializes the plots Sets up a single event loop for duration of the dakotaGraphics object, continuously adding data to a single window. There is no reset. To start over with a new data set, you need a new object (delete old and instantiate new).

References Variables::continuous_variable_labels(), Variables::cv(), Variables::discrete_int_variable_labels(), Variables::discrete_real_variable_labels(), Variables::div(), Variables::drv(), Response::function_labels(), Graphics::graphics2D, Response::num_functions(), Dakota::re_match(), and Graphics::win2dOn.

Referenced by SurrBasedMinimizer::initialize_graphics(), NonDReliability::initialize_graphics(), and Iterator::initialize_graphics().

43.46.2.2 void create_tabular_datastream (const Variables & *vars*, const Response & *response*, const std::string & *tabular_data_file*)

opens the tabular data file stream and prints the headings Opens the tabular data file stream and prints headings, one for each continuous and discrete variable and one for each response function, using the variable and response function labels. This tabular data is used for post-processing of DAKOTA results in Matlab, Tecplot, etc.

References Graphics::tabularCntrLabel, Graphics::tabularDataFlag, and Graphics::tabularDataFStream.

Referenced by SurrBasedMinimizer::initialize_graphics(), and Iterator::initialize_graphics().

43.46.2.3 void add_datapoint (const Variables & *vars*, const Response & *response*)

adds data to each window in the 2d graphics and adds a row to the tabular data file based on the results of a model evaluation Adds data to each 2d plot and each tabular data column (one for each active variable and for each response function). graphicsCntr is used for the x axis in the graphics and the first column in the tabular data.

References Response::active_set_request_vector(), Variables::continuous_variables(), Variables::discrete_-int_variables(), Variables::discrete_real_variables(), Response::function_values(), Graphics::graphics2D, Graphics::graphicsCntr, Graphics::tabularDataFlag, Graphics::tabularDataFStream, Graphics::win2dOn, and Dakota::write_data_tabular().

Referenced by Model::compute_response(), NonDLocalReliability::mean_value(), SurrBasedLocalMinimizer::minimize_surrogates(), Model::synchronize(), Model::synchronize_nowait(), and NonDLocalReliability::update_level_data().

43.46.2.4 void add_datapoint (int *i*, double *x*, double *y*)

adds data to a single window in the 2d graphics Adds data to a single 2d plot. Allows complete flexibility in defining other kinds of x-y plotting in the 2D graphics.

References Graphics::graphics2D, and Graphics::win2dOn.

43.46.2.5 void new_dataset (int *i*)

creates a separate line graphic for subsequent data points for a single window in the 2d graphics Used for displaying multiple data sets within the same plot.

References Graphics::graphics2D, and Graphics::win2dOn.

Referenced by NonDLocalReliability::update_level_data().

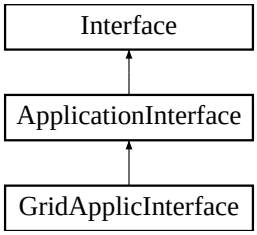
The documentation for this class was generated from the following files:

- DakotaGraphics.H

- DakotaGraphics.C

43.47 GridApplicInterface Class Reference

Derived application interface class which spawns simulation codes using grid services such as Condor or Globus. Inheritance diagram for GridApplicInterface::



Public Member Functions

- GridApplicInterface (const ProblemDescDB &problem_db)

  constructor

- ~GridApplicInterface ()

  destructor

- void derived_map (const Variables &vars, const ActiveSet &set, Response &response, int fn_eval_id)

  Called by map() and other functions to execute the simulation in synchronous mode. The portion of performing an evaluation that is specific to a derived class.

- void derived_map_asynch (const ParamResponsePair &pair)

  Called by map() and other functions to execute the simulation in asynchronous mode. The portion of performing an asynchronous evaluation that is specific to a derived class.

- void derived_synch (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version waits for at least one completion.

- void derived_synch_nowait (PRPQueue &prp_queue)

  For asynchronous function evaluations, this method is used to detect completion of jobs and process their results. It provides the processing code that is specific to derived classes. This version is nonblocking and will return without any completions if none are immediately available.

- int derived_synchronous_local_analysis (const int &analysis_id)
- const StringArray & analysis_drivers () const

  retrieve the analysis drivers specification for application interfaces

- const AnalysisCode * analysis_code () const

  return AnalysisCode::fileNameMap when defined for derived Interface class

Public Attributes

- SysCallAnalysisCode code

  Used to read/write parameter files and responses.

Protected Member Functions

- void derived_synch_kernel (PRPQueue &prp_queue)

  Convenience function for common code between derived_synch() & derived_synch_nowait().

- bool grid_file_test (const String &root_file)

  test file(s) for existence based on root_file name

Protected Attributes

- IntSet idSet

  Set of function evaluation id's for active asynchronous system call evaluations.

- IntShortMap failCountMap

  map linking function evaluation id's to number of response read failures

- start_grid_computing_t start_grid_computing

  handle to dynamically linked start_grid_computing function

- perform_analysis_t perform_analysis

  handle to dynamically linked perform_analysis grid function

- get_jobs_completed_t get_jobs_completed

  handle to dynamically linked get_jobs_completed grid function

- stop_grid_computing_t stop_grid_computing

  handle to dynamically linked stop_grid_computing function

43.47.1 Detailed Description

Derived application interface class which spawns simulation codes using grid services such as Condor or Globus. This class is currently a modified copy of SysCallApplicInterface adapted for use with an external grid dervices library which was dynamically linked using dlopen() services.

43.47.2 Member Function Documentation

43.47.2.1 int derived_synchronous_local_analysis (const int & *analysis_id*) `[inline, virtual]`

This code provides the derived function used by ApplicationInterface::serve_analyses_synch().

TODO - allow local analyses?????

Reimplemented from ApplicationInterface.

References GridApplicInterface::code, and SysCallAnalysisCode::spawn_analysis().

43.47.2.2 void derived_synch_kernel (PRPQueue & *prp_queue*) `[protected]`

Convenience function for common code between derived_synch() & derived_synch_nowait(). Convenience function for common code between wait and nowait case.

References Dakota::abort_handler(), Response::active_set(), GridApplicInterface::code, ApplicationInterface::completionSet, GridApplicInterface::failCountMap, GridApplicInterface::grid_file_test(), GridApplicInterface::idSet, Dakota::lookup_by_eval_id(), ApplicationInterface::manage_failure(), ParamResponsePair::prp_parameters(), ParamResponsePair::prp_response(), AnalysisCode::read_results_files(), and AnalysisCode::results_filename().

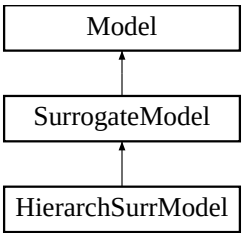
Referenced by GridApplicInterface::derived_synch(), and GridApplicInterface::derived_synch_nowait().

The documentation for this class was generated from the following files:

- GridApplicInterface.H
- GridApplicInterface.C

43.48 HierarchSurrModel Class Reference

Derived model class within the surrogate model branch for managing hierarchical surrogates (models of varying fidelity). Inheritance diagram for HierarchSurrModel::



Public Member Functions

- HierarchSurrModel (ProblemDescDB &problem_db)

  constructor

- ~HierarchSurrModel ()

  destructor

Protected Member Functions

- void derived_compute_response (const ActiveSet &set)

  portion of compute_response() specific to HierarchSurrModel

- void derived_asynch_compute_response (const ActiveSet &set)

  portion of asynch_compute_response() specific to HierarchSurrModel

- const IntResponseMap & derived_synchronize ()

  portion of synchronize() specific to HierarchSurrModel

- const IntResponseMap & derived_synchronize_nowait ()

  portion of synchronize_nowait() specific to HierarchSurrModel

- Model & surrogate_model ()

  return lowFidelityModel

- Model & truth_model ()

  return highFidelityModel

- void derived_subordinate_models (ModelList &ml, bool recurse_flag)

  return lowFidelityModel and highFidelityModel

- void primary_response_fn_weights (const RealVector &wts, bool recurse_flag=true)

  set the relative weightings for multiple objective functions or least squares terms and optionally recurses into LF/HF models

- void surrogate_response_mode (short mode)

  set responseMode and pass any bypass request on to highFidelityModel for any lower-level surrogate recursions.

- void surrogate_function_indices (const IntSet &surr_fn_indices)

  (re)set the surrogate index set in SurrogateModel::surrogateFnIndices

- void build_approximation ()

  use highFidelityModel to compute the truth values needed for correction of lowFidelityModel results

- void component_parallel_mode (short mode)

  update component parallel mode for supporting parallelism in lowFidelityModel and highFidelityModel

- void derived_init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set up lowFidelityModel and highFidelityModel for parallel operations

- void derived_init_serial ()

  set up lowFidelityModel and highFidelityModel for serial operations.

- void derived_set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set active parallel configuration within lowFidelityModel and highFidelityModel

- void derived_free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  deallocate communicator partitions for the HierarchSurrModel (request forwarded to lowFidelityModel and highFidelityModel)

- void serve ()

  Service lowFidelityModel and highFidelityModel job requests received from the master. Completes when a termination message is received from stop_servers().

- void stop_servers ()

  Executed by the master to terminate lowFidelityModel and highFidelityModel server operations when iteration on the HierarchSurrModel is complete.

- void inactive_view (short view, bool recurse_flag=true)

  update the Model's inactive view based on higher level (nested) context and optionally recurse into

- int evaluation_id () const

  Return the current evaluation id for the HierarchSurrModel.

- void set_evaluation_reference ()

  set the evaluation counter reference points for the HierarchSurrModel (request forwarded to lowFidelityModel and highFidelityModel)

- void fine_grained_evaluation_counters ()

  request fine-grained evaluation reporting within lowFidelityModel and highFidelityModel

- void print_evaluation_summary (std::ostream &s, bool minimal_header=false, bool relative_count=true) const

  print the evaluation summary for the HierarchSurrModel (request forwarded to lowFidelityModel and highFidelityModel)

Private Member Functions

- void update_model (Model &model)

  update the incoming model (lowFidelityModel or highFidelityModel) with current variable values/bounds/labels

Private Attributes

- int hierModelEvalCntr

  number of calls to derived_compute_response()/ derived_asynch_compute_response()

- IntResponseMap cachedTruthRespMap

  map of high-fidelity responses retrieved in derived_synchronize_nowait() that could not be returned since corresponding low-fidelity response portions were still pending.

- Model lowFidelityModel

  provides approximate low fidelity function evaluations. Model is of arbitrary type and supports recursions (e.g., lowFidelityModel can be a data fit surrogate on a low fidelity model).

- Model highFidelityModel

  provides truth evaluations for computing corrections to the low fidelity results. Model is of arbitrary type and supports recursions.

- Response highFidRefResponse

  the reference high fidelity response computed in build_approximation() and used for calculating corrections.

43.48.1 Detailed Description

Derived model class within the surrogate model branch for managing hierarchical surrogates (models of varying fidelity). The HierarchSurrModel class manages hierarchical models of varying fidelity. In particular, it uses a low fidelity model as a surrogate for a high fidelity model. The class contains a lowFidelityModel which performs the approximate low fidelity function evaluations and a highFidelityModel which provides truth evaluations for computing corrections to the low fidelity results.

43.48.2 Member Function Documentation

43.48.2.1 void derived_compute_response (const ActiveSet & *set*) [protected, virtual]

portion of compute_response() specific to HierarchSurrModel Compute the response synchronously using lowFidelityModel, highFidelityModel, or both (mixed case). For the lowFidelityModel portion, compute the high fidelity response if needed with build_approximation(), and, if correction is active, correct the low fidelity results.

Reimplemented from Model.

References Response::active_set(), DiscrepancyCorrection::apply(), SurrogateModel::approxBuilds, SurrogateModel::asv_mapping(), HierarchSurrModel::build_approximation(), HierarchSurrModel::component_parallel_mode(), DiscrepancyCorrection::compute(), Model::compute_response(), DiscrepancyCorrection::computed(), Variables::continuous_variables(), Response::copy(), Model::current_response(), Model::currentResponse, Model::currentVariables, SurrogateModel::deltaCorr, SurrogateModel::force_rebuild(), HierarchSurrModel::hierModelEvalCntr, HierarchSurrModel::highFidelityModel, HierarchSurrModel::highFidRefResponse, HierarchSurrModel::lowFidelityModel, Model::outputLevel, ActiveSet::request_vector(), SurrogateModel::response_mapping(), SurrogateModel::responseMode, Response::update(), and HierarchSurrModel::update_model().

43.48.2.2 void derived_asynch_compute_response (const ActiveSet & *set*) [protected, virtual]

portion of asynch_compute_response() specific to HierarchSurrModel Compute the response asynchronously using lowFidelityModel, highFidelityModel, or both (mixed case). For the lowFidelityModel portion, compute the high fidelity response with build_approximation() (for correcting the low fidelity results in derived_synchronize() and derived_synchronize_nowait()) if not performed previously.

Reimplemented from Model.

References SurrogateModel::approxBuilds, SurrogateModel::asv_mapping(), Model::asynch_compute_response(), HierarchSurrModel::build_approximation(), Variables::continuous_variables(), Dakota::copy_data(), Model::currentVariables, Model::evaluation_id(), SurrogateModel::force_rebuild(), HierarchSurrModel::hierModelEvalCntr, HierarchSurrModel::highFidelityModel, HierarchSurrModel::lowFidelityModel, SurrogateModel::rawCVarsMap, ActiveSet::request_vector(), SurrogateModel::responseMode, SurrogateModel::surrIdMap, SurrogateModel::truthIdMap, and HierarchSurrModel::update_model().

43.48.2.3 const IntResponseMap & derived_synchronize () [protected, virtual]

portion of synchronize() specific to HierarchSurrModel Blocking retrieval of asynchronous evaluations from lowFidelityModel, highFidelityModel, or both (mixed case). For the lowFidelityModel portion, apply correction (if active) to each response in the array. derived_synchronize() is designed for the general case where derived_asynch_compute_response() may be inconsistent in its use of low fidelity evaluations, high fidelity evaluations, or both.

Reimplemented from Model.

References DiscrepancyCorrection::apply(), SurrogateModel::cachedApproxRespMap, HierarchSurrModel::cachedTruthRespMap, HierarchSurrModel::component_parallel_mode(), DiscrepancyCorrection::compute(), DiscrepancyCorrection::computed(), SurrogateModel::deltaCorr, HierarchSurrModel::highFidelityModel, HierarchSurrModel::highFidRefResponse, HierarchSurrModel::lowFidelityModel, Model::outputLevel, SurrogateModel::rawCVarsMap, SurrogateModel::response_mapping(), Surrogate-

Model::responseMode, SurrogateModel::surrIdMap, SurrogateModel::surrResponseMap, Model::synchronize(), and SurrogateModel::truthIdMap.

43.48.2.4 const IntResponseMap & derived_synchronize_nowait () [protected, virtual]

portion of synchronize_nowait() specific to HierarchSurrModel Nonblocking retrieval of asynchronous evaluations from lowFidelityModel, highFidelityModel, or both (mixed case). For the lowFidelityModel portion, apply correction (if active) to each response in the map. derived_synchronize_nowait() is designed for the general case where derived_asynch_compute_response() may be inconsistent in its use of actual evals, approx evals, or both.

Reimplemented from Model.

References DiscrepancyCorrection::apply(), SurrogateModel::cachedApproxRespMap, HierarchSurrModel::cachedTruthRespMap, HierarchSurrModel::component_parallel_mode(), DiscrepancyCorrection::compute(), DiscrepancyCorrection::computed(), SurrogateModel::deltaCorr, HierarchSurrModel::highFidelityModel, HierarchSurrModel::highFidRefResponse, HierarchSurrModel::lowFidelityModel, Model::outputLevel, SurrogateModel::rawCVarsMap, SurrogateModel::response_mapping(), SurrogateModel::responseMode, SurrogateModel::surrIdMap, SurrogateModel::surrResponseMap, Model::synchronize_nowait(), and SurrogateModel::truthIdMap.

43.48.2.5 int evaluation_id () const [inline, protected, virtual]

Return the current evaluation id for the HierarchSurrModel. return the hierarchical model evaluation count. Due to possibly intermittent use of surrogate bypass, this is not the same as either the loFi or hiFi model evaluation counts. It also does not distinguish duplicate evals.

Reimplemented from Model.

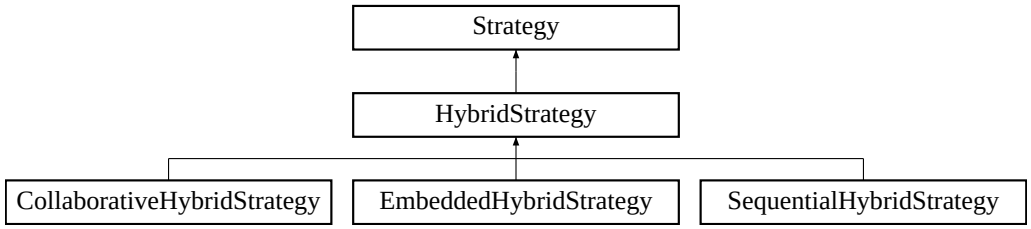
References HierarchSurrModel::hierModelEvalCntr.

The documentation for this class was generated from the following files:

- HierarchSurrModel.H
- HierarchSurrModel.C

43.49 HybridStrategy Class Reference

Base class for hybrid minimization strategies. Inheritance diagram for HybridStrategy::



Protected Member Functions

- HybridStrategy (ProblemDescDB &problem_db)

  constructor

- ~HybridStrategy ()

  destructor

- void allocate_methods ()

  initialize selectedIterators and userDefinedModels

- void deallocate_methods ()

  free communicators for selectedIterators and userDefinedModels

Protected Attributes

- StringArray methodList

  the list of method identifiers

- int numIterators

  number of methods in methodList

- IteratorArray selectedIterators

  the set of iterators, one for each entry in methodList

- ModelArray userDefinedModels

  the set of models, one for each iterator

43.49.1 Detailed Description

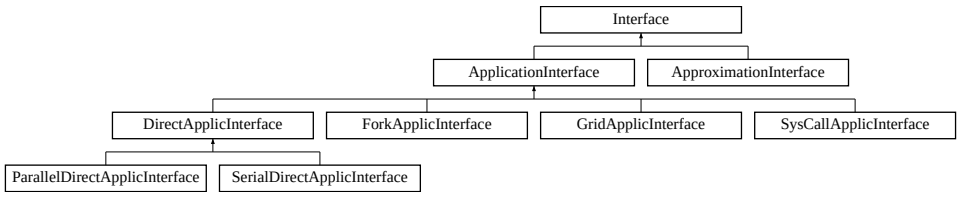
Base class for hybrid minimization strategies. This base class shares code for three approaches to hybrid minimization: (1) the sequential hybrid; (2) the embedded hybrid; and (3) the collaborative hybrid.

The documentation for this class was generated from the following files:

- HybridStrategy.H
- HybridStrategy.C

43.50 Interface Class Reference

Base class for the interface class hierarchy. Inheritance diagram for Interface::



Public Member Functions

- Interface ()

  default constructor

- Interface (ProblemDescDB &problem_db)

  standard constructor for envelope

- Interface (const Interface &interface)

  copy constructor

- virtual ~Interface ()

  destructor

- Interface operator= (const Interface &interface)

  assignment operator

- virtual void map (const Variables &vars, const ActiveSet &set, Response &response, const bool asynch_-flag=false)

  the function evaluator: provides a "mapping" from the variables to the responses.

- virtual const IntResponseMap & synch ()

  recovers data from a series of asynchronous evaluations (blocking)

- virtual const IntResponseMap & synch_nowait ()

  recovers data from a series of asynchronous evaluations (nonblocking)

- virtual void serve_evaluations ()

  evaluation server function for multiprocessor executions

- virtual void stop_evaluation_servers ()

  send messages from iterator rank 0 to terminate evaluation servers

- virtual void init_communicators (const IntArray &message_lengths, const int &max_iterator_concurrency)

allocate communicator partitions for concurrent evaluations within an iterator and concurrent multiprocessor analyses within an evaluation.

- virtual void set_communicators (const IntArray &message_lengths)

  set the local parallel partition data for an interface (the partitions are already allocated in ParallelLibrary).

- virtual void free_communicators ()

  deallocate communicator partitions for concurrent evaluations within an iterator and concurrent multiprocessor analyses within an evaluation.

- virtual void init_serial ()

  reset certain defaults for serial interface objects.

- virtual int asynch_local_evaluation_concurrency () const

  return the user-specified concurrency for asynch local evaluations

- virtual String interface_synchronization () const

  return the user-specified interface synchronization

- virtual int minimum_points (bool constraint_flag) const

  returns the minimum number of points required to build a particular ApproximationInterface (used by DataFitSurrModels).

- virtual int recommended_points (bool constraint_flag) const

  returns the recommended number of points required to build a particular ApproximationInterface (used by DataFitSurrModels).

- virtual void approximation_function_indices (const IntSet &approx_fn_indices)

  set the (currently active) approximation function index set

- virtual void update_approximation (const Variables &vars, const IntResponsePair &response_pr)

  updates the anchor point for an approximation

- virtual void update_approximation (const RealMatrix &samples, const IntResponseMap &resp_map)

  updates the current data points for an approximation

- virtual void update_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map)

  updates the current data points for an approximation

- virtual void append_approximation (const Variables &vars, const IntResponsePair &response_pr)

  appends a single point to an existing approximation

- virtual void append_approximation (const RealMatrix &samples, const IntResponseMap &resp_map)

  appends multiple points to an existing approximation

- virtual void append_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map)

  appends multiple points to an existing approximation

- virtual void build_approximation (const RealVector &lower_bnds, const RealVector &upper_bnds)

  builds the approximation

- virtual void rebuild_approximation (const BoolDeque &rebuild_deque)

  rebuilds the approximation after a data update

- virtual void pop_approximation (bool save_surr_data)

  removes data from last append from the approximation

- virtual void restore_approximation ()

  restores the approximation to a selected previous state

- virtual bool restore_available ()

  queries the approximation for the ability to restore a previous increment

- virtual void finalize_approximation ()

  finalizes the approximation by applying all trial increments

- virtual void store_approximation ()

  move the current approximation into storage for later combination

- virtual void combine_approximation (short corr_type)

  combine the current approximation with one previously stored

- virtual void clear_current ()

  clears current data from an approximation interface

- virtual void clear_all ()

  clears all data from an approximation interface

- virtual std::vector< Approximation > & approximations ()

  retrieve the Approximations within an ApproximationInterface

- virtual const Pecos::SurrogateData & approximation_data (size_t index)

  retrieve the approximation data from a particular Approximation within an ApproximationInterface

- virtual const RealVectorArray & approximation_coefficients ()

  retrieve the approximation coefficients from each Approximation within an ApproximationInterface

- virtual void approximation_coefficients (const RealVectorArray &approx_coeffs)

  set the approximation coefficients within each Approximation within an ApproximationInterface

- virtual const RealVector & approximation_variances (const RealVector &c_variables)

  retrieve the approximation variances from each Approximation within an ApproximationInterface

- virtual const StringArray & analysis_drivers () const

  retrieve the analysis drivers specification for application interfaces

- virtual const AnalysisCode ∗ analysis_code () const

  return AnalysisCode::fileNameMap when defined for derived Interface class

- virtual bool evaluation_cache () const

  return flag indicating usage of the global evaluation cache

- void assign_rep (Interface ∗interface_rep, bool ref_count_incr=true)

  replaces existing letter with a new one

- const String & interface_type () const

  returns the interface type

- const String & interface_id () const

  returns the interface identifier

- int evaluation_id () const

  returns the value of the (total) evaluation id counter for the interface

- void fine_grained_evaluation_counters (size_t num_fns)

  set fineGrainEvalCounters to true and initialize counters if needed

- void init_evaluation_counters (size_t num_fns)

  initialize fine grained evaluation counters

- void set_evaluation_reference ()

  set evaluation count reference points for the interface

- void print_evaluation_summary (std::ostream &s, bool minimal_header, bool relative_count) const

  print an evaluation summary for the interface

- bool multi_proc_eval_flag () const

  returns a flag signaling the use of multiprocessor evaluation partitions

- bool iterator_eval_dedicated_master_flag () const

  returns a flag signaling the use of a dedicated master processor at the iterator-evaluation scheduling level

- bool is_null () const

  function to check interfaceRep (does this envelope contain a letter?)

Protected Member Functions

- Interface (BaseConstructor, const ProblemDescDB &problem_db)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- Interface (NoDBBaseConstructor, size_t num_fns, short output_level)

  constructor initializes the base class part of letter classes (NoDBBaseConstructor used for on the fly instantiations without a DB)

- void init_algebraic_mappings (const Variables &vars, const Response &response)

  Define algebraicACVIndices, algebraicACVIds, and algebraicFnIndices.

- void asv_mapping (const ActiveSet &total_set, ActiveSet &algebraic_set, ActiveSet &core_set)

  define the evaluation requirements for algebraic_mappings() (algebraic_set) and the core Application/Approximation mapping (core_set) from the total Interface evaluation requirements (total_set)

- void algebraic_mappings (const Variables &vars, const ActiveSet &algebraic_set, Response &algebraic_response)

  evaluate the algebraic_response using the AMPL solver library and the data extracted from the algebraic_mappings file

- void response_mapping (const Response &algebraic_response, const Response &core_response, Response &total_response)

  combine the response from algebraic_mappings() with the response from derived_map() to create the total response

Protected Attributes

- String interfaceType

  the interface type: system, fork, direct, grid, or approximation

- String interfaceId

  the interface specification identifier string from the DAKOTA input file

- bool algebraicMappings

  flag for the presence of algebraic_mappings that define the subset of an Interface's parameter to response mapping that is explicit and algebraic.

- bool coreMappings

  flag for the presence of non-algebraic mappings that define the core of an Interface's parameter to response mapping (using analysis_drivers for ApplicationInterface or functionSurfaces for ApproximationInterface).

- int currEvalId

  identifier for the current evaluation, which may differ from the evaluation counters in the case of evaluation scheduling; used on iterator master as well as server processors. Currently, this is set prior to all invocations of derived_map() for all processors.

- bool fineGrainEvalCounters

  controls use of fn val/grad/hess counters

- int evalIdCntr

  total interface evaluation counter

- int newEvalIdCntr

  new (non-duplicate) interface evaluation counter

- int evalIdRefPt

  iteration reference point for evalIdCntr

- int newEvalIdRefPt

  iteration reference point for newEvalIdCntr

- IntArray fnValCounter

  number of value evaluations by resp fn

- IntArray fnGradCounter

  number of gradient evaluations by resp fn

- IntArray fnHessCounter

  number of Hessian evaluations by resp fn

- IntArray newFnValCounter

  number of new value evaluations by resp fn

- IntArray newFnGradCounter

  number of new gradient evaluations by resp fn

- IntArray newFnHessCounter

  number of new Hessian evaluations by resp fn

- IntArray fnValRefPt

  iteration reference point for fnValCounter

- IntArray fnGradRefPt

  iteration reference point for fnGradCounter

- IntArray fnHessRefPt

  iteration reference point for fnHessCounter

- IntArray newFnValRefPt

  iteration reference point for newFnValCounter

- IntArray newFnGradRefPt

  iteration reference point for newFnGradCounter

- IntArray newFnHessRefPt

  iteration reference point for newFnHessCounter

- IntResponseMap rawResponseMap

  Set of responses returned after either a blocking or nonblocking schedule of asynchronous evaluations.

- StringArray fnLabels

  response function descriptors from the DAKOTA input file (used in print_evaluation_summary() and derived direct interface classes)

- bool multiProcEvalFlag

  flag for multiprocessor evaluation partitions (evalComm)

- bool ieDedMasterFlag

  flag for dedicated master partitioning at the iterator level

- short outputLevel

  output verbosity level: {SILENT,QUIET,NORMAL,VERBOSE,DEBUG}_OUTPUT

Private Member Functions

- Interface * get_interface (ProblemDescDB &problem_db)

  Used by the envelope to instantiate the correct letter class.

- int algebraic_function_type (String)

  Used by algebraic mappings to determine the correct AMPL function evaluation call to make.

Private Attributes

- StringArray algebraicVarTags

  set of variable tags from AMPL stub.col

- SizetArray algebraicACVIndices

  set of indices mapping AMPL algebraic variables to DAKOTA all continuous variables

- SizetArray algebraicACVIds

  set of ids mapping AMPL algebraic variables to DAKOTA all continuous variables

- StringArray algebraicFnTags

  set of function tags from AMPL stub.row

- IntArray algebraicFnTypes

  function type: > 0 = objective, < 0 = constraint |value|-1 is the objective (constraint) index when making AMPL objval (conival) calls

- SizetArray algebraicFnIndices

  set of indices mapping AMPL algebraic objective functions to DAKOTA response functions

- RealArray algebraicConstraintWeights

  set of weights for computing Hessian matrices for algebraic constraints;

- int numAlgebraicResponses

  number of algebraic responses (objectives+constraints)

- Interface ∗ interfaceRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing interfaceRep

- ASL ∗ asl

  pointer to an AMPL solver library (ASL) object

43.50.1 Detailed Description

Base class for the interface class hierarchy. The Interface class hierarchy provides the part of a Model that is responsible for mapping a set of Variables into a set of Responses. The mapping is performed using either a simulation-based application interface or a surrogate-based approximation interface. For memory efficiency and enhanced polymorphism, the interface hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Interface) serves as the envelope and one of the derived classes (selected in Interface::get_interface()) serves as the letter.

43.50.2 Constructor & Destructor Documentation

43.50.2.1 Interface ()

default constructor used in Model envelope class instantiations

43.50.2.2 Interface (ProblemDescDB & *problem_db*)

standard constructor for envelope Used in Model instantiation to build the envelope. This constructor only needs to extract enough data to properly execute get_interface, since Interface::Interface(BaseConstructor, problem_db) builds the actual base class data inherited by the derived interfaces.

References Dakota::abort_handler(), Interface::get_interface(), and Interface::interfaceRep.

43.50.2.3 Interface (const Interface & *interface*)

copy constructor Copy constructor manages sharing of interfaceRep and incrementing of referenceCount.

References Interface::interfaceRep, and Interface::referenceCount.

43.50.2.4 ~Interface () `[virtual]`

destructor Destructor decrements referenceCount and only deletes interfaceRep if referenceCount is zero.

References Interface::interfaceRep, and Interface::referenceCount.

43.50.2.5 Interface (BaseConstructor, const ProblemDescDB & *problem_db*) `[protected]`

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all inherited interfaces. get_interface() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_-interface() again). Since this is the letter and the letter IS the representation, interfaceRep is set to NULL (an uninitialized pointer causes problems in ~Interface).

References Dakota::abort_handler(), Interface::algebraic_function_type(), Interface::algebraicConstraintWeights, Interface::algebraicFnTags, Interface::algebraicFnTypes, Interface::algebraicMappings, Interface::algebraicVarTags, Interface::asl, Interface::coreMappings, String::data(), String::ends(), Interface::fineGrainEvalCounters, Interface::fnLabels, ProblemDescDB::get_dsa(), ProblemDescDB::get_string(), Interface::init_evaluation_counters(), and Interface::outputLevel.

43.50.3 Member Function Documentation

43.50.3.1 Interface operator= (const Interface & *interface*)

assignment operator Assignment operator decrements referenceCount for old interfaceRep, assigns new interfaceRep, and increments referenceCount for new interfaceRep.

References Interface::interfaceRep, and Interface::referenceCount.

43.50.3.2 void assign_rep (Interface * *interface_rep*, bool *ref_count_incr* = `true`)

replaces existing letter with a new one Similar to the assignment operator, the assign_rep() function decrements referenceCount for the old interfaceRep and assigns the new interfaceRep. It is different in that it is used for publishing derived class letters to existing envelopes, as opposed to sharing representations among multiple envelopes (in particular, assign_rep is passed a letter object and operator= is passed an envelope object). Letter assignment supports two models as governed by ref_count_incr:

- ref_count_incr = true (default): the incoming letter belongs to another envelope. In this case, increment the reference count in the normal manner so that deallocation of the letter is handled properly.
- ref_count_incr = false: the incoming letter is instantiated on the fly and has no envelope. This case is modeled after get_interface(): a letter is dynamically allocated using new and passed into assign_rep, the

letter's reference count is not incremented, and the letter is not remotely deleted (its memory management is passed over to the envelope).

References Dakota::abort_handler(), Interface::interfaceRep, and Interface::referenceCount.

Referenced by DataFitSurrModel::DataFitSurrModel(), model_interface_plugins(), and run_dakota().

43.50.3.3 Interface ∗ get_interface (ProblemDescDB & *problem_db*) [private]

Used by the envelope to instantiate the correct letter class. used only by the envelope constructor to initialize interfaceRep to the appropriate derived type.

References ProblemDescDB::get_string().

Referenced by Interface::Interface().

43.50.4 Member Data Documentation

43.50.4.1 IntResponseMap rawResponseMap [protected]

Set of responses returned after either a blocking or nonblocking schedule of asynchronous evaluations. The map is a full/partial set of completions which are identified through their evalIdCntr key. The raw set is postprocessed (i.e., finite diff grads merged) in Model::synchronize() where it becomes responseMap.

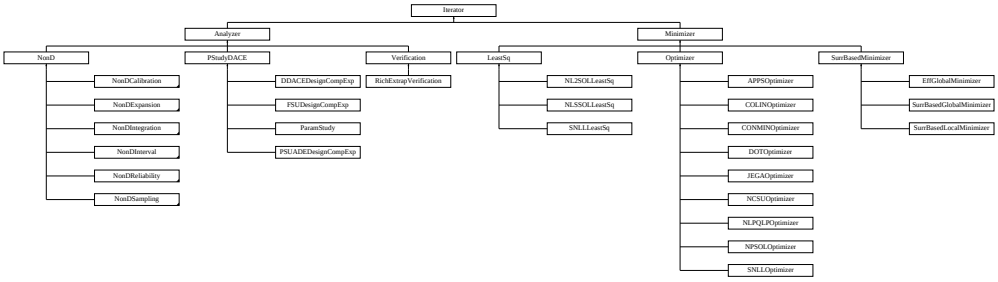
Referenced by ApplicationInterface::asynchronous_local_evaluations(), ApplicationInterface::asynchronous_local_evaluations_nowait(), ApplicationInterface::asynchronous_local_evaluations_static(), ApplicationInterface::self_schedule_evaluations(), ApplicationInterface::static_schedule_evaluations(), ApproximationInterface::synch(), ApplicationInterface::synch(), ApproximationInterface::synch_nowait(), ApplicationInterface::synch_nowait(), and ApplicationInterface::synchronous_local_evaluations().

The documentation for this class was generated from the following files:

- DakotaInterface.H
- DakotaInterface.C

43.51 Iterator Class Reference

Base class for the iterator class hierarchy. Inheritance diagram for Iterator::



Public Member Functions

- Iterator ()

  default constructor

- Iterator (Model &model)

  standard envelope constructor

- Iterator (const String &method_name, Model &model)

  alternate envelope constructor for instantiations by name

- Iterator (const Iterator &iterator)

  copy constructor

- virtual ~Iterator ()

  destructor

- Iterator operator= (const Iterator &iterator)

  assignment operator

- virtual void initialize_run ()

  utility function to perform common operations prior to pre_run(); typically memory initialization; setting of instance pointers

- virtual void pre_run ()

  pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori

- virtual void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- virtual void post_run (std::ostream &s)

  post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way

- virtual void finalize_run ()

  utility function to perform common operations following post_run(); deallocation and resetting of instance pointers

- virtual void reset ()

  restore initial state for repeated sub-iterator executions

- virtual const Variables & variables_results () const

  return a single final iterator solution (variables)

- virtual const Response & response_results () const

  return a single final iterator solution (response)

- virtual const VariablesArray & variables_array_results ()

  return multiple final iterator solutions (variables). This should only be used if returns_multiple_points() returns true.

- virtual const ResponseArray & response_array_results ()

  return multiple final iterator solutions (response). This should only be used if returns_multiple_points() returns true.

- virtual bool accepts_multiple_points () const

  indicates if this iterator accepts multiple initial points. Default return is false. Override to return true if appropriate.

- virtual bool returns_multiple_points () const

  indicates if this iterator returns multiple final points. Default return is false. Override to return true if appropriate.

- virtual void initial_points (const VariablesArray &pts)

  sets the multiple initial points for this iterator. This should only be used if accepts_multiple_points() returns true.

- virtual void response_results_active_set (const ActiveSet &set)

  set the requested data for the final iterator response results

- virtual void initialize_graphics (bool graph_2d, bool tabular_data, const String &tabular_file)

  initialize the 2D graphics window and the tabular graphics data

- virtual void print_results (std::ostream &s)

  print the final iterator results

- virtual int num_samples () const

  get the current number of samples

- virtual void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)

reset sampling iterator to use at least min_samples

- virtual const String & sampling_scheme () const

  return sampling name

- virtual const Model & algorithm_space_model () const

  return the result of any recasting or surrogate model recursion layered on top of iteratedModel by the derived Iterator ctor chain

- virtual String uses_method () const

  return name of any enabling iterator used by this iterator

- virtual void method_recourse ()

  perform a method switch, if possible, due to a detected conflict

- virtual const VariablesArray & all_variables ()

  return the complete set of evaluated variables

- virtual const RealMatrix & all_samples ()

  return the complete set of evaluated samples

- virtual const IntResponseMap & all_responses () const

  return the complete set of computed responses

- virtual bool compact_mode () const

  returns Analyzer::compactMode

- void run_iterator (std::ostream &s)

  orchestrate initialize/pre/run/post/finalize phases

- void assign_rep (Iterator *iterator_rep, bool ref_count_incr=true)

  replaces existing letter with a new one

- ProblemDescDB & problem_description_db () const

  return the problem description database (probDescDB)

- const String & method_name () const

  return the method name

- const String & method_id () const

  return the method identifier (methodId)

- void output_level (short out_lev)

  set the method output level (outputLevel)

- short output_level () const

return the method output level (outputLevel)

- void summary_output (bool summary_output_flag)

  Set summary output control; true enables evaluation/results summary.

- int maximum_concurrency () const

  return the maximum concurrency supported by the iterator

- void maximum_concurrency (int max_conc)

  set the maximum concurrency supported by the iterator

- size_t num_final_solutions () const

  return the number of solutions to retain in best variables/response arrays

- void num_final_solutions (size_t num_final)

  set the number of solutions to retain in best variables/response arrays

- void active_set (const ActiveSet &set)

  set the default active set vector (for use with iterators that employ evaluate_parameter_sets())

- const ActiveSet & active_set () const

  return the default active set vector (used by iterators that employ evaluate_parameter_sets())

- void sub_iterator_flag (bool si_flag)

  set subIteratorFlag (and update summaryOutputFlag if needed)

- void active_variable_mappings (const SizetArray &c_index1, const SizetArray &di_index1, const SizetArray &dr_index1, const ShortArray &c_target2, const ShortArray &di_target2, const ShortArray &dr_target2)

  set primaryA{CV,DIV,DRV}MapIndices, secondaryA{CV,DIV,DRV}MapTargets

- bool is_null () const

  function to check iteratorRep (does this envelope contain a letter?)

- Iterator * iterator_rep () const

  returns iteratorRep for access to derived class member functions that are not mapped to the top Iterator level

Protected Member Functions

- Iterator (BaseConstructor, Model &model)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- Iterator (NoDBBaseConstructor, Model &model)

  alternate constructor for base iterator classes constructed on the fly

- Iterator (NoDBBaseConstructor)

  alternate constructor for base iterator classes constructed on the fly

- virtual const VariablesArray & initial_points () const

  gets the multiple initial points for this iterator. This will only be meaningful after a call to initial_points mutator.

Protected Attributes

- Model iteratedModel

  shallow copy of the model passed into the constructor or a thin RecastModel wrapped around it

- ProblemDescDB & probDescDB

  class member reference to the problem description database

- String methodName

  name of the iterator (the user's method spec)

- Real convergenceTol

  iteration convergence tolerance

- int maxIterations

  maximum number of iterations for the iterator

- int maxFunctionEvals

  maximum number of fn evaluations for the iterator

- int maxConcurrency

  maximum coarse-grained concurrency

- size_t numFunctions

  number of response functions

- size_t numContinuousVars

  number of active continuous vars

- size_t numDiscreteIntVars

  number of active discrete integer vars

- size_t numDiscreteRealVars

  number of active discrete real vars

- size_t numFinalSolutions

  number of solutions to retain in best variables/response arrays

- ActiveSet activeSet

  tracks the response data requirements on each function evaluation

- VariablesArray bestVariablesArray

  collection of N best solution variables found during the study

- ResponseArray bestResponseArray

  collection of N best solution responses found during the study

- bool subIteratorFlag

  flag indicating if this Iterator is a sub-iterator (NestedModel::subIterator or DataFitSurrModel::daceIterator)

- SizetArray primaryACVarMapIndices

  "primary" all continuous variable mapping indices flowed down from higher level iteration

- SizetArray primaryADIVarMapIndices

  "primary" all discrete int variable mapping indices flowed down from higher level iteration

- SizetArray primaryADRVarMapIndices

  "primary" all discrete real variable mapping indices flowed down from higher level iteration

- ShortArray secondaryACVarMapTargets

  "secondary" all continuous variable mapping targets flowed down from higher level iteration

- ShortArray secondaryADIVarMapTargets

  "secondary" all discrete int variable mapping targets flowed down from higher level iteration

- ShortArray secondaryADRVarMapTargets

  "secondary" all discrete real variable mapping targets flowed down from higher level iteration

- String gradientType

  type of gradient data: analytic, numerical, mixed, or none

- String methodSource

  source of numerical gradient routine: dakota or vendor

- String intervalType

  type of numerical gradient interval: central or forward

- String hessianType

  type of Hessian data: analytic, numerical, quasi, mixed, or none

- Real fdGradStepSize

  relative finite difference step size for numerical gradients

- Real fdHessByGradStepSize

relative finite difference step size for numerical Hessians estimated using first-order differences of gradients

- Real fdHessByFnStepSize

  relative finite difference step size for numerical Hessians estimated using second-order differences of function values

- short outputLevel

  output verbosity level: {SILENT,QUIET,NORMAL,VERBOSE,DEBUG}_OUTPUT

- bool summaryOutputFlag

  flag for summary output (evaluation stats, final results); default true, but false for on-the-fly (helper) iterators and sub-iterator use cases

- bool asynchFlag

  copy of the model's asynchronous evaluation flag

- int writePrecision

  write precision as specified by the user

Private Member Functions

- Iterator * get_iterator (Model &model)

  Used by the envelope to instantiate the correct letter class.

- Iterator * get_iterator (const String &method_name, Model &model)

  Used by the envelope to instantiate the correct letter class.

- virtual void pre_output ()

  convenience function to write variables to file, following pre-run

- virtual void post_input ()

  read tabular data for post-run mode

Private Attributes

- String methodId

  method identifier string from the input file

- Iterator * iteratorRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing iteratorRep

43.51.1 Detailed Description

Base class for the iterator class hierarchy. The Iterator class is the base class for one of the primary class hierarchies in DAKOTA. The iterator hierarchy contains all of the iterative algorithms which use repeated execution of simulations as function evaluations. For memory efficiency and enhanced polymorphism, the iterator hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Iterator) serves as the envelope and one of the derived classes (selected in Iterator::get_iterator()) serves as the letter.

43.51.2 Constructor & Destructor Documentation

43.51.2.1 Iterator ()

default constructor The default constructor is used in Vector<Iterator> instantiations and for initialization of Iterator objects contained in Strategy derived classes (see derived class header files). iteratorRep is NULL in this case (a populated problem_db is needed to build a meaningful Iterator object). This makes it necessary to check for NULL pointers in the copy constructor, assignment operator, and destructor.

Referenced by SurrBasedGlobalMinimizer::SurrBasedGlobalMinimizer(), and SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.51.2.2 Iterator (Model & *model*)

standard envelope constructor Used in iterator instantiations within strategy constructors. Envelope constructor only needs to extract enough data to properly execute get_iterator(), since letter holds the actual base class data.

References Dakota::abort_handler(), Iterator::get_iterator(), and Iterator::iteratorRep.

43.51.2.3 Iterator (const String & *method_name*, Model & *model*)

alternate envelope constructor for instantiations by name Used in sub-iterator instantiations within iterator constructors. Envelope constructor only needs to extract enough data to properly execute get_iterator(), since letter holds the actual base class data.

References Dakota::abort_handler(), Iterator::get_iterator(), and Iterator::iteratorRep.

43.51.2.4 Iterator (const Iterator & *iterator*)

copy constructor Copy constructor manages sharing of iteratorRep and incrementing of referenceCount.

References Iterator::iteratorRep, and Iterator::referenceCount.

43.51.2.5 ~Iterator () `[virtual]`

destructor Destructor decrements referenceCount and only deletes iteratorRep when referenceCount reaches zero.

References Iterator::iteratorRep, and Iterator::referenceCount.

43.51.2.6 Iterator (BaseConstructor, Model & *model*) [protected]

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor builds the base class data for all inherited iterators. get_iterator() instantiates a derived class and the derived class selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_iterator() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~Iterator).

References Dakota::abort_handler(), Iterator::fdGradStepSize, Iterator::fdHessByFnStepSize, Iterator::fdHessByGradStepSize, ProblemDescDB::get_dil(), ProblemDescDB::get_rdv(), Iterator::gradientType, Iterator::hessianType, Iterator::intervalType, Iterator::methodName, Iterator::methodSource, Iterator::numContinuousVars, Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, Iterator::numFunctions, and Iterator::probDescDB.

43.51.2.7 Iterator (NoDBBaseConstructor, Model & *model*) [protected]

alternate constructor for base iterator classes constructed on the fly This alternate constructor builds base class data for inherited iterators. It is used for on-the-fly instantiations for which DB queries cannot be used. Therefore it only sets attributes taken from the incoming model. Since there are no iterator-specific redefinitions of maxIterations or numFinalSolutions in NoDBBaseConstructor mode, go ahead and assign default value for all iterators.

43.51.2.8 Iterator (NoDBBaseConstructor) [protected]

alternate constructor for base iterator classes constructed on the fly This alternate constructor builds base class data for inherited iterators. It is used for on-the-fly instantiations for which DB queries cannot be used. It has no incoming model, so only sets up a minimal set of defaults. However, its use is preferable to the default constructor, which should remain as minimal as possible. Since there are no iterator-specific redefinitions of maxIterations or numFinalSolutions in NoDBBaseConstructor mode, go ahead and assign default value for all iterators.

43.51.3 Member Function Documentation

43.51.3.1 Iterator operator= (const Iterator & *iterator*)

assignment operator Assignment operator decrements referenceCount for old iteratorRep, assigns new iteratorRep, and increments referenceCount for new iteratorRep.

References Iterator::iteratorRep, and Iterator::referenceCount.

43.51.3.2 void initialize_run () [virtual]

utility function to perform common operations prior to pre_run(); typically memory initialization; setting of instance pointers Perform initialization phases of run sequence, like allocating memory and setting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's initialize_run(), typically _before_ performing its own implementation steps.

Reimplemented in CONMINOptimizer, LeastSq, Minimizer, NonD, Optimizer, DOTOptimizer, NLPQLPOptimizer, SNLLLeastSq, and SNLLOptimizer.

References Model::asynch_flag(), Iterator::asynchFlag, Iterator::initialize_run(), Model::is_null(), Iterator::iteratedModel, Iterator::iteratorRep, Iterator::maxConcurrency, Model::set_communicators(), Model::set_evaluation_reference(), and Iterator::summaryOutputFlag.

Referenced by Iterator::initialize_run(), and Iterator::run_iterator().

43.51.3.3 void pre_run () [virtual]

pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori pre-run phase, which a derived iterator may optionally reimplement; when not present, pre-run is likely integrated into the derived run function. This is a virtual function; when re-implementing, a derived class must call its nearest parent's pre_run(), if implemented, typically _before_ performing its own implementation steps.

Reimplemented in DDACEDesignCompExp, FSUDesignCompExp, NonDLHSSampling, ParamStudy, and PSUADEDesignCompExp.

References Iterator::iteratorRep, and Iterator::pre_run().

Referenced by Iterator::pre_run(), and Iterator::run_iterator().

43.51.3.4 void run () [virtual]

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented in LeastSq, NonD, Optimizer, PStudyDACE, Verification, and SurrBasedMinimizer.

References Dakota::abort_handler(), Iterator::iteratorRep, and Iterator::run().

Referenced by Iterator::run(), and Iterator::run_iterator().

43.51.3.5 void post_run (std::ostream & *s*) [virtual]

post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way Post-run phase, which a derived iterator may optionally reimplement; when not present, post-run is likely integrated into run. This is a virtual function; when re-implementing, a derived class must call its nearest parent's post_run(), typically _after_ performing its own implementation steps.

Reimplemented in COLINOptimizer, LeastSq, Optimizer, DDACEDesignCompExp, FSUDesignCompExp, NonDLHSSampling, ParamStudy, PSUADEDesignCompExp, SNLLLeastSq, and SNLLOptimizer.

References Model::is_null(), Iterator::iteratedModel, Iterator::iteratorRep, Iterator::post_run(), Model::print_evaluation_summary(), Iterator::print_results(), and Iterator::summaryOutputFlag.

Referenced by Iterator::post_run(), and Iterator::run_iterator().

43.51.3.6 void finalize_run () [virtual]

utility function to perform common operations following post_run(); deallocation and resetting of instance pointers Optional: perform finalization phases of run sequence, like deallocating memory and resetting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's finalize_run(), typically _after_ performing its own implementation steps.

Reimplemented in LeastSq, Minimizer, NonD, Optimizer, SNLLLeastSq, and SNLLOptimizer.

References Iterator::finalize_run(), and Iterator::iteratorRep.

Referenced by Iterator::finalize_run(), and Iterator::run_iterator().

43.51.3.7 void initialize_graphics (bool *graph_2d*, bool *tabular_data*, const String & *tabular_file*) [virtual]

initialize the 2D graphics window and the tabular graphics data This is a convenience function for encapsulating graphics initialization operations. It does not require a strategyRep forward since it is only used by letter objects.

Reimplemented in NonDReliability, and SurrBasedMinimizer.

References Model::auto_graphics(), Graphics::create_plots_2d(), Graphics::create_tabular_datastream(), Model::current_response(), Model::current_variables(), Dakota::dakota_graphics, Iterator::initialize_graphics(), Iterator::iteratedModel, and Iterator::iteratorRep.

Referenced by Iterator::initialize_graphics(), SequentialHybridStrategy::run_sequential(), SingleMethodStrategy::run_strategy(), EmbeddedHybridStrategy::run_strategy(), ConcurrentStrategy::run_strategy(), and CollaborativeHybridStrategy::run_strategy().

43.51.3.8 void print_results (std::ostream & *s*) [virtual]

print the final iterator results This virtual function provides additional iterator-specific final results outputs beyond the function evaluation summary printed in finalize_run().

Reimplemented in Analyzer, LeastSq, Optimizer, PStudyDACE, Verification, NonDExpansion, NonDGlobalReliability, NonDGPMSABayesCalibration, NonDIncremLHSSampling, NonDInterval, NonDLHSSampling, NonDLocalReliability, RichExtrapVerification, and SurrBasedMinimizer.

References Iterator::iteratorRep, and Iterator::print_results().

Referenced by Iterator::post_run(), and Iterator::print_results().

43.51.3.9 int num_samples () const [virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented in DDACEDesignCompExp, FSUDesignCompExp, NonDCubature, NonDLocalRefinement, NonDQuadrature, NonDSampling, NonDSparseGrid, and PSUADEDesignCompExp.

References Model::derivative_concurrency(), Iterator::iteratedModel, Iterator::iteratorRep, Iterator::maxConcurrency, and Iterator::num_samples().

Referenced by DataFitSurrModel::build_global(), NonDGlobalReliability::get_best_sample(), Iterator::num_samples(), Analyzer::samples_to_variables_array(), and Analyzer::variables_array_to_samples().

43.51.3.10 void run_iterator (std::ostream & *s*)

orchestrate initialize/pre/run/post/finalize phases Iterator supports a construct/initialize-run/pre-run/run/post-run/finalize-run/destruct progression. This member (non-virtual) function sequences these run phases; it accepts an ostream, but controls verbosity with outputLevel

References ParallelLibrary::command_line_post_run(), ParallelLibrary::command_line_pre_run(), ParallelLibrary::command_line_run(), Iterator::finalize_run(), Iterator::initialize_run(), Iterator::iteratedModel, Iterator::iteratorRep, Iterator::methodName, Iterator::outputLevel, Model::parallel_library(), Iterator::post_input(), Iterator::post_run(), Iterator::pre_output(), Iterator::pre_run(), Iterator::run(), Iterator::run_iterator(), and Iterator::summaryOutputFlag.

Referenced by DataFitSurrModel::build_global(), NonDExpansion::compute_statistics(), NestedModel::derived_compute_response(), NonDGlobalReliability::importance_sampling(), SurrBasedLocalMinimizer::minimize_surrogates(), SurrBasedGlobalMinimizer::minimize_surrogates(), EffGlobalMinimizer::minimize_surrogates_on_model(), NonDLocalReliability::mpp_search(), NonDGlobalReliability::optimize_gaussian_process(), GaussProcApproximation::optimize_theta_global(), GaussProcApproximation::optimize_theta_multipoint(), NonDLocalReliability::probability(), NonDLocalInterval::quantify_uncertainty(), NonDLHSInterval::quantify_uncertainty(), NonDGPMSABayesCalibration::quantify_uncertainty(), NonDGPImpSampling::quantify_uncertainty(), NonDGlobalInterval::quantify_uncertainty(), NonDBayesCalibration::quantify_uncertainty(), SurrBasedLocalMinimizer::relax_constraints(), Strategy::run_iterator(), and Iterator::run_iterator().

43.51.3.11 void assign_rep (Iterator * *iterator_rep*, bool *ref_count_incr* = `true`)

replaces existing letter with a new one Similar to the assignment operator, the assign_rep() function decrements referenceCount for the old iteratorRep and assigns the new iteratorRep. It is different in that it is used for publishing derived class letters to existing envelopes, as opposed to sharing representations among multiple envelopes (in particular, assign_rep is passed a letter object and operator= is passed an envelope object). Letter assignment supports two models as governed by ref_count_incr:

- ref_count_incr = true (default): the incoming letter belongs to another envelope. In this case, increment the reference count in the normal manner so that deallocation of the letter is handled properly.
- ref_count_incr = false: the incoming letter is instantiated on the fly and has no envelope. This case is modeled after get_iterator(): a letter is dynamically allocated using new and passed into assign_rep, the letter's reference count is not incremented, and the letter is not remotely deleted (its memory management is passed over to the envelope).

References Dakota::abort_handler(), Iterator::iteratorRep, and Iterator::referenceCount.

Referenced by NonDExpansion::construct_cubature(), NonDExpansion::construct_expansion_sampler(), NonD::construct_lhs(), NonDExpansion::construct_local_refinement(), NonDExpansion::construct_quadrature(), NonDExpansion::construct_sparse_grid(), EffGlobalMinimizer::EffGlobalMinimizer(), NonDLocalReliability::method_recourse(), NonDLocalInterval::method_recourse(), NonDBayesCalibration::NonDBayesCalibration(), NonDGlobalInterval::NonDGlobalInterval(), NonDGlobalReliability::NonDGlobalReliability(), NonDGPMSABayesCalibration::NonDGPMSABayesCalibration(),

NonDLHSInterval::NonDLHSInterval(), NonDLocalInterval::NonDLocalInterval(), NonDLocalReliability::NonDLocalReliability(), GaussProcApproximation::optimize_theta_global(), GaussProcApproximation::optimize_theta_multipoint(), and SurrBasedLocalMinimizer::relax_constraints().

43.51.3.12 Iterator ∗ get_iterator (Model & *model*) [private]

Used by the envelope to instantiate the correct letter class. Used only by the envelope constructor to initialize iteratorRep to the appropriate derived type, as given by the methodName attribute.

References String::begins(), String::ends(), ProblemDescDB::get_string(), Iterator::method_name(), Iterator::methodName, and Iterator::probDescDB.

Referenced by Iterator::Iterator().

43.51.3.13 Iterator ∗ get_iterator (const String & *method_name*, Model & *model*) [private]

Used by the envelope to instantiate the correct letter class. Used only by the envelope constructor to initialize iteratorRep to the appropriate derived type, as given by the passed method_name.

References String::begins().

43.51.4 Member Data Documentation

43.51.4.1 Real fdGradStepSize [protected]

relative finite difference step size for numerical gradients A scalar value (instead of the vector fd_gradient_step_size spec) is used within the iterator hierarchy since this attribute is only used to publish a step size to vendor numerical gradient algorithms.

Referenced by DOTOptimizer::initialize(), CONMINOptimizer::initialize(), Iterator::Iterator(), NLSSOLLeastSq::NLSSOLLeastSq(), NPSOLOptimizer::NPSOLOptimizer(), SNLLLeastSq::SNLLLeastSq(), and SNLLOptimizer::SNLLOptimizer().

43.51.4.2 Real fdHessByGradStepSize [protected]

relative finite difference step size for numerical Hessians estimated using first-order differences of gradients A scalar value (instead of the vector fd_hessian_step_size spec) is used within the iterator hierarchy since this attribute is only used to publish a step size to vendor numerical Hessian algorithms.

Referenced by Iterator::Iterator().

43.51.4.3 Real fdHessByFnStepSize [protected]

relative finite difference step size for numerical Hessians estimated using second-order differences of function values A scalar value (instead of the vector fd_hessian_step_size spec) is used within the iterator hierarchy since this attribute is only used to publish a step size to vendor numerical Hessian algorithms.

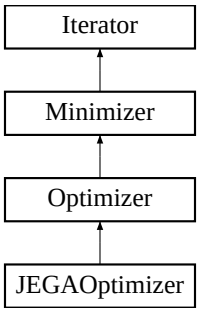
Referenced by Iterator::Iterator().

The documentation for this class was generated from the following files:

- DakotaIterator.H
- DakotaIterator.C

43.52 JEGAOptimizer Class Reference

A version of Dakota::Optimizer for instantiation of John Eddy's Genetic Algorithms (JEGA). Inheritance diagram for JEGAOptimizer::



Classes

- class Driver

  A subclass of the JEGA front end driver that exposes the individual protected methods to execute the algorithm.

- class Evaluator

  An evaluator specialization that knows how to interact with Dakota.

- class EvaluatorCreator

  A specialization of the JEGA::FrontEnd::EvaluatorCreator that creates a new instance of a Evaluator.

Public Member Functions

- virtual void find_optimum ()

  Performs the iterations to determine the optimal set of solutions.

- virtual bool accepts_multiple_points () const

  Overridden to return true since JEGA algorithms can accept multiple initial points.

- virtual bool returns_multiple_points () const

  Overridden to return true since JEGA algorithms can return multiple final points.

- virtual void initial_points (const VariablesArray &pts)

  Overridden to assign the _initPts member variable to the passed in collection of Dakota::Variables.

- virtual const VariablesArray & initial_points () const

  Overridden to return the collection of initial points for the JEGA algorithm created and run by this JEGAOptimizer.

- JEGAOptimizer (Model &model)

  Constructs a JEGAOptimizer class object.

- ~JEGAOptimizer ()

  Destructs a JEGAOptimizer.

Protected Member Functions

- void LoadDakotaResponses (const JEGA::Utilities::Design &from, Variables &vars, Response &resp) const

  Loads the JEGA-style Design class into equivolent Dakota-style Variables and Response objects.

- void ReCreateTheParameterDatabase ()

  Destroys the current parameter database and creates a new empty one.

- void LoadTheParameterDatabase ()

  Reads information out of the known Dakota::ProblemDescDB and puts it into the current parameter database.

- void LoadAlgorithmConfig (JEGA::FrontEnd::AlgorithmConfig &aConfig)

  Completely initializes the supplied algorithm configuration.

- void LoadProblemConfig (JEGA::FrontEnd::ProblemConfig &pConfig)

  Completely initializes the supplied problem configuration.

- void LoadTheDesignVariables (JEGA::FrontEnd::ProblemConfig &pConfig)

  Adds DesignVariableInfo objects into the problem configuration object.

- void LoadTheObjectiveFunctions (JEGA::FrontEnd::ProblemConfig &pConfig)

  Adds ObjectiveFunctionInfo objects into the problem configuration object.

- void LoadTheConstraints (JEGA::FrontEnd::ProblemConfig &pConfig)

  Adds ConstraintInfo objects into the problem configuration object.

- void GetBestSolutions (const JEGA::Utilities::DesignOFSortSet &from, std::multimap< RealRealPair, JEGA::Utilities::Design * > &designSortMap)

  Returns up to _numBest designs sorted by DAKOTA's fitness (L2 constraint violation, then utopia or objective), taking into account the algorithm type. The front of the returned map can be viewed as a single "best".

- void GetBestMOSolutions (const JEGA::Utilities::DesignOFSortSet &from, std::multimap< RealRealPair, JEGA::Utilities::Design * > &designSortMap)

  Retreive the best Designs from a set of solutions assuming that they are generated by a multi objective algorithm.

- void GetBestSOSolutions (const JEGA::Utilities::DesignOFSortSet &from, std::multimap< RealRealPair, JEGA::Utilities::Design * > &designSortMap)

  Retreive the best Designs from a set of solutions assuming that they are generated by a single objective algorithm.

- JEGA::DoubleMatrix ToDoubleMatrix (const VariablesArray &variables) const

  Converts the items in a VariablesArray into a DoubleMatrix whereby the items in the matrix are the design variables.

- void resize_variables_results_array (std::size_t newsize)

  Safely resizes the best variables array taking into account the requirements put forth by the envelope-letter design pattern.

- void resize_response_results_array (std::size_t newsize)

  Safely resizes the best response array taking into account the requirements put forth by the envelope-letter design pattern.

Private Attributes

- EvaluatorCreator * _theEvalCreator

  A pointer to an EvaluatorCreator used to create the evaluator used by JEGA in Dakota (a JEGAEvaluator).

- JEGA::Utilities::ParameterDatabase * _theParamDB

  A pointer to the ParameterDatabase from which all parameters are retrieved by the created algorithms.

- VariablesArray _initPts

  An array of initial points to use as an initial population.

Static Private Attributes

- static const std::string SOGA_METHOD_TXT

  The text that indicates the SOGA method.

- static const std::string MOGA_METHOD_TXT

  The text that indicates the MOGA method.

43.52.1 Detailed Description

A version of Dakota::Optimizer for instantiation of John Eddy's Genetic Algorithms (JEGA). This class encapsulates the necessary functionality for creating and properly initializing the JEGA algorithms (MOGA and SOGA).

43.52.2 Constructor & Destructor Documentation

43.52.2.1 JEGAOptimizer (Model & *model*)

Constructs a JEGAOptimizer class object. This method does some of the initialization work for the algorithm. In particular, it initialized the JEGA core.

Parameters:

model The Dakota::Model that will be used by this optimizer for problem information, etc.

References JEGAOptimizer::_theEvalCreator, ProblemDescDB::get_int(), ProblemDescDB::get_short(), Model::init_communicators(), Iterator::iteratedModel, JEGAOptimizer::LoadTheParameterDatabase(), Optimizer::localObjectiveRecast, Iterator::maxConcurrency, Iterator::methodName, JEGAOptimizer::MOGA_METHOD_TXT, Iterator::numFinalSolutions, Iterator::probDescDB, and Minimizer::scaleFlag.

43.52.3 Member Function Documentation

43.52.3.1 void LoadDakotaResponses (const JEGA::Utilities::Design & *from*, Dakota::Variables & *vars*, Dakota::Response & *resp*) const [protected]

Loads the JEGA-style Design class into equivolent Dakota-style Variables and Response objects. This version is meant for the case where a Variables and a Response object exist and just need to be loaded.

Parameters:

from The JEGA Design class object from which to extract the variable and response information for Dakota.

vars The Dakota::Variables object into which to load the design variable values of *from*.

resp The Dakota::Response object into which to load the objective function and constraint values of *from*.

References Variables::continuous_variables(), Variables::discrete_int_variables(), Variables::discrete_real_variables(), Response::function_values(), Iterator::numContinuousVars, Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, Iterator::numFunctions, Minimizer::numNonlinearConstraints, and Optimizer::numObjectiveFns.

Referenced by JEGAOptimizer::find_optimum().

43.52.3.2 void LoadTheParameterDatabase () [protected]

Reads information out of the known Dakota::ProblemDescDB and puts it into the current parameter database. This should be called from the JEGAOptimizer constructor since it is the only time when the problem description database is certain to be configured to supply data for this optimizer.

References JEGAOptimizer::_theParamDB, ProblemDescDB::get_bool(), ProblemDescDB::get_int(), ProblemDescDB::get_rdv(), ProblemDescDB::get_real(), ProblemDescDB::get_short(), ProblemDescDB::get_sizet(), ProblemDescDB::get_string(), Iterator::probDescDB, and JEGAOptimizer::ReCreateTheParameterDatabase().

Referenced by JEGAOptimizer::JEGAOptimizer().

43.52.3.3 void LoadAlgorithmConfig (JEGA::FrontEnd::AlgorithmConfig & *aConfig*) [protected]

Completely initializes the supplied algorithm configuration. This loads the supplied configuration object with appropriate data retrieved from the parameter database.

Parameters:

aConfig The algorithm configuration object to load.

References Iterator::method_id(), Iterator::methodName, JEGAOptimizer::MOGA_METHOD_TXT, and JEGAOptimizer::SOGA_METHOD_TXT.

Referenced by JEGAOptimizer::find_optimum().

43.52.3.4 void LoadProblemConfig (JEGA::FrontEnd::ProblemConfig & *pConfig*) `[protected]`

Completely initializes the supplied problem configuration. This loads the fresh configuration object using the LoadTheDesignVariables, LoadTheObjectiveFunctions, and LoadTheConstraints methods.

Parameters:

pConfig The problem configuration object to load.

References JEGAOptimizer::LoadTheConstraints(), JEGAOptimizer::LoadTheDesignVariables(), and JEGAOptimizer::LoadTheObjectiveFunctions().

Referenced by JEGAOptimizer::find_optimum().

43.52.3.5 void LoadTheDesignVariables (JEGA::FrontEnd::ProblemConfig & *pConfig*) `[protected]`

Adds DesignVariableInfo objects into the problem configuration object. This retrieves design variable information from the ParameterDatabase and creates DesignVariableInfo's from it.

Parameters:

pConfig The problem configuration object to load.

References Iterator::iteratedModel, Iterator::numContinuousVars, and Iterator::numDiscreteIntVars.

Referenced by JEGAOptimizer::LoadProblemConfig().

43.52.3.6 void LoadTheObjectiveFunctions (JEGA::FrontEnd::ProblemConfig & *pConfig*) `[protected]`

Adds ObjectiveFunctionInfo objects into the problem configuration object. This retrieves objective function information from the ParameterDatabase and creates ObjectiveFunctionInfo's from it.

Parameters:

pConfig The problem configuration object to load.

References Dakota::asstring(), and Optimizer::numObjectiveFns.

Referenced by JEGAOptimizer::LoadProblemConfig().

43.52.3.7 void LoadTheConstraints (JEGA::FrontEnd::ProblemConfig & *pConfig*) [protected]

Adds ConstraintInfo objects into the problem configuration object. This retrieves constraint function information from the ParameterDatabase and creates ConstraintInfo's from it.

Parameters:

pConfig The problem configuration object to load.

References Dakota::asstring(), Dakota::copy_row_vector(), Iterator::iteratedModel, Minimizer::numLinearEqConstraints, Minimizer::numLinearIneqConstraints, Minimizer::numNonlinearEqConstraints, and Minimizer::numNonlinearIneqConstraints.

Referenced by JEGAOptimizer::LoadProblemConfig().

43.52.3.8 void GetBestSolutions (const JEGA::Utilities::DesignOFSortSet & *from*, std::multimap< RealRealPair, JEGA::Utilities::Design * > & *designSortMap*) [protected]

Returns up to _numBest designs sorted by DAKOTA's fitness (L2 constraint violation, then utopia or objective), taking into account the algorithm type. The front of the returned map can be viewed as a single "best".

Parameters:

from The full set of designs returned by the solver.

designSortMap Map of best solutions with key pair<constraintViolation, fitness>

eventually this functionality must be moved into a separate post-processing application for MO datasets.

References JEGAOptimizer::GetBestMOSolutions(), JEGAOptimizer::GetBestSOSolutions(), Iterator::methodName, JEGAOptimizer::MOGA_METHOD_TXT, and JEGAOptimizer::SOGA_METHOD_TXT.

Referenced by JEGAOptimizer::find_optimum().

43.52.3.9 void GetBestMOSolutions (const JEGA::Utilities::DesignOFSortSet & *from*, std::multimap< RealRealPair, JEGA::Utilities::Design * > & *designSortMap*) [protected]

Retreive the best Designs from a set of solutions assuming that they are generated by a multi objective algorithm. eventually this functionality must be moved into a separate post-processing application for MO datasets.

References Iterator::numFinalSolutions.

Referenced by JEGAOptimizer::GetBestSolutions().

43.52.3.10 void GetBestSOSolutions (const JEGA::Utilities::DesignOFSortSet & *from*, std::multimap< RealRealPair, JEGA::Utilities::Design * > & *designSortMap*) [protected]

Retreive the best Designs from a set of solutions assuming that they are generated by a single objective algorithm. eventually this functionality must be moved into a separate post-processing application for MO datasets.

References JEGAOptimizer::_theParamDB, and Iterator::numFinalSolutions.

Referenced by JEGAOptimizer::GetBestSolutions().

43.52.3.11 JEGA::DoubleMatrix ToDoubleMatrix (const VariablesArray & *variables*) const [protected]

Converts the items in a VariablesArray into a DoubleMatrix whereby the items in the matrix are the design variables. The matrix will not contain responses but when being used by Dakota, this doesn't matter. JEGA will attempt to re-evaluate these points but Dakota will recognize that they do not require re-evaluation and thus it will be a cheap operation.

Parameters:

variables The array of DakotaVariables objects to use as the contents of the returned matrix.

Returns:

The matrix created using the supplied VariablesArray.

Referenced by JEGAOptimizer::find_optimum().

43.52.3.12 void resize_variables_results_array (std::size_t *newsize*) [protected]

Safely resizes the best variables array taking into account the requirements put forth by the envelope-letter design pattern. Do not directly call resize on the bestVariablesArray object unless you intend to share the internal content (letter) with other objects after assignment.

Parameters:

newsize The new size for the variables array.

References Iterator::bestVariablesArray.

Referenced by JEGAOptimizer::find_optimum().

43.52.3.13 void resize_response_results_array (std::size_t *newsize*) [protected]

Safely resizes the best response array taking into account the requirements put forth by the envelope-letter design pattern. Do not directly call resize on the bestResponseArray object unless you intend to share the internal content (letter) with other objects after assignment.

Parameters:

newsize The new size for the responses array.

References Iterator::bestResponseArray.

Referenced by JEGAOptimizer::find_optimum().

43.52.3.14 void find_optimum () [virtual]

Performs the iterations to determine the optimal set of solutions. Override of pure virtual method in Optimizer base class.

The extraction of parameter values actually occurs in this method when the JEGA::FrontEnd::Driver::ExecuteAlgorithm is called. Also the loading of the problem and algorithm configurations occurs in this method. That way, if it is called more than once and the algorithm or problem has changed, it will be accounted for.

Implements Optimizer.

References JEGAOptimizer::_initPts, JEGAOptimizer::_theEvalCreator, JEGAOptimizer::_theParamDB, Driver::DestroyAlgorithm(), Driver::ExtractAllData(), JEGAOptimizer::GetBestSolutions(), JEGAOptimizer::initial_points(), JEGAOptimizer::LoadAlgorithmConfig(), JEGAOptimizer::LoadDakotaResponses(), JEGAOptimizer::LoadProblemConfig(), Driver::PerformIterations(), JEGAOptimizer::resize_response_results_array(), JEGAOptimizer::resize_variables_results_array(), and JEGAOptimizer::ToDoubleMatrix().

43.52.3.15 bool accepts_multiple_points () const [virtual]

Overridden to return true since JEGA algorithms can accept multiple initial points.

Returns:

true, always.

Reimplemented from Iterator.

43.52.3.16 bool returns_multiple_points () const [virtual]

Overridden to return true since JEGA algorithms can return multiple final points.

Returns:

true, always.

Reimplemented from Iterator.

43.52.3.17 void initial_points (const VariablesArray & *pts*) [virtual]

Overridden to assign the _initPts member variable to the passed in collection of Dakota::Variables.

Parameters:

pts The array of initial points for the JEGA algorithm created and run by this JEGAOptimizer.

Reimplemented from Iterator.

References JEGAOptimizer::_initPts.

43.52.3.18 const VariablesArray & initial_points () const [virtual]

Overridden to return the collection of initial points for the JEGA algorithm created and run by this JEGAOptimizer.

Returns:

The collection of initial points for the JEGA algorithm created and run by this JEGAOptimizer.

Reimplemented from Iterator.

References JEGAOptimizer::_initPts.

Referenced by JEGAOptimizer::find_optimum().

43.52.4 Member Data Documentation

43.52.4.1 VariablesArray _initPts [private]

An array of initial points to use as an initial population. This member is here to help support the use of JEGA algorithms in Dakota strategies. If this array is populated, then whatever initializer is specified will be ignored and the DoubleMatrix initializer will be used instead on a matrix created from the data in this array.

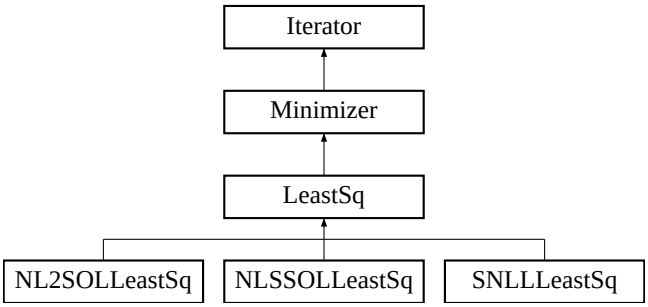
Referenced by JEGAOptimizer::find_optimum(), and JEGAOptimizer::initial_points().

The documentation for this class was generated from the following files:

- JEGAOptimizer.H
- JEGAOptimizer.C

43.53 LeastSq Class Reference

Base class for the nonlinear least squares branch of the iterator hierarchy. Inheritance diagram for LeastSq::



Protected Member Functions

- LeastSq ()

  default constructor

- LeastSq (Model &model)

  standard constructor

- LeastSq (NoDBBaseConstructor, Model &model)

  alternate constructor

- ~LeastSq ()

  destructor

- void initialize_run ()
- void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- void post_run (std::ostream &s)
- void finalize_run ()

  utility function to perform common operations following post_run(); deallocation and resetting of instance pointers

- void print_results (std::ostream &s)
- virtual void minimize_residuals ()=0

  Used within the least squares branch for minimizing the sum of squares residuals. Redefines the run virtual function for the least squares branch.

- void get_confidence_intervals ()

  Calculate confidence intervals on estimated parameters.

Static Protected Member Functions

- static void primary_resp_recast (const Variables &native_vars, const Variables &scaled_vars, const Response &native_response, Response &scaled_response)

  primary response conversion map for RecastModel used in scaling: transform least squares terms (fns, grads, Hessians) from native (user) to iterator space

Protected Attributes

- int numLeastSqTerms

  number of least squares terms

- LeastSq * prevLSqInstance

  pointer containing previous value of leastSqInstance

- bool weightFlag

  flag indicating whether weighted least squares is active

- String obsDataFilename

  filename from which to read observed data

- bool obsDataFlag

  flag indicating whether user-supplied data is active

- RealVector obsData

  storage for user-supplied data for computing residuals

- RealVector confBoundsLower

  lower bounds for confidence intervals on calibration parameters

- RealVector confBoundsUpper

  upper bounds for confidence intervals on calibration parameters

Static Protected Attributes

- static LeastSq * leastSqInstance

  pointer to LeastSq instance used in static member functions

43.53.1 Detailed Description

Base class for the nonlinear least squares branch of the iterator hierarchy. The LeastSq class provides common data and functionality for least squares solvers (including NL2OL, NLSSOLLeastSq, and SNLLLeastSq.

43.53.2 Constructor & Destructor Documentation

43.53.2.1 LeastSq (Model & *model*) [protected]

standard constructor This constructor extracts the inherited data for the least squares branch and performs sanity checking on gradient and constraint settings.

References Dakota::abort_handler(), Model::assign_rep(), Iterator::bestVariablesArray, Variables::copy(), Model::current_variables(), Minimizer::cvScaleTypes, ProblemDescDB::get_bool(), ProblemDescDB::get_sizet(), Model::init_communicators(), RecastModel::initialize(), Minimizer::initialize_scaling(), Iterator::iteratedModel, Iterator::maxConcurrency, Model::model_rep(), Iterator::numContinuousVars, Iterator::numFunctions, Minimizer::numIterPrimaryFns, LeastSq::numLeastSqTerms, Minimizer::numNonlinearConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, LeastSq::obsData, LeastSq::obsDataFilename, LeastSq::obsDataFlag, Minimizer::optimizationFlag, Iterator::outputLevel, LeastSq::primary_resp_recast(), Model::primary_response_fn_weights(), Minimizer::primaryRespScaleFlag, Iterator::probDescDB, Dakota::read_data_tabular(), Minimizer::responseScaleTypes, Minimizer::scaleFlag, Minimizer::secondary_resp_recast(), Minimizer::secondaryRespScaleFlag, Minimizer::variables_recast(), Minimizer::varsScaleFlag, and LeastSq::weightFlag.

43.53.3 Member Function Documentation

43.53.3.1 void initialize_run () [protected, virtual]

This function should be invoked (or reimplemented) by any derived implementations of initialize_run() (which would otherwise hide it).

Reimplemented from Minimizer.

Reimplemented in SNLLLeastSq.

References Iterator::iteratedModel, LeastSq::leastSqInstance, LeastSq::obsDataFlag, LeastSq::prevLSqInstance, Minimizer::scaleFlag, and Model::update_from_subordinate_model().

43.53.3.2 void run () [inline, protected, virtual]

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented from Iterator.

References LeastSq::minimize_residuals().

43.53.3.3 void post_run (std::ostream & *s*) [protected, virtual]

Implements portions of post_run specific to LeastSq for scaling back to native variables and functions. This function should be invoked (or reimplemented) by any derived implementations of post_run() (which would otherwise hide it).

Reimplemented from Iterator.

Reimplemented in SNLLLeastSq.

References Dakota::abort_handler(), Response::active_set_request_vector(), Iterator::bestResponseArray, Iterator::bestVariablesArray, Variables::continuous_variables(), Response::copy(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Response::function_value(), Response::function_values(), Iterator::iteratedModel, Minimizer::modify_s2n(), Minimizer::need_resp_trans_byvars(), LeastSq::numLeastSqTerms, Minimizer::numNonlinearConstraints, Model::primary_response_fn_weights(), Minimizer::primaryRespScaleFlag, Minimizer::response_modify_s2n(), Minimizer::secondaryRespScaleFlag, Model::subordinate_model(), Response::update_partial(), Minimizer::varsScaleFlag, and LeastSq::weightFlag.

43.53.3.4 void finalize_run () [inline, protected, virtual]

utility function to perform common operations following post_run(); deallocation and resetting of instance pointers Optional: perform finalization phases of run sequence, like deallocating memory and resetting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's finalize_run(), typically _after_ performing its own implementation steps.

Reimplemented from Minimizer.

Reimplemented in SNLLLeastSq.

References LeastSq::leastSqInstance, and LeastSq::prevLSqInstance.

43.53.3.5 void print_results (std::ostream & *s*) [protected, virtual]

Redefines default iterator results printing to include nonlinear least squares results (residual terms and constraints).

Reimplemented from Iterator.

References Iterator::activeSet, Iterator::bestResponseArray, Iterator::bestVariablesArray, LeastSq::confBoundsLower, LeastSq::confBoundsUpper, Model::continuous_variable_labels(), Dakota::data_pairs, Model::interface_id(), Iterator::iteratedModel, Dakota::lookup_by_val(), Iterator::numContinuousVars, Iterator::numFunctions, LeastSq::numLeastSqTerms, ActiveSet::request_values(), Dakota::write_data_partial(), and Dakota::write_precision.

43.53.3.6 void primary_resp_recast (const Variables & *native_vars*, const Variables & *scaled_vars*, const Response & *native_response*, Response & *iterator_response*) [static, protected]

primary response conversion map for RecastModel used in scaling: transform least squares terms (fns, grads, Hessians) from native (user) to iterator space Least squares function map from user/native space to iterator/scaled space using a RecastModel. If no scaling also copies constraints.

References Dakota::_NPOS, Response::active_set_derivative_vector(), Response::active_set_request_vector(), Variables::acv(), Variables::all_continuous_variable_ids(), Variables::continuous_variable_ids(), Response::copy(), Variables::cv(), Dakota::find_index(), Response::function_gradient_view(), Response::function_hessian_view(), Response::function_labels(), Response::function_value(), Response::function_values(), Response::function_values_view(), Variables::icv(), Variables::inactive_continuous_variable_ids(), Iterator::iteratedModel, LeastSq::leastSqInstance, Minimizer::need_resp_trans_byvars(), LeastSq::numLeastSqTerms, LeastSq::obsData, LeastSq::obsDataFlag, Iterator::outputLevel, Model::primary_response_fn_weights(), Minimizer::primaryRespScaleFlag, Minimizer::response_modify_n2s(), Model::subordinate_model(), Response::update(), Response::update_partial(), LeastSq::weightFlag, and

Dakota::write_data().

Referenced by LeastSq::LeastSq().

43.53.3.7 void get_confidence_intervals () [protected]

Calculate confidence intervals on estimated parameters. Calculate individual confidence intervals for each parameter. These bounds are based on a linear approximation of the nonlinear model.

References Iterator::activeSet, Iterator::bestResponseArray, Iterator::bestVariablesArray, Model::compute_response(), LeastSq::confBoundsLower, LeastSq::confBoundsUpper, Model::continuous_variables(), Model::current_response(), Response::function_gradients(), Iterator::iteratedModel, Iterator::numContinuousVars, LeastSq::numLeastSqTerms, ActiveSet::request_values(), Minimizer::scaleFlag, and Minimizer::vendorNumericalGradFlag.

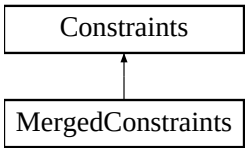
Referenced by NLSSOLLeastSq::minimize_residuals(), NL2SOLLeastSq::minimize_residuals(), and SNLLLeastSq::post_run().

The documentation for this class was generated from the following files:

- DakotaLeastSq.H
- DakotaLeastSq.C

43.54 MergedConstraints Class Reference

Derived class within the Constraints hierarchy which employs the merged data view. Inheritance diagram for MergedConstraints::



Public Member Functions

- MergedConstraints (const SharedVariablesData &svd)

  lightweight constructor

- MergedConstraints (const ProblemDescDB &problem_db, const SharedVariablesData &svd)

  standard constructor

- ~MergedConstraints ()

  destructor

- void write (std::ostream &s) const

  write a variable constraints object to an std::ostream

- void read (std::istream &s)

  read a variable constraints object from an std::istream

Protected Member Functions

- void reshape (const SizetArray &vc_totals)

  reshape the lower/upper bound arrays within the Constraints hierarchy

- void build_active_views ()

  construct active views of all variables bounds arrays

- void build_inactive_views ()

  construct inactive views of all variables bounds arrays

43.54.1 Detailed Description

Derived class within the Constraints hierarchy which employs the merged data view. Derived variable constraints classes take different views of the design, uncertain, and state variable types and the continuous and discrete domain types. The MergedConstraints derived class combines continuous and discrete domain types but separates design, uncertain, and state variable types. The result is merged design bounds arrays (mergedDesignLowerBnds, mergedDesignUpperBnds), uncertain distribution bounds arrays (uncertainLowerBnds, uncertainUpperBnds), and merged state bounds arrays (mergedStateLowerBnds, mergedStateUpperBnds). The branch and bound strategy uses this approach (see Variables::get_variables(problem_db) for variables type selection; variables type is passed to the Constraints constructor in Model).

43.54.2 Constructor & Destructor Documentation

43.54.2.1 MergedConstraints (const ProblemDescDB & *problem_db*, const SharedVariablesData & *svd*)

standard constructor In this class, a merged data approach is used in which continuous and discrete arrays are combined into a single continuous array (integrality is relaxed; the converse of truncating reals is not currently supported but could be in the future if needed). Iterators/strategies which use this class include: BranchBndOptimizer. Extract fundamental lower and upper bounds and merge continuous and discrete domains to create mergedDesignLowerBnds, mergedDesignUpperBnds, mergedStateLowerBnds, and mergedStateUpperBnds.

References Constraints::allContinuousLowerBnds, Constraints::allContinuousUpperBnds, Constraints::build_views(), SharedVariablesData::components_totals(), Dakota::copy_data_partial(), ProblemDescDB::get_idv(), ProblemDescDB::get_rdv(), Constraints::manage_linear_constraints(), Dakota::merge_data_partial(), Constraints::sharedVarsData, and SharedVariablesData::vc_lookup().

43.54.3 Member Function Documentation

43.54.3.1 void reshape (const SizetArray & *vc_totals*) `[protected, virtual]`

reshape the lower/upper bound arrays within the Constraints hierarchy Resizes the derived bounds arrays.

Reimplemented from Constraints.

References Constraints::allContinuousLowerBnds, Constraints::allContinuousUpperBnds, and Constraints::build_views().

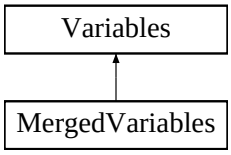
Referenced by MergedConstraints::MergedConstraints().

The documentation for this class was generated from the following files:

- MergedConstraints.H
- MergedConstraints.C

43.55 MergedVariables Class Reference

Derived class within the Variables hierarchy which employs the merged data view. Inheritance diagram for MergedVariables::



Public Member Functions

- MergedVariables (const ProblemDescDB &problem_db, const std::pair< short, short > &view)

  standard constructor

- MergedVariables (const SharedVariablesData &svd)

  lightweight constructor

- ~MergedVariables ()

  destructor

Protected Member Functions

- void read (std::istream &s)

  read a variables object from an std::istream

- void write (std::ostream &s) const

  write a variables object to an std::ostream

- void write_aprepro (std::ostream &s) const

  write a variables object to an std::ostream in aprepro format

- void read_tabular (std::istream &s)
- void write_tabular (std::ostream &s) const

  write a variables object in tabular format to an std::ostream

- void reshape (const SizetArray &vc_totals)

  reshapes an existing Variables object based on the incoming variablesComponents

- void build_active_views ()

  construct active views of all variables arrays

- void build_inactive_views ()

construct inactive views of all variables arrays

43.55.1 Detailed Description

Derived class within the Variables hierarchy which employs the merged data view. Derived variables classes take different views of the design, uncertain, and state variable types and the continuous and discrete domain types. The MergedVariables derived class combines continuous and discrete domain types but separates design, uncertain, and state variable types. The result is a single continuous array of design variables (mergedDesignVars), a single continuous array of uncertain variables (uncertainVars), and a single continuous array of state variables (mergedStateVars). The branch and bound strategy uses this approach (see Variables::get_variables(problem_db)).

43.55.2 Constructor & Destructor Documentation

43.55.2.1 MergedVariables (const ProblemDescDB & *problem_db*, const std::pair< short, short > & *view*)

standard constructor In this class, a merged data approach is used in which continuous and discrete arrays are combined into a single continuous array (integrality is relaxed; the converse of truncating reals is not currently supported but could be in the future if needed). Iterators/strategies which use this class include: BranchBndOptimizer. Extract fundamental variable types and labels and merge continuous and discrete domains to create aggregate arrays and views.

References Variables::allContinuousVars, Variables::build_views(), SharedVariablesData::components_totals(), Dakota::copy_data_partial(), ProblemDescDB::get_idv(), ProblemDescDB::get_rdv(), Dakota::merge_data_partial(), Variables::sharedVarsData, SharedVariablesData::vc_lookup(), and SharedVariablesData::view().

43.55.3 Member Function Documentation

43.55.3.1 void read_tabular (std::istream & *s*) `[protected, virtual]`

Presumes variables object is appropriately sized to receive data

Reimplemented from Variables.

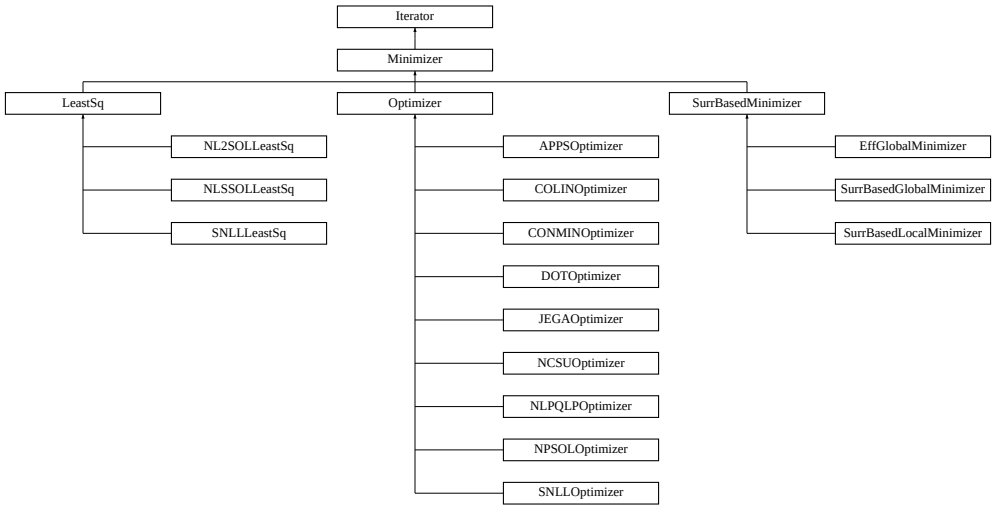
References Variables::allContinuousVars, SharedVariablesData::components_totals(), Dakota::read_data_partial_tabular(), and Variables::sharedVarsData.

The documentation for this class was generated from the following files:

- MergedVariables.H
- MergedVariables.C

43.56 Minimizer Class Reference

Base class for the optimizer and least squares branches of the iterator hierarchy. Inheritance diagram for Minimizer::



Protected Member Functions

- Minimizer ()

  default constructor

- Minimizer (Model &model)

  standard constructor

- Minimizer (NoDBBaseConstructor, Model &model)

  alternate constructor for "on the fly" instantiations

- Minimizer (NoDBBaseConstructor, size_t num_lin_ineq, size_t num_lin_eq, size_t num_nln_ineq, size_t num_nln_eq)

  alternate constructor for "on the fly" instantiations

- ~Minimizer ()

  destructor

- void initialize_run ()

  utility function to perform common operations prior to pre_run(); typically memory initialization; setting of instance pointers

- void finalize_run ()

  utility function to perform common operations following post_run(); deallocation and resetting of instance pointers

- void initialize_scaling ()

  initialize scaling types, multipliers, and offsets; perform error checking

- void compute_scaling (int object_type, int auto_type, int num_vars, RealVector &lbs, RealVector &ubs, RealVector &targets, const StringArray &scale_strings, const RealVector &scales, IntArray &scale_types, RealVector &scale_mults, RealVector &scale_offsets)

  general helper function for initializing scaling types and factors on a vector of variables, functions, constraints, etc.

- bool compute_scale_factor (const Real lower_bound, const Real upper_bound, Real ∗multiplier, Real ∗offset)

  automatically compute a single scaling factor -- bounds case

- bool compute_scale_factor (const Real target, Real ∗multiplier)

  automatically compute a single scaling factor -- target case

- bool need_resp_trans_byvars (const ShortArray &asv, int start_index, int num_resp)

  determine if response transformation is needed due to variable transformations

- RealVector modify_n2s (const RealVector &native_vars, const IntArray &scale_types, const RealVector &multipliers, const RealVector &offsets) const

  general RealVector mapping from native to scaled variables vectors:

- RealVector modify_s2n (const RealVector &scaled_vars, const IntArray &scale_types, const RealVector &multipliers, const RealVector &offsets) const

  general RealVector mapping from scaled to native variables (and values)

- void response_modify_n2s (const Variables &scaled_vars, const Response &native_response, Response &scaled_response, int native_offset, int recast_offset, int num_responses) const

  map reponses from native to scaled variable space

- void response_modify_s2n (const Variables &native_vars, const Response &scaled_response, Response &native_response, int scaled_offset, int native_offset, int num_responses) const

  map responses from scaled to native variable space

- RealMatrix lin_coeffs_modify_n2s (const RealMatrix &native_coeffs, const RealVector &cv_multipliers, const RealVector &lin_multipliers) const

  general linear coefficients mapping from native to scaled space

- void print_scaling (const String &info, const IntArray &scale_types, const RealVector &scale_mults, const RealVector &scale_offsets, const StringArray &labels)

  print scaling information for a particular response type in tabular form

- Real objective (const RealVector &fn_vals, const RealVector &primary_wts) const

  compute a composite objective value from one or more primary functions

- void objective_gradient (const RealVector &fn_vals, const RealMatrix &fn_grads, const RealVector &primary_wts, RealVector &obj_grad) const

  compute the gradient of the composite objective function

- void objective_hessian (const RealVector &fn_vals, const RealMatrix &fn_grads, const RealSymMatrixArray &fn_hessians, const RealVector &primary_wts, RealSymMatrix &obj_hess) const

  compute the Hessian of the composite objective function

Static Protected Member Functions

- static void variables_recast (const Variables &scaled_vars, Variables &native_vars)

  variables conversion map for RecastModel used in scaling: transform variables from scaled to native (user) space

- static void gnewton_set_recast (const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set)

  conversion of request vector values for the Gauss-Newton Hessian approximation

- static void secondary_resp_recast (const Variables &native_vars, const Variables &scaled_vars, const Response &native_response, Response &scaled_response)

  secondary response conversion map for RecastModel used in scaling: transform constraints (fns, grads, Hessians) from native (user) to

Protected Attributes

- Real constraintTol

  optimizer/least squares constraint tolerance

- Real bigRealBoundSize

  cutoff value for inequality constraint and continuous variable bounds

- int bigIntBoundSize

  cutoff value for discrete variable bounds

- size_t numNonlinearIneqConstraints

  number of nonlinear inequality constraints

- size_t numNonlinearEqConstraints

  number of nonlinear equality constraints

- size_t numLinearIneqConstraints

  number of linear inequality constraints

- size_t numLinearEqConstraints

  number of linear equality constraints

- int numNonlinearConstraints

  total number of nonlinear constraints

- int numLinearConstraints

  total number of linear constraints

- int numConstraints

  total number of linear and nonlinear constraints

- bool optimizationFlag

  flag for use where optimization and NLS must be distinguished

- size_t numUserPrimaryFns

  number of objective functions or least squares terms in the user's model

- size_t numIterPrimaryFns

  number of objective functions or least squares terms in iterator's view

- bool boundConstraintFlag

  convenience flag for denoting the presence of user-specified bound constraints. Used for method selection and error checking.

- bool speculativeFlag

  flag for speculative gradient evaluations

- bool scaleFlag

  flag for overall scaling status

- bool varsScaleFlag

  flag for variables scaling

- bool primaryRespScaleFlag

  flag for primary response scaling

- bool secondaryRespScaleFlag

  flag for secondary response scaling

- IntArray cvScaleTypes

  scale flags for continuous vars.

- RealVector cvScaleMultipliers

  scales for continuous variables

- RealVector cvScaleOffsets

  offsets for continuous variables

- IntArray responseScaleTypes

  scale flags for all responses

- RealVector responseScaleMultipliers

  scales for all responses

- RealVector responseScaleOffsets

  offsets for all responses (zero < for functions, not for nonlin con)

- IntArray linearIneqScaleTypes

  scale flags for linear ineq

- RealVector linearIneqScaleMultipliers

  scales for linear ineq constrs.

- RealVector linearIneqScaleOffsets

  offsets for linear ineq constrs.

- IntArray linearEqScaleTypes

  scale flags for linear eq.

- RealVector linearEqScaleMultipliers

  scales for linear constraints

- RealVector linearEqScaleOffsets

  offsets for linear constraints

- Minimizer * prevMinInstance

  pointer containing previous value of minimizerInstance

- bool vendorNumericalGradFlag

  convenience flag for gradType == numerical && methodSource == vendor

Static Protected Attributes

- static Minimizer * minimizerInstance

  pointer to Minimizer used in static member functions

Friends

- class SOLBase

the SOLBase class is not derived the iterator hierarchy but still needs access to iterator hierarchy data (to avoid attribute replication)

- class SNLLBase

  the SNLLBase class is not derived the iterator hierarchy but still needs access to iterator hierarchy data (to avoid attribute replication)

43.56.1 Detailed Description

Base class for the optimizer and least squares branches of the iterator hierarchy. The Minimizer class provides common data and functionality for Optimizer and LeastSq.

43.56.2 Constructor & Destructor Documentation

43.56.2.1 Minimizer (Model & *model*) `[protected]`

standard constructor This constructor extracts inherited data for the optimizer and least squares branches and performs sanity checking on constraint settings.

References Dakota::abort_handler(), Response::active_set_request_vector(), String::begins(), Iterator::bestResponseArray, Minimizer::bigIntBoundSize, Minimizer::bigRealBoundSize, Minimizer::boundConstraintFlag, Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Response::copy(), Model::current_response(), Model::discrete_int_lower_bounds(), Model::discrete_int_upper_bounds(), Model::discrete_real_lower_bounds(), Model::discrete_real_upper_bounds(), String::ends(), ProblemDescDB::get_sizet(), Iterator::gradientType, Iterator::hessianType, Iterator::maxIterations, Iterator::methodName, Iterator::methodSource, Iterator::numContinuousVars, Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, Iterator::numFinalSolutions, Iterator::numFunctions, Minimizer::numLinearEqConstraints, Minimizer::numLinearIneqConstraints, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Iterator::probDescDB, and Minimizer::vendorNumericalGradFlag.

43.56.3 Member Function Documentation

43.56.3.1 void initialize_run () `[protected, virtual]`

utility function to perform common operations prior to pre_run(); typically memory initialization; setting of instance pointers Perform initialization phases of run sequence, like allocating memory and setting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's initialize_run(), typically _before_ performing its own implementation steps.

Reimplemented from Iterator.

Reimplemented in CONMINOptimizer, LeastSq, Optimizer, DOTOptimizer, NLPQLPOptimizer, SNLLLeastSq, and SNLLOptimizer.

References Model::all_continuous_variables(), Model::all_discrete_int_variables(), Model::all_discrete_real_variables(), Iterator::bestVariablesArray, Iterator::iteratedModel, Minimizer::minimizerInstance, Minimizer::prevMinInstance, and Iterator::subIteratorFlag.

43.56.3.2 void finalize_run () [inline, protected, virtual]

utility function to perform common operations following post_run(); deallocation and resetting of instance pointers Optional: perform finalization phases of run sequence, like deallocating memory and resetting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's finalize_run(), typically _after_ performing its own implementation steps.

Reimplemented from Iterator.

Reimplemented in LeastSq, Optimizer, SNLLLeastSq, and SNLLOptimizer.

References Minimizer::minimizerInstance, and Minimizer::prevMinInstance.

43.56.3.3 void initialize_scaling () [protected]

initialize scaling types, multipliers, and offsets; perform error checking helper function used in constructors of derived classes to set up scaling types, multipliers and offsets when input scaling flag is enabled

References Dakota::abort_handler(), Minimizer::compute_scaling(), Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::continuous_variable_labels(), Model::continuous_variables(), Dakota::copy_data(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, ProblemDescDB::get_dsa(), ProblemDescDB::get_rdv(), Iterator::iteratedModel, Minimizer::lin_coeffs_modify_n2s(), Model::linear_eq_constraint_coeffs(), Model::linear_eq_constraint_targets(), Model::linear_ineq_constraint_coeffs(), Model::linear_ineq_constraint_lower_bounds(), Model::linear_ineq_constraint_upper_bounds(), Minimizer::linearEqScaleMultipliers, Minimizer::linearEqScaleOffsets, Minimizer::linearEqScaleTypes, Minimizer::linearIneqScaleMultipliers, Minimizer::linearIneqScaleOffsets, Minimizer::linearIneqScaleTypes, Model::model_rep(), Minimizer::modify_n2s(), Model::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Iterator::numContinuousVars, Iterator::numFunctions, Minimizer::numLinearEqConstraints, Minimizer::numLinearIneqConstraints, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, Iterator::outputLevel, Minimizer::primaryRespScaleFlag, Minimizer::print_scaling(), Iterator::probDescDB, Model::response_labels(), Minimizer::responseScaleMultipliers, Minimizer::responseScaleOffsets, Minimizer::responseScaleTypes, Minimizer::secondaryRespScaleFlag, RecastModel::submodel_supports_derivative_estimation(), Model::subordinate_model(), Model::supports_derivative_estimation(), and Minimizer::varsScaleFlag.

Referenced by LeastSq::LeastSq(), and Optimizer::Optimizer().

43.56.3.4 void variables_recast (const Variables & *scaled_vars*, Variables & *native_vars*) [static, protected]

variables conversion map for RecastModel used in scaling: transform variables from scaled to native (user) space Variables map from iterator/scaled space to user/native space using a RecastModel.

References Variables::continuous_variable_labels(), Variables::continuous_variables(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Minimizer::minimizerInstance, Minimizer::modify_s2n(), Iterator::outputLevel, and Dakota::write_data().

Referenced by LeastSq::LeastSq(), and Optimizer::Optimizer().

43.56.3.5 void gnewton_set_recast (const Variables & *recast_vars*, const ActiveSet & *recast_set*, ActiveSet & *sub_model_set*) [static, protected]

conversion of request vector values for the Gauss-Newton Hessian approximation For Gauss-Newton Hessian requests, activate the 2 bit and mask the 4 bit.

References ActiveSet::request_value(), and ActiveSet::request_vector().

Referenced by Optimizer::Optimizer(), and SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.56.3.6 void secondary_resp_recast (const Variables & *native_vars*, const Variables & *scaled_vars*, const Response & *native_response*, Response & *iterator_response*) [static, protected]

secondary response conversion map for RecastModel used in scaling: transform constraints (fns, grads, Hessians) from native (user) to Constraint function map from user/native space to iterator/scaled/combined space using a RecastModel.

References Response::active_set_request_vector(), Minimizer::minimizerInstance, Minimizer::need_resp_trans_byvars(), Minimizer::numIterPrimaryFns, Minimizer::numNonlinearConstraints, Minimizer::numUserPrimaryFns, Minimizer::response_modify_n2s(), Minimizer::secondaryRespScaleFlag, and Response::update_partial().

Referenced by LeastSq::LeastSq(), and Optimizer::Optimizer().

43.56.3.7 bool need_resp_trans_byvars (const ShortArray & *asv*, int *start_index*, int *num_resp*) [protected]

determine if response transformation is needed due to variable transformations Determine if variable transformations present and derivatives requested, which implies a response transformation is necessay

References Minimizer::varsScaleFlag.

Referenced by Optimizer::post_run(), LeastSq::post_run(), Optimizer::primary_resp_recast(), LeastSq::primary_resp_recast(), and Minimizer::secondary_resp_recast().

43.56.3.8 RealVector modify_n2s (const RealVector & *native_vars*, const IntArray & *scale_types*, const RealVector & *multipliers*, const RealVector & *offsets*) const [protected]

general RealVector mapping from native to scaled variables vectors: general RealVector mapping from native to scaled variables; loosely, in greatest generality: scaled_var = log((native_var - offset) / multiplier)

Referenced by Minimizer::initialize_scaling().

43.56.3.9 RealVector modify_s2n (const RealVector & *scaled_vars*, const IntArray & *scale_types*, const RealVector & *multipliers*, const RealVector & *offsets*) const [protected]

general RealVector mapping from scaled to native variables (and values) general RealVector mapping from scaled to native variables and/or vals; loosely, in greatest generality: scaled_var = (LOG_BASE^scaled_var) $*$ multiplier + offset

Referenced by SNLLLeastSq::post_run(), Optimizer::post_run(), LeastSq::post_run(), COLINOptimizer::post_run(), and Minimizer::variables_recast().

43.56.3.10 void response_modify_n2s (const Variables & *native_vars*, const Response & *native_response*, Response & *recast_response*, int *native_offset*, int *recast_offset*, int *num_responses*) const [protected]

map reponses from native to scaled variable space scaling response mapping: modifies response from a model (user/native) for use in iterators (scaled) -- not including MOO/NLS objective reductions

References Response::active_set(), Variables::acv(), Variables::all_continuous_variable_ids(), Variables::all_continuous_variables(), Variables::continuous_variable_ids(), Variables::continuous_variables(), Dakota::copy_data(), Variables::cv(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Dakota::find_index(), Response::function_gradient_view(), Response::function_gradients(), Response::function_hessian_view(), Response::function_hessians(), Response::function_labels(), Response::function_value(), Response::function_values(), Variables::icv(), Variables::inactive_continuous_variable_ids(), Variables::inactive_continuous_variables(), Minimizer::numIterPrimaryFns, Iterator::outputLevel, Minimizer::responseScaleMultipliers, Minimizer::responseScaleOffsets, Minimizer::responseScaleTypes, Dakota::write_col_vector_trans(), Dakota::write_data(), and Dakota::write_precision.

Referenced by Optimizer::primary_resp_recast(), LeastSq::primary_resp_recast(), and Minimizer::secondary_resp_recast().

43.56.3.11 void response_modify_s2n (const Variables & *native_vars*, const Response & *scaled_response*, Response & *native_response*, int *scaled_offset*, int *native_offset*, int *num_responses*) const [protected]

map responses from scaled to native variable space scaling response mapping: modifies response from scaled (iterator) to native (user) space -- not including MOO/NLS objective reductions

References Response::active_set(), Variables::acv(), Variables::all_continuous_variable_ids(), Variables::all_continuous_variables(), Variables::continuous_variable_ids(), Variables::continuous_variables(), Dakota::copy_data(), Variables::cv(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Dakota::find_index(), Response::function_gradient_view(), Response::function_gradients(), Response::function_hessian_view(), Response::function_hessians(), Response::function_labels(), Response::function_value(), Response::function_values(), Variables::icv(), Variables::inactive_continuous_variable_ids(), Variables::inactive_continuous_variables(), Minimizer::numIterPrimaryFns, Iterator::outputLevel, Minimizer::responseScaleMultipliers, Minimizer::responseScaleOffsets, Minimizer::responseScaleTypes, Dakota::write_col_vector_trans(), Dakota::write_data(), and Dakota::write_precision.

Referenced by Optimizer::post_run(), and LeastSq::post_run().

43.56.3.12 RealMatrix lin_coeffs_modify_n2s (const RealMatrix & *src_coeffs*, const RealVector & *cv_multipliers*, const RealVector & *lin_multipliers*) const [protected]

general linear coefficients mapping from native to scaled space compute scaled linear constraint matrix given design variable multipliers and linear scaling multipliers. Only scales components corresponding to continuous variables so for src_coeffs of size MxN, lin_multipliers.size() <= M, cv_multipliers.size() <= N

Referenced by Minimizer::initialize_scaling().

43.56.3.13 Real objective (const RealVector & *fn_vals*, const RealVector & *primary_wts*) const [protected]

compute a composite objective value from one or more primary functions The composite objective computation sums up the contributions from one of more primary functions using the primary response fn weights.

References Minimizer::numUserPrimaryFns, and Minimizer::optimizationFlag.

Referenced by SurrBasedLocalMinimizer::approx_subprob_objective_eval(), SurrBasedMinimizer::augmented_lagrangian_merit(), EffGlobalMinimizer::expected_improvement(), SurrBasedMinimizer::lagrangian_merit(), Optimizer::objective_reduction(), SurrBasedMinimizer::penalty_merit(), COLINOptimizer::post_run(), SurrBasedMinimizer::update_filter(), and SurrBasedLocalMinimizer::update_penalty().

43.56.3.14 void objective_gradient (const RealVector & *fn_vals*, const RealMatrix & *fn_grads*, const RealVector & *primary_wts*, RealVector & *obj_grad*) const [protected]

compute the gradient of the composite objective function The composite objective gradient computation combines the contributions from one of more primary function gradients, including the effect of any primary function weights. In the case of a linear mapping (MOO), only the primary function gradients are required, but in the case of a nonlinear mapping (NLS), primary function values are also needed. Within RecastModel::set_mapping(), the active set requests are automatically augmented to make values available when needed, based on nonlinearRespMapping settings.

References Iterator::numContinuousVars, Minimizer::numUserPrimaryFns, and Minimizer::optimizationFlag.

Referenced by SurrBasedLocalMinimizer::approx_subprob_objective_eval(), SurrBasedMinimizer::augmented_lagrangian_gradient(), SurrBasedMinimizer::lagrangian_gradient(), Optimizer::objective_reduction(), SurrBasedMinimizer::penalty_gradient(), and SurrBasedMinimizer::update_lagrange_multipliers().

43.56.3.15 void objective_hessian (const RealVector & *fn_vals*, const RealMatrix & *fn_grads*, const RealSymMatrixArray & *fn_hessians*, const RealVector & *primary_wts*, RealSymMatrix & *obj_hess*) const [protected]

compute the Hessian of the composite objective function The composite objective Hessian computation combines the contributions from one of more primary function Hessians, including the effect of any primary function weights. In the case of a linear mapping (MOO), only the primary function Hessians are required, but in the case of a nonlinear mapping (NLS), primary function values and gradients are also needed in general (gradients only in the case of a Gauss-Newton approximation). Within the default RecastModel::set_mapping(), the active set requests are automatically augmented to make values and gradients available when needed, based on nonlinearRespMapping settings.

References Dakota::abort_handler(), Iterator::numContinuousVars, Minimizer::numUserPrimaryFns, and Minimizer::optimizationFlag.

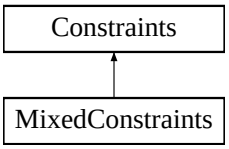
Referenced by Optimizer::objective_reduction().

The documentation for this class was generated from the following files:

- DakotaMinimizer.H
- DakotaMinimizer.C

43.57 MixedConstraints Class Reference

Derived class within the Constraints hierarchy which employs the default data view (no variable or domain type array merging). Inheritance diagram for MixedConstraints::



Public Member Functions

- MixedConstraints (const SharedVariablesData &svd)

  lightweight constructor

- MixedConstraints (const ProblemDescDB &problem_db, const SharedVariablesData &svd)

  standard constructor

- ~MixedConstraints ()

  destructor

- void write (std::ostream &s) const

  write a variable constraints object to an std::ostream

- void read (std::istream &s)

  read a variable constraints object from an std::istream

Protected Member Functions

- void reshape (const SizetArray &vc_totals)

  reshape the lower/upper bound arrays within the Constraints hierarchy

- void build_active_views ()

  construct active views of all variables bounds arrays

- void build_inactive_views ()

  construct inactive views of all variables bounds arrays

43.57.1 Detailed Description

Derived class within the Constraints hierarchy which employs the default data view (no variable or domain type array merging). Derived variable constraints classes take different views of the design, uncertain, and state variable types and the continuous and discrete domain types. The MixedConstraints derived class separates the design, uncertain, and state variable types as well as the continuous and discrete domain types. The result is separate lower and upper bounds arrays for continuous design, discrete design, uncertain, continuous state, and discrete state variables. This is the default approach, so all iterators and strategies not specifically utilizing the All or Merged views use this approach (see Variables::get_variables(problem_db) for variables type selection; variables type is passed to the Constraints constructor in Model).

43.57.2 Constructor & Destructor Documentation

43.57.2.1 MixedConstraints (const ProblemDescDB & *problem_db*, const SharedVariablesData & *svd*)

standard constructor In this class, mixed continuous/discrete variables are used. Most iterators/strategies use this approach, which is the default in Constraints::get_constraints().

References Constraints::allContinuousLowerBnds, Constraints::allContinuousUpperBnds, Constraints::allDiscreteIntLowerBnds, Constraints::allDiscreteIntUpperBnds, Constraints::allDiscreteRealLowerBnds, Constraints::allDiscreteRealUpperBnds, Constraints::build_views(), SharedVariablesData::components_totals(), Dakota::copy_data_partial(), ProblemDescDB::get_idv(), ProblemDescDB::get_rdv(), Constraints::manage_linear_constraints(), Constraints::numLinearEqCons, Constraints::numLinearIneqCons, Constraints::sharedVarsData, SharedVariablesData::vc_lookup(), and SharedVariablesData::view().

43.57.3 Member Function Documentation

43.57.3.1 void reshape (const SizetArray & *vc_totals*) `[protected, virtual]`

reshape the lower/upper bound arrays within the Constraints hierarchy Resizes the derived bounds arrays.

Reimplemented from Constraints.

References Constraints::allContinuousLowerBnds, Constraints::allContinuousUpperBnds, Constraints::allDiscreteIntLowerBnds, Constraints::allDiscreteIntUpperBnds, Constraints::allDiscreteRealLowerBnds, Constraints::allDiscreteRealUpperBnds, and Constraints::build_views().

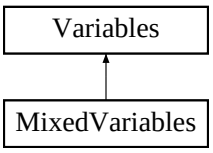
Referenced by MixedConstraints::MixedConstraints().

The documentation for this class was generated from the following files:

- MixedConstraints.H
- MixedConstraints.C

43.58 MixedVariables Class Reference

Derived class within the Variables hierarchy which employs the default data view (no variable or domain type array merging). Inheritance diagram for MixedVariables::



Public Member Functions

- MixedVariables (const ProblemDescDB &problem_db, const std::pair< short, short > &view)

  standard constructor

- MixedVariables (const SharedVariablesData &svd)

  lightweight constructor

- ~MixedVariables ()

  destructor

Protected Member Functions

- void read (std::istream &s)

  read a variables object from an std::istream

- void write (std::ostream &s) const

  write a variables object to an std::ostream

- void write_aprepro (std::ostream &s) const

  write a variables object to an std::ostream in aprepro format

- void read_tabular (std::istream &s)
- void write_tabular (std::ostream &s) const

  write a variables object in tabular format to an std::ostream

- void reshape (const SizetArray &vc_totals)

  reshapes an existing Variables object based on the incoming variablesComponents

- void build_active_views ()

  construct active views of all variables arrays

- void build_inactive_views ()

construct inactive views of all variables arrays

43.58.1 Detailed Description

Derived class within the Variables hierarchy which employs the default data view (no variable or domain type array merging). Derived variables classes take different views of the design, uncertain, and state variable types and the continuous and discrete domain types. The MixedVariables derived class separates the design, uncertain, and state variable types as well as the continuous and discrete domain types. The result is separate arrays for continuous design, discrete design, uncertain, continuous state, and discrete state variables. This is the default approach, so all iterators and strategies not specifically utilizing the All or Merged views use this approach (see Variables::get_variables(problem_db)).

43.58.2 Constructor & Destructor Documentation

43.58.2.1 MixedVariables (const ProblemDescDB & *problem_db*, const std::pair< short, short > & *view*)

standard constructor In this class, the distinct approach is used (design, uncertain, and state variable types and continuous and discrete domain types are distinct). Most iterators/strategies use this approach.

References Variables::allContinuousVars, Variables::allDiscreteIntVars, Variables::allDiscreteRealVars, Variables::build_views(), SharedVariablesData::components_totals(), Dakota::copy_data_partial(), ProblemDescDB::get_idv(), ProblemDescDB::get_rdv(), Variables::sharedVarsData, and SharedVariablesData::vc_lookup().

43.58.3 Member Function Documentation

43.58.3.1 void read_tabular (std::istream & *s*) `[protected, virtual]`

Presumes variables object is already appropriately sized to receive!

Reimplemented from Variables.

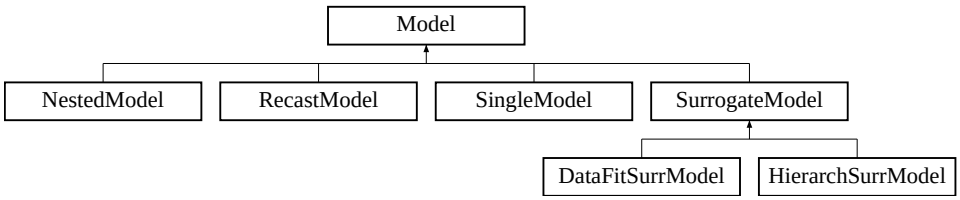
References Variables::allContinuousVars, Variables::allDiscreteIntVars, Variables::allDiscreteRealVars, and Dakota::read_data_tabular().

The documentation for this class was generated from the following files:

- MixedVariables.H
- MixedVariables.C

43.59 Model Class Reference

Base class for the model class hierarchy. Inheritance diagram for Model::



Public Member Functions

- Model ()

  default constructor

- Model (ProblemDescDB &problem_db)

  standard constructor for envelope

- Model (const Model &model)

  copy constructor

- virtual ~Model ()

  destructor

- Model operator= (const Model &model)

  assignment operator

- virtual Iterator & subordinate_iterator ()

  return the sub-iterator in nested and surrogate models

- virtual Model & subordinate_model ()

  return a single sub-model defined from subModel in nested and recast models and truth_model() in surrogate models; used for a directed dive through model recursions that may bypass some components.

- virtual Model & surrogate_model ()

  return the approximation sub-model in surrogate models

- virtual Model & truth_model ()

  return the truth sub-model in surrogate models

- virtual void derived_subordinate_models (ModelList &ml, bool recurse_flag)

  portion of subordinate_models()() specific to derived model classes

- virtual void update_from_subordinate_model (bool recurse_flag=true)

propagate vars/labels/bounds/targets from the bottom up

- virtual Interface & interface ()

  return the interface employed by the derived model class, if present: SingleModel::userDefinedInterface, DataFitSurrModel::approxInterface, or NestedModel::optionalInterface

- virtual void primary_response_fn_weights (const RealVector &wts, bool recurse_flag=true)

  set the relative weightings for multiple objective functions or least squares terms

- virtual void surrogate_function_indices (const IntSet &surr_fn_indices)

  set the (currently active) surrogate function index set

- virtual void build_approximation ()

  build a new SurrogateModel approximation

- virtual bool build_approximation (const Variables &vars, const IntResponsePair &response_pr)

  build a new SurrogateModel approximation using/enforcing response at vars

- virtual void update_approximation (bool rebuild_flag)

  replace the approximation data within an existing surrogate based on data updates propagated elsewhere

- virtual void update_approximation (const Variables &vars, const IntResponsePair &response_pr, bool rebuild_flag)

  replace the anchor point data within an existing surrogate

- virtual void update_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map, bool rebuild_flag)

  replace the data points within an existing surrogate

- virtual void append_approximation (bool rebuild_flag)

  append to the existing approximation data within a surrogate based on data updates propagated elsewhere

- virtual void append_approximation (const Variables &vars, const IntResponsePair &response_pr, bool rebuild_flag)

  append a single point to an existing surrogate's data

- virtual void append_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map, bool rebuild_flag)

  append multiple points to an existing surrogate's data

- virtual void pop_approximation (bool save_surr_data)

  remove the previous data set addition to a surrogate (e.g., due to a previous append_approximation() call); flag manages storing of surrogate data for use in a subsequent restore_approximation()

- virtual void restore_approximation ()

  restore a previous approximation data state within a surrogate

- virtual bool restore_available ()

  query for whether a trial increment is restorable within a surrogate

- virtual void finalize_approximation ()

  finalize an approximation by applying all previous trial increments

- virtual void store_approximation ()

  move the current approximation into storage for later combination

- virtual void combine_approximation (short corr_type)

  combine the current approximation with one previously stored

- virtual bool force_rebuild ()

  determine whether a surrogate model rebuild should be forced based on changes in the inactive data

- virtual std::vector< Approximation > & approximations ()

  retrieve the set of Approximations within a DataFitSurrModel

- virtual const Pecos::SurrogateData & approximation_data (size_t index)

  retrieve the approximation data from a particular Approximation instance within a DataFitSurrModel

- virtual const RealVectorArray & approximation_coefficients ()

  retrieve the approximation coefficients from each Approximation within a DataFitSurrModel

- virtual void approximation_coefficients (const RealVectorArray &approx_coeffs)

  set the approximation coefficients for each Approximation within a DataFitSurrModel

- virtual const RealVector & approximation_variances (const RealVector &c_vars)

  retrieve the approximation variances from each Approximation within a DataFitSurrModel

- virtual void surrogate_response_mode (short mode)

  set response computation mode used in SurrogateModels for forming currentResponse

- virtual short surrogate_response_mode () const

  return response computation mode used in SurrogateModels for forming currentResponse

- virtual DiscrepancyCorrection & discrepancy_correction ()

  return the DiscrepancyCorrection object used by SurrogateModels

- virtual void component_parallel_mode (short mode)

  update component parallel mode for supporting parallelism in a model's interface component, sub-model component, or neither component [componentParallelMode = 0 (none), 1 (INTERFACE/APPROX_-INTERFACE/OPTIONAL_INTERFACE/LF_MODEL/SURROGATE_MODEL), or 2 (SUB_MODEL/ACTUAL_-MODEL/HF_MODEL/TRUTH_MODEL)].

- virtual String local_eval_synchronization ()

return derived model synchronization setting

- virtual int local_eval_concurrency ()

  return derived model asynchronous evaluation concurrency

- virtual void serve ()

  Service job requests received from the master. Completes when a termination message is received from stop_servers().

- virtual void stop_servers ()

  Executed by the master to terminate all server operations for a particular model when iteration on the model is complete.

- virtual bool derived_master_overload () const

  Return a flag indicating the combination of multiprocessor evaluations and a dedicated master iterator scheduling. Used in synchronous compute_response functions to prevent the error of trying to run a multiprocessor job on the master.

- virtual void inactive_view (short view, bool recurse_flag=true)

  update the Model's inactive view based on higher level (nested) context

- virtual const String & interface_id () const

  return the interface identifier

- virtual int evaluation_id () const

  Return the value of the evaluation id counter for the Model.

- virtual bool evaluation_cache () const

  Indicates the usage of an evaluation cache by the Model.

- virtual void set_evaluation_reference ()

  Set the reference points for the evaluation counters within the Model.

- virtual void fine_grained_evaluation_counters ()

  Request fine-grained evaluation reporting within the Model.

- virtual void print_evaluation_summary (std::ostream &s, bool minimal_header=false, bool relative_count=true) const

  Print an evaluation summary for the Model.

- ModelList & subordinate_models (bool recurse_flag=true)

  return the sub-models in nested and surrogate models

- void compute_response ()

  Compute the Response at currentVariables (default ActiveSet).

- void compute_response (const ActiveSet &set)

Compute the Response at currentVariables (specified ActiveSet).

- void asynch_compute_response ()

  Spawn an asynchronous job (or jobs) that computes the value of the Response at currentVariables (default ActiveSet).

- void asynch_compute_response (const ActiveSet &set)

  Spawn an asynchronous job (or jobs) that computes the value of the Response at currentVariables (specified ActiveSet).

- const IntResponseMap & synchronize ()

  Execute a blocking scheduling algorithm to collect the complete set of results from a group of asynchronous evaluations.

- const IntResponseMap & synchronize_nowait ()

  Execute a nonblocking scheduling algorithm to collect all available results from a group of asynchronous evaluations.

- void init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  allocate communicator partitions for a model and store configuration in modelPCIterMap

- void init_serial ()

  for cases where init_communicators() will not be called, modify some default settings to behave properly in serial.

- void set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set active parallel configuration for the model (set modelPCIter from modelPCIterMap)

- void free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  deallocate communicator partitions for a model

- void stop_configurations ()

  called from Strategy::init_iterator() for iteratorComm rank 0 to terminate serve_configurations() on other iteratorComm processors

- int serve_configurations ()

  called from Strategy::init_iterator() for iteratorComm rank != 0 to balance init_communicators() calls on iteratorComm rank 0

- void estimate_message_lengths ()

  estimate messageLengths for a model

- void assign_rep (Model *model_rep, bool ref_count_incr=true)

  replaces existing letter with a new one

- size_t tv () const

  returns total number of vars

- size_t cv () const

  returns number of active continuous variables

- size_t div () const

  returns number of active discrete integer vars

- size_t drv () const

  returns number of active discrete real vars

- size_t icv () const

  returns number of inactive continuous variables

- size_t idiv () const

  returns number of inactive discrete integer vars

- size_t idrv () const

  returns number of inactive discrete real vars

- size_t acv () const

  returns total number of continuous variables

- size_t adiv () const

  returns total number of discrete integer vars

- size_t adrv () const

  returns total number of discrete real vars

- void active_variables (const Variables &vars)

  set the active variables in currentVariables

- const RealVector & continuous_variables () const

  return the active continuous variables from currentVariables

- void continuous_variables (const RealVector &c_vars)

  set the active continuous variables in currentVariables

- void continuous_variable (const Real &c_var, const size_t &i)

  set an active continuous variable in currentVariables

- const IntVector & discrete_int_variables () const

  return the active discrete integer variables from currentVariables

- void discrete_int_variables (const IntVector &d_vars)

  set the active discrete integer variables in currentVariables

- void discrete_int_variable (const int &d_var, const size_t &i)

set an active discrete integer variable in currentVariables

- const RealVector & discrete_real_variables () const
  return the active discrete real variables from currentVariables
- void discrete_real_variables (const RealVector &d_vars)
  set the active discrete real variables in currentVariables
- void discrete_real_variable (const Real &d_var, const size_t &i)
  set an active discrete real variable in currentVariables
- UShortMultiArrayConstView continuous_variable_types () const
  return the active continuous variable types from currentVariables
- UShortMultiArrayConstView discrete_int_variable_types () const
  return the active discrete variable types from currentVariables
- UShortMultiArrayConstView discrete_real_variable_types () const
  return the active discrete variable types from currentVariables
- SizetMultiArrayConstView continuous_variable_ids () const
  return the active continuous variable identifiers from currentVariables
- const RealVector & inactive_continuous_variables () const
  return the inactive continuous variables in currentVariables
- void inactive_continuous_variables (const RealVector &i_c_vars)
  set the inactive continuous variables in currentVariables
- const IntVector & inactive_discrete_int_variables () const
  return the inactive discrete variables in currentVariables
- void inactive_discrete_int_variables (const IntVector &i_d_vars)
  set the inactive discrete variables in currentVariables
- const RealVector & inactive_discrete_real_variables () const
  return the inactive discrete variables in currentVariables
- void inactive_discrete_real_variables (const RealVector &i_d_vars)
  set the inactive discrete variables in currentVariables
- SizetMultiArrayConstView inactive_continuous_variable_ids () const
  return the inactive continuous variable identifiers from currentVariables
- const RealVector & all_continuous_variables () const
  return all continuous variables in currentVariables

- void all_continuous_variables (const RealVector &a_c_vars)
  set all continuous variables in currentVariables
- void all_continuous_variable (const Real &a_c_var, const size_t &i)
  set a variable within the all continuous variables in currentVariables
- const IntVector & all_discrete_int_variables () const
  return all discrete variables in currentVariables
- void all_discrete_int_variables (const IntVector &a_d_vars)
  set all discrete variables in currentVariables
- void all_discrete_int_variable (const int &a_d_var, const size_t &i)
  set a variable within the all discrete variables in currentVariables
- const RealVector & all_discrete_real_variables () const
  return all discrete variables in currentVariables
- void all_discrete_real_variables (const RealVector &a_d_vars)
  set all discrete variables in currentVariables
- void all_discrete_real_variable (const Real &a_d_var, const size_t &i)
  set a variable within the all discrete variables in currentVariables
- UShortMultiArrayConstView all_continuous_variable_types () const
  return all continuous variable types from currentVariables
- UShortMultiArrayConstView all_discrete_int_variable_types () const
  return all discrete variable types from currentVariables
- UShortMultiArrayConstView all_discrete_real_variable_types () const
  return all discrete variable types from currentVariables
- SizetMultiArrayConstView all_continuous_variable_ids () const
  return all continuous variable identifiers from currentVariables
- const IntSetArray & discrete_design_set_int_values () const
  return the sets of values available for each of the discrete design set integer variables
- void discrete_design_set_int_values (const IntSetArray &isa)
  define the sets of values available for each of the discrete design set integer variables
- const RealSetArray & discrete_design_set_real_values () const
  return the sets of values available for each of the discrete design set integer variables

- void discrete_design_set_real_values (const RealSetArray &rsa)

  define the sets of values available for each of the discrete design set integer variables

- Pecos::DistributionParams & distribution_parameters ()

  return distribParams

- void distribution_parameters (const Pecos::DistributionParams &dp)

  set distribParams

- const IntSetArray & discrete_state_set_int_values () const

  return the sets of values available for each of the discrete state set integer variables

- void discrete_state_set_int_values (const IntSetArray &isa)

  define the sets of values available for each of the discrete state set integer variables

- const RealSetArray & discrete_state_set_real_values () const

  return the sets of values available for each of the discrete state set integer variables

- void discrete_state_set_real_values (const RealSetArray &rsa)

  define the sets of values available for each of the discrete state set integer variables

- StringMultiArrayConstView continuous_variable_labels () const

  return the active continuous variable labels from currentVariables

- void continuous_variable_labels (StringMultiArrayConstView c_v_labels)

  set the active continuous variable labels in currentVariables

- StringMultiArrayConstView discrete_int_variable_labels () const

  return the active discrete variable labels from currentVariables

- void discrete_int_variable_labels (StringMultiArrayConstView d_v_labels)

  set the active discrete variable labels in currentVariables

- StringMultiArrayConstView discrete_real_variable_labels () const

  return the active discrete variable labels from currentVariables

- void discrete_real_variable_labels (StringMultiArrayConstView d_v_labels)

  set the active discrete variable labels in currentVariables

- StringMultiArrayConstView inactive_continuous_variable_labels () const

  return the inactive continuous variable labels in currentVariables

- void inactive_continuous_variable_labels (StringMultiArrayConstView i_c_v_labels)

  set the inactive continuous variable labels in currentVariables

- StringMultiArrayConstView inactive_discrete_int_variable_labels () const

return the inactive discrete variable labels in currentVariables

- void inactive_discrete_int_variable_labels (StringMultiArrayConstView i_d_v_labels)
  set the inactive discrete variable labels in currentVariables
- StringMultiArrayConstView inactive_discrete_real_variable_labels () const
  return the inactive discrete variable labels in currentVariables
- void inactive_discrete_real_variable_labels (StringMultiArrayConstView i_d_v_labels)
  set the inactive discrete variable labels in currentVariables
- StringMultiArrayConstView all_continuous_variable_labels () const
  return all continuous variable labels in currentVariables
- void all_continuous_variable_labels (StringMultiArrayConstView a_c_v_labels)
  set all continuous variable labels in currentVariables
- void all_continuous_variable_label (const String &a_c_v_label, const size_t &i)
  set a label within the all continuous labels in currentVariables
- StringMultiArrayConstView all_discrete_int_variable_labels () const
  return all discrete variable labels in currentVariables
- void all_discrete_int_variable_labels (StringMultiArrayConstView a_d_v_labels)
  set all discrete variable labels in currentVariables
- void all_discrete_int_variable_label (const String &a_d_v_label, const size_t &i)
  set a label within the all discrete labels in currentVariables
- StringMultiArrayConstView all_discrete_real_variable_labels () const
  return all discrete variable labels in currentVariables
- void all_discrete_real_variable_labels (StringMultiArrayConstView a_d_v_labels)
  set all discrete variable labels in currentVariables
- void all_discrete_real_variable_label (const String &a_d_v_label, const size_t &i)
  set a label within the all discrete labels in currentVariables
- const StringArray & response_labels () const
  return the response labels from currentResponse
- void response_labels (const StringArray &resp_labels)
  set the response labels in currentResponse
- const RealVector & continuous_lower_bounds () const
  return the active continuous lower bounds from userDefinedConstraints

- void continuous_lower_bounds (const RealVector &c_l_bnds)
  set the active continuous lower bounds in userDefinedConstraints
- const RealVector & continuous_upper_bounds () const
  return the active continuous upper bounds from userDefinedConstraints
- void continuous_upper_bounds (const RealVector &c_u_bnds)
  set the active continuous upper bounds in userDefinedConstraints
- const IntVector & discrete_int_lower_bounds () const
  return the active discrete lower bounds from userDefinedConstraints
- void discrete_int_lower_bounds (const IntVector &d_l_bnds)
  set the active discrete lower bounds in userDefinedConstraints
- const IntVector & discrete_int_upper_bounds () const
  return the active discrete upper bounds from userDefinedConstraints
- void discrete_int_upper_bounds (const IntVector &d_u_bnds)
  set the active discrete upper bounds in userDefinedConstraints
- const RealVector & discrete_real_lower_bounds () const
  return the active discrete lower bounds from userDefinedConstraints
- void discrete_real_lower_bounds (const RealVector &d_l_bnds)
  set the active discrete lower bounds in userDefinedConstraints
- const RealVector & discrete_real_upper_bounds () const
  return the active discrete upper bounds from userDefinedConstraints
- void discrete_real_upper_bounds (const RealVector &d_u_bnds)
  set the active discrete upper bounds in userDefinedConstraints
- const RealVector & inactive_continuous_lower_bounds () const
  return the inactive continuous lower bounds in userDefinedConstraints
- void inactive_continuous_lower_bounds (const RealVector &i_c_l_bnds)
  set the inactive continuous lower bounds in userDefinedConstraints
- const RealVector & inactive_continuous_upper_bounds () const
  return the inactive continuous upper bounds in userDefinedConstraints
- void inactive_continuous_upper_bounds (const RealVector &i_c_u_bnds)
  set the inactive continuous upper bounds in userDefinedConstraints

- const IntVector & inactive_discrete_int_lower_bounds () const
  return the inactive discrete lower bounds in userDefinedConstraints
- void inactive_discrete_int_lower_bounds (const IntVector &i_d_l_bnds)
  set the inactive discrete lower bounds in userDefinedConstraints
- const IntVector & inactive_discrete_int_upper_bounds () const
  return the inactive discrete upper bounds in userDefinedConstraints
- void inactive_discrete_int_upper_bounds (const IntVector &i_d_u_bnds)
  set the inactive discrete upper bounds in userDefinedConstraints
- const RealVector & inactive_discrete_real_lower_bounds () const
  return the inactive discrete lower bounds in userDefinedConstraints
- void inactive_discrete_real_lower_bounds (const RealVector &i_d_l_bnds)
  set the inactive discrete lower bounds in userDefinedConstraints
- const RealVector & inactive_discrete_real_upper_bounds () const
  return the inactive discrete upper bounds in userDefinedConstraints
- void inactive_discrete_real_upper_bounds (const RealVector &i_d_u_bnds)
  set the inactive discrete upper bounds in userDefinedConstraints
- const RealVector & all_continuous_lower_bounds () const
  return all continuous lower bounds in userDefinedConstraints
- void all_continuous_lower_bounds (const RealVector &a_c_l_bnds)
  set all continuous lower bounds in userDefinedConstraints
- void all_continuous_lower_bound (const Real &a_c_l_bnd, const size_t &i)
  set a lower bound within continuous lower bounds in userDefinedConstraints
- const RealVector & all_continuous_upper_bounds () const
  return all continuous upper bounds in userDefinedConstraints
- void all_continuous_upper_bounds (const RealVector &a_c_u_bnds)
  set all continuous upper bounds in userDefinedConstraints
- void all_continuous_upper_bound (const Real &a_c_u_bnd, const size_t &i)
  set an upper bound within all continuous upper bounds in userDefinedConstraints
- const IntVector & all_discrete_int_lower_bounds () const
  return all discrete lower bounds in userDefinedConstraints
- void all_discrete_int_lower_bounds (const IntVector &a_d_l_bnds)

set all discrete lower bounds in userDefinedConstraints

- void all_discrete_int_lower_bound (const int &a_d_l_bnd, const size_t &i)
  set a lower bound within all discrete lower bounds in userDefinedConstraints
- const IntVector & all_discrete_int_upper_bounds () const
  return all discrete upper bounds in userDefinedConstraints
- void all_discrete_int_upper_bounds (const IntVector &a_d_u_bnds)
  set all discrete upper bounds in userDefinedConstraints
- void all_discrete_int_upper_bound (const int &a_d_u_bnd, const size_t &i)
  set an upper bound within all discrete upper bounds in userDefinedConstraints
- const RealVector & all_discrete_real_lower_bounds () const
  return all discrete lower bounds in userDefinedConstraints
- void all_discrete_real_lower_bounds (const RealVector &a_d_l_bnds)
  set all discrete lower bounds in userDefinedConstraints
- void all_discrete_real_lower_bound (const Real &a_d_l_bnd, const size_t &i)
  set a lower bound within all discrete lower bounds in userDefinedConstraints
- const RealVector & all_discrete_real_upper_bounds () const
  return all discrete upper bounds in userDefinedConstraints
- void all_discrete_real_upper_bounds (const RealVector &a_d_u_bnds)
  set all discrete upper bounds in userDefinedConstraints
- void all_discrete_real_upper_bound (const Real &a_d_u_bnd, const size_t &i)
  set an upper bound within all discrete upper bounds in userDefinedConstraints
- size_t num_linear_ineq_constraints () const
  return the number of linear inequality constraints
- size_t num_linear_eq_constraints () const
  return the number of linear equality constraints
- const RealMatrix & linear_ineq_constraint_coeffs () const
  return the linear inequality constraint coefficients
- void linear_ineq_constraint_coeffs (const RealMatrix &lin_ineq_coeffs)
  set the linear inequality constraint coefficients
- const RealVector & linear_ineq_constraint_lower_bounds () const
  return the linear inequality constraint lower bounds

- void linear_ineq_constraint_lower_bounds (const RealVector &lin_ineq_l_bnds)
  set the linear inequality constraint lower bounds
- const RealVector & linear_ineq_constraint_upper_bounds () const
  return the linear inequality constraint upper bounds
- void linear_ineq_constraint_upper_bounds (const RealVector &lin_ineq_u_bnds)
  set the linear inequality constraint upper bounds
- const RealMatrix & linear_eq_constraint_coeffs () const
  return the linear equality constraint coefficients
- void linear_eq_constraint_coeffs (const RealMatrix &lin_eq_coeffs)
  set the linear equality constraint coefficients
- const RealVector & linear_eq_constraint_targets () const
  return the linear equality constraint targets
- void linear_eq_constraint_targets (const RealVector &lin_eq_targets)
  set the linear equality constraint targets
- size_t num_nonlinear_ineq_constraints () const
  return the number of nonlinear inequality constraints
- size_t num_nonlinear_eq_constraints () const
  return the number of nonlinear equality constraints
- const RealVector & nonlinear_ineq_constraint_lower_bounds () const
  return the nonlinear inequality constraint lower bounds
- void nonlinear_ineq_constraint_lower_bounds (const RealVector &nln_ineq_l_bnds)
  set the nonlinear inequality constraint lower bounds
- const RealVector & nonlinear_ineq_constraint_upper_bounds () const
  return the nonlinear inequality constraint upper bounds
- void nonlinear_ineq_constraint_upper_bounds (const RealVector &nln_ineq_u_bnds)
  set the nonlinear inequality constraint upper bounds
- const RealVector & nonlinear_eq_constraint_targets () const
  return the nonlinear equality constraint targets
- void nonlinear_eq_constraint_targets (const RealVector &nln_eq_targets)
  set the nonlinear equality constraint targets

- const Variables & current_variables () const

  return the current variables (currentVariables)

- const Constraints & user_defined_constraints () const

  return the user-defined constraints (userDefinedConstraints)

- const Response & current_response () const

  return the current response (currentResponse)

- ProblemDescDB & problem_description_db () const

  return the problem description database (probDescDB)

- ParallelLibrary & parallel_library () const

  return the parallel library (parallelLib)

- const String & model_type () const

  return the model type (modelType)

- const String & surrogate_type () const

  return the surrogate type (surrogateType)

- const String & model_id () const

  return the model identifier (modelId)

- size_t num_functions () const

  return number of functions in currentResponse

- const String & gradient_type () const

  return the gradient evaluation type (gradType)

- const String & method_source () const

  return the numerical gradient evaluation method source (methodSrc)

- const String & interval_type () const

  return the numerical gradient evaluation interval type (intervalType)

- bool ignore_bounds () const

  option for ignoring bounds when numerically estimating derivatives

- bool central_hess () const

  option for using old 2nd-order scheme when computing finite-diff Hessian

- const RealVector & fd_gradient_step_size () const

  return the finite difference gradient step size (fdGradSS)

- const IntList & gradient_id_analytic () const

return the mixed gradient analytic IDs (gradIdAnalytic)

- const IntList & gradient_id_numerical () const

  return the mixed gradient numerical IDs (gradIdNumerical)

- const String & hessian_type () const

  return the Hessian evaluation type (hessType)

- const String & quasi_hessian_type () const

  return the Hessian evaluation type (quasiHessType)

- const RealVector & fd_hessian_by_grad_step_size () const

  return gradient-based finite difference Hessian step size (fdHessByGradSS)

- const RealVector & fd_hessian_by_fn_step_size () const

  return function-based finite difference Hessian step size (fdHessByFnSS)

- const IntList & hessian_id_analytic () const

  return the mixed Hessian analytic IDs (hessIdAnalytic)

- const IntList & hessian_id_numerical () const

  return the mixed Hessian analytic IDs (hessIdNumerical)

- const IntList & hessian_id_quasi () const

  return the mixed Hessian analytic IDs (hessIdQuasi)

- const RealVector & primary_response_fn_weights () const

  get the relative weightings for multiple objective functions or least squares terms. Used by ConcurrentStrategy for Pareto set optimization.

- bool derivative_estimation ()

  indicates potential usage of estimate_derivatives() based on gradType/hessType

- void supports_derivative_estimation (bool sed_flag)

  set whether this model should perform or pass on derivative estimation

- void init_comms_bcast_flag (bool icb_flag)

  set initCommsBcastFlag

- int evaluation_capacity () const

  return the evaluation capacity for use in iterator logic

- int derivative_concurrency () const

  return the gradient concurrency for use in parallel configuration logic

- bool asynch_flag () const

return the asynchronous evaluation flag (asynchEvalFlag)

- void asynch_flag (const bool flag)

  set the asynchronous evaluation flag (asynchEvalFlag)

- short output_level () const

  return the outputLevel

- void output_level (const short level)

  set the outputLevel

- const IntArray & message_lengths () const

  return the array of MPI packed message buffer lengths (messageLengths)

- void parallel_configuration_iterator (const ParConfigLIter &pc_iter)

  set modelPCIter

- const ParConfigLIter & parallel_configuration_iterator () const

  return modelPCIter

- void auto_graphics (const bool flag)

  set modelAutoGraphicsFlag to activate posting of graphics data within compute_response/synchronize functions (automatic graphics posting in the model as opposed to graphics posting at the strategy level).

- bool is_null () const

  function to check modelRep (does this envelope contain a letter)

- Model * model_rep () const

  returns modelRep for access to derived class member functions that are not mapped to the top Model level

- Real FDstep1 (const Real &x0_j, const Real &lb_j, const Real &ub_j, Real h_mag)

  function returning finite-difference step size (affected by bounds)

- Real FDstep2 (const Real &x0_j, const Real &lb_j, const Real &ub_j, Real h)

  function returning second central-difference step size (affected by bounds)

Public Attributes

- bool shortStep

  flags finite-difference step size adjusted by bounds

Protected Member Functions

- Model (BaseConstructor, ProblemDescDB &problem_db)

  constructor initializing the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- Model (NoDBBaseConstructor, ParallelLibrary &parallel_lib, const SharedVariablesData &svd, const ActiveSet &set, short output_level)

  constructor initializing base class for derived model class instances constructed on the fly

- Model (RecastBaseConstructor, ProblemDescDB &problem_db, ParallelLibrary &parallel_lib)

  constructor initializing base class for recast model class instances constructed on the fly

- virtual void derived_compute_response (const ActiveSet &set)

  portion of compute_response() specific to derived model classes

- virtual void derived_asynch_compute_response (const ActiveSet &set)

  portion of asynch_compute_response() specific to derived model classes

- virtual const IntResponseMap & derived_synchronize ()

  portion of synchronize() specific to derived model classes

- virtual const IntResponseMap & derived_synchronize_nowait ()

  portion of synchronize_nowait() specific to derived model classes

- virtual void derived_init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  portion of init_communicators() specific to derived model classes

- virtual void derived_init_serial ()

  portion of init_serial() specific to derived model classes

- virtual void derived_set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  portion of set_communicators() specific to derived model classes

- virtual void derived_free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  portion of free_communicators() specific to derived model classes

Protected Attributes

- Variables currentVariables

  the set of current variables used by the model for performing function evaluations

- size_t numDerivVars

  the number of active continuous variables used in computing most response derivatives (i.e., in places such as quasi-Hessians and response corrections where only the active continuous variables are supported)

- Response currentResponse

  the set of current responses that holds the results of model function evaluations

- size_t numFns

  the number of functions in currentResponse

- Constraints userDefinedConstraints

  Explicit constraints on variables are maintained in the Constraints class hierarchy. Currently, this includes linear constraints and bounds, but could be extended in the future to include other explicit constraints which (1) have their form specified by the user, and (2) are not catalogued in Response since their form and coefficients are published to an iterator at startup.

- String modelType

  type of model: single, nested, or surrogate

- String surrogateType

  type of surrogate model: local_∗, multipoint_∗, global_∗, or hierarchical

- String gradType

  grad type: none,numerical,analytic,mixed

- String methodSrc

  method source: dakota,vendor

- String intervalType

  interval type: forward,central

- bool ignoreBounds

  option to ignore bounds when computing < finite differences

- bool centralHess

  option to use old 2nd-order finite diffs for Hessians

- RealVector fdGradSS

  relative step sizes for numerical gradients

- IntList gradIdAnalytic

  analytic id's for mixed gradients

- IntList gradIdNumerical

  numerical id's for mixed gradients

- String hessType

  Hess type: none,numerical,quasi,analytic,mixed.

- String quasiHessType

  quasi-Hessian type: bfgs, damped_bfgs, sr1

- RealVector fdHessByGradSS

  relative step sizes for numerical Hessians < estimated with 1st-order grad differences

- RealVector fdHessByFnSS

  relative step sizes for numerical Hessians < estimated with 2nd-order fn differences

- IntList hessIdAnalytic

  analytic id's for mixed Hessians

- IntList hessIdNumerical

  numerical id's for mixed Hessians

- IntList hessIdQuasi

  quasi id's for mixed Hessians

- bool supportsEstimDerivs

  whether model should perform or forward < derivative estimation

- IntArray messageLengths

  length of packed MPI buffers containing vars, vars/set, response, and PRPair

- ProblemDescDB & probDescDB

  class member reference to the problem description database

- ParallelLibrary & parallelLib

  class member reference to the parallel library

- ParConfigLIter modelPCIter

  the ParallelConfiguration node used by this model instance

- short componentParallelMode

  the component parallelism mode: 0 (none), 1 (INTERFACE/LF_MODEL), or 2 (SUB_MODEL/HF_-MODEL/TRUTH_MODEL)

- bool asynchEvalFlag

  flags asynch evaluations (local or distributed)

- short outputLevel

  output verbosity level: {SILENT,QUIET,NORMAL,VERBOSE,DEBUG}_OUTPUT

- IntSetArray discreteDesignSetIntValues

  array of IntSet's, each containing the set of allowable integer values corresponding to discrete design integer set variable

- RealSetArray discreteDesignSetRealValues

  array of RealSet's, each containing the set of allowable real values corresponding to discrete design real set variable

- Pecos::DistributionParams distParams

  container for random variable distribution parameters

- IntSetArray discreteStateSetIntValues

  array of IntSet's, each containing the set of allowable integer values corresponding to discrete state integer set variable

- RealSetArray discreteStateSetRealValues

  array of RealSet's, each containing the set of allowable real values corresponding to discrete state real set variable

- RealVector primaryRespFnWts

  primary response function weightings (either weights for multiobjective optimization or weighted least squares)

Private Member Functions

- Model ∗ get_model (ProblemDescDB &problem_db)

  Used by the envelope to instantiate the correct letter class.

- int estimate_derivatives (const ShortArray &map_asv, const ShortArray &fd_grad_asv, const ShortArray &fd_hess_asv, const ShortArray &quasi_hess_asv, const ActiveSet &original_set, const bool asynch_-flag)

  evaluate numerical gradients using finite differences. This routine is selected with "method_source dakota" (the default method_source) in the numerical gradient specification.

- void synchronize_derivatives (const Variables &vars, const IntResponseMap &fd_responses, Response &new_response, const ShortArray &fd_grad_asv, const ShortArray &fd_hess_asv, const ShortArray &quasi_hess_asv, const ActiveSet &original_set)

  combine results from an array of finite difference response objects (fd_grad_responses) into a single response (new_response)

- void update_response (const Variables &vars, Response &new_response, const ShortArray &fd_grad_-asv, const ShortArray &fd_hess_asv, const ShortArray &quasi_hess_asv, const ActiveSet &original_set, Response &initial_map_response, const RealMatrix &new_fn_grads, const RealSymMatrixArray &new_-fn_hessians)

  overlay results to update a response object

- void update_quasi_hessians (const Variables &vars, Response &new_response, const ActiveSet &original_set)

  perform quasi-Newton Hessian updates

- bool manage_asv (const ShortArray &asv_in, ShortArray &map_asv_out, ShortArray &fd_grad_asv_out, ShortArray &fd_hess_asv_out, ShortArray &quasi_hess_asv_out)

  Coordinates usage of estimate_derivatives() calls based on asv_in.

Private Attributes

- String modelId

  model identifier string from the input file

- int modelEvalCntr

  evaluation counter for top-level compute_response() and asynch_compute_response() calls. Differs from lower level counters in case of numerical derivative estimation (several lower level evaluations are assimilated into a single higher level evaluation)

- bool estDerivsFlag

  flags presence of estimated derivatives within a set of calls to asynch_compute_response()

- int evaluationCapacity

  capacity for concurrent evaluations supported by the Model

- std::map< int, ParConfigLIter > modelPCIterMap

  map<> used for tracking modelPCIter instances using concurrency level as the lookup key

- bool initCommsBcastFlag

  flag for determining need to bcast the max concurrency from init_communicators(); set from Strategy::init_iterator()

- bool modelAutoGraphicsFlag

  flag for posting of graphics data within compute_response (automatic graphics posting in the model as opposed to graphics posting at the strategy level)

- ModelList modelList

  used to collect sub-models for subordinate_models()

- VariablesList varsList

  history of vars populated in asynch_compute_response() and used in synchronize().

- std::list< ShortArray > asvList

  if estimate_derivatives() is used, transfers ASVs from asynch_compute_response() to synchronize()

- std::list< ActiveSet > setList

  if estimate_derivatives() is used, transfers ActiveSets from asynch_compute_response() to synchronize()

- BoolList initialMapList

  transfers initial_map flag values from estimate_derivatives() to synchronize_derivatives()

- BoolList dbCaptureList

  transfers db_capture flag values from estimate_derivatives() to synchronize_derivatives()

- ResponseList dbResponseList

  transfers database captures from estimate_derivatives() to synchronize_derivatives()

- RealList deltaList

  transfers deltas from estimate_derivatives() to synchronize_derivatives()

- IntIntMap numFDEvalsMap

  tracks the number of evaluations used within estimate_derivatives(). Used in synchronize() as a key for combining finite difference responses into numerical gradients.

- IntIntMap rawEvalIdMap

  maps from the raw evaluation ids returned by derived_synchronize() and derived_synchronize_nowait() to the corresponding modelEvalCntr id. Used for rekeying responseMap.

- RealVectorArray xPrev

  previous parameter vectors used in computing s for quasi-Newton updates

- RealMatrix fnGradsPrev

  previous gradient vectors used in computing y for quasi-Newton updates

- RealSymMatrixArray quasiHessians

  quasi-Newton Hessian approximations

- SizetArray numQuasiUpdates

  number of quasi-Newton Hessian updates applied

- IntResponseMap responseMap

  used to return a map of responses for asynchronous evaluations in final concatenated form. The similar map in Interface contains raw responses.

- IntResponseMap graphicsRespMap

  used to cache the data returned from derived_synchronize_nowait() prior to sequential input into the graphics

- Model $*$ modelRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing modelRep

43.59.1 Detailed Description

Base class for the model class hierarchy. The Model class is the base class for one of the primary class hierarchies in DAKOTA. The model hierarchy contains a set of variables, an interface, and a set of responses, and an iterator operates on the model to map the variables into responses using the interface. For memory efficiency and enhanced polymorphism, the model hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Model) serves as the envelope and one of the derived classes (selected in Model::get_model()) serves as the letter.

43.59.2 Constructor & Destructor Documentation

43.59.2.1 Model ()

default constructor The default constructor is used in vector<Model> instantiations and for initialization of Model objects contained in Iterator and derived Strategy classes. modelRep is NULL in this case (a populated problem_db is needed to build a meaningful Model object). This makes it necessary to check for NULL in the copy constructor, assignment operator, and destructor.

43.59.2.2 Model (ProblemDescDB & *problem_db*)

standard constructor for envelope Used in model instantiations within strategy constructors. Envelope constructor only needs to extract enough data to properly execute get_model, since Model(BaseConstructor, problem_db) builds the actual base class data for the derived models.

References Dakota::abort_handler(), Model::get_model(), and Model::modelRep.

43.59.2.3 Model (const Model & *model*)

copy constructor Copy constructor manages sharing of modelRep and incrementing of referenceCount.

References Model::modelRep, and Model::referenceCount.

43.59.2.4 ~Model () `[virtual]`

destructor Destructor decrements referenceCount and only deletes modelRep when referenceCount reaches zero.

References Model::modelRep, and Model::referenceCount.

43.59.2.5 Model (BaseConstructor, ProblemDescDB & *problem_db*) `[protected]`

constructor initializing the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor builds the base class data for all inherited models. get_model() instantiates a derived class and the derived class selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_model() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~Model).

References Model::fdGradSS, Model::fdHessByFnSS, Model::fdHessByGradSS, Model::gradIdNumerical, Model::gradType, Model::hessIdNumerical, and Model::hessType.

43.59.2.6 Model (RecastBaseConstructor, ProblemDescDB & *problem_db*, ParallelLibrary & *parallel_lib*) [protected]

constructor initializing base class for recast model class instances constructed on the fly This constructor also builds the base class data for inherited models. However, it is used for recast models which are instantiated on the fly. Therefore it only initializes a small subset of attributes. Note that parallel_lib is managed separately from problem_db since parallel_lib is needed even in cases where problem_db is an empty envelope (i.e., use of dummy_db in Model(NoDBBaseConstructor) above.

43.59.3 Member Function Documentation

43.59.3.1 Model operator= (const Model & *model*)

assignment operator Assignment operator decrements referenceCount for old modelRep, assigns new modelRep, and increments referenceCount for new modelRep.

References Model::modelRep, and Model::referenceCount.

43.59.3.2 Iterator & subordinate_iterator () [virtual]

return the sub-iterator in nested and surrogate models return by reference requires use of dummy objects, but is important to allow use of assign_rep() since this operation must be performed on the original envelope object.

Reimplemented in DataFitSurrModel, NestedModel, and RecastModel.

References Dakota::dummy_iterator, Model::modelRep, and Model::subordinate_iterator().

Referenced by NonDExpansion::compute_expansion(), NonDExpansion::compute_print_converged_results(), NonDExpansion::compute_print_iteration_results(), NonDExpansion::finalize_sets(), NonDGlobalReliability::get_best_sample(), NonDPolynomialChaos::increment_expansion(), NonDExpansion::increment_sets(), NLPQLPOptimizer::initialize(), NCSUOptimizer::initialize(), DOTOptimizer::initialize(), CONMINOptimizer::initialize(), NonDExpansion::initialize_expansion(), NonDExpansion::initialize_sets(), NonDStochCollocation::initialize_u_space_model(), NonDPolynomialChaos::initialize_u_space_model(), NonDExpansion::initialize_u_space_model(), SurrBasedLocalMinimizer::minimize_surrogates(), SurrBasedGlobalMinimizer::minimize_surrogates(), NonDLocalInterval::NonDLocalInterval(), NonDLocalReliability::NonDLocalReliability(), NonDGlobalReliability::optimize_gaussian_process(), NonDExpansion::refine_expansion(), SOLBase::SOLBase(), RecastModel::subordinate_iterator(), Model::subordinate_iterator(), and NonDExpansion::update_hierarchy().

43.59.3.3 Model & subordinate_model () [virtual]

return a single sub-model defined from subModel in nested and recast models and truth_model() in surrogate models; used for a directed dive through model recursions that may bypass some components. return by reference requires use of dummy objects, but is important to allow use of assign_rep() since this operation must be performed on the original envelope object.

Reimplemented in NestedModel, RecastModel, and SurrogateModel.

References Dakota::dummy_model, Model::modelRep, and Model::subordinate_model().

Referenced by NonDGlobalReliability::expected_feasibility(), NonDGlobalReliability::expected_-improvement(), SurrogateModel::force_rebuild(), Minimizer::initialize_scaling(), NonDExpansion::initialize_-u_space_model(), NonDGlobalReliability::optimize_gaussian_process(), LeastSq::post_run(), COLINOptimizer::post_run(), Optimizer::primary_resp_recast(), LeastSq::primary_resp_recast(), Model::subordinate_model(), and DataFitSurrModel::update_global().

43.59.3.4 Model & surrogate_model () [virtual]

return the approximation sub-model in surrogate models return by reference requires use of dummy objects, but is important to allow use of assign_rep() since this operation must be performed on the original envelope object.

Reimplemented in DataFitSurrModel, HierarchSurrModel, and RecastModel.

References Dakota::dummy_model, Model::modelRep, and Model::surrogate_model().

Referenced by SurrBasedLocalMinimizer::find_center_approx(), SurrBasedLocalMinimizer::minimize_-surrogates(), SurrBasedGlobalMinimizer::minimize_surrogates(), SurrBasedLocalMinimizer::SurrBasedLocalMinimizer(), RecastModel::surrogate_model(), and Model::surrogate_model().

43.59.3.5 Model & truth_model () [virtual]

return the truth sub-model in surrogate models return by reference requires use of dummy objects, but is important to allow use of assign_rep() since this operation must be performed on the original envelope object.

Reimplemented in DataFitSurrModel, HierarchSurrModel, and RecastModel.

References Dakota::dummy_model, Model::modelRep, and Model::truth_model().

Referenced by SurrogateModel::force_rebuild(), SurrBasedMinimizer::initialize_graphics(), SurrBasedLocalMinimizer::minimize_surrogates(), SurrBasedGlobalMinimizer::minimize_surrogates(), SurrBasedMinimizer::print_results(), SurrogateModel::subordinate_model(), SurrBasedLocalMinimizer::SurrBasedLocalMinimizer(), RecastModel::truth_model(), and Model::truth_model().

43.59.3.6 void update_from_subordinate_model (bool *recurse_flag* = true) [virtual]

propagate vars/labels/bounds/targets from the bottom up used only for instantiate-on-the-fly model recursions (all RecastModel instantiations and alternate DataFitSurrModel instantiations). Single, Hierarchical, and Nested Models do not redefine the function since they do not support instantiate-on-the-fly. This means that the recursion will stop as soon as it encounters a Model that was instantiated normally, which is appropriate since ProblemDescDB-constructed Models use top-down information flow and do not require bottom-up updating.

Reimplemented in DataFitSurrModel, and RecastModel.

References Model::modelRep, and Model::update_from_subordinate_model().

Referenced by NonDLocalReliability::initialize_class_data(), NonDExpansion::initialize_expansion(), Optimizer::initialize_run(), LeastSq::initialize_run(), EffGlobalMinimizer::minimize_surrogates_-on_model(), NonDGlobalReliability::optimize_gaussian_process(), NonDLocalInterval::quantify_-uncertainty(), NonDGlobalInterval::quantify_uncertainty(), RecastModel::update_from_subordinate_model(), DataFitSurrModel::update_from_subordinate_model(), and Model::update_from_subordinate_model().

43.59.3.7 Interface & interface () [virtual]

return the interface employed by the derived model class, if present: SingleModel::userDefinedInterface, DataFitSurrModel::approxInterface, or NestedModel::optionalInterface return by reference requires use of dummy objects, but is important to allow use of assign_rep() since this operation must be performed on the original envelope object.

Reimplemented in DataFitSurrModel, NestedModel, RecastModel, and SingleModel.

References Dakota::dummy_interface, Model::interface(), and Model::modelRep.

Referenced by RecastModel::interface(), Model::interface(), and SurrBasedGlobalMinimizer::minimize_surrogates().

43.59.3.8 String local_eval_synchronization () [virtual]

return derived model synchronization setting SingleModels and HierarchSurrModels redefine this virtual function. A default value of "synchronous" prevents asynch local operations for:

- NestedModels: a subIterator can support message passing parallelism, but not asynch local.
- DataFitSurrModels: while asynch evals on approximations will work due to some added bookkeeping, avoiding them is preferable.

Reimplemented in RecastModel, and SingleModel.

References Model::local_eval_synchronization(), and Model::modelRep.

Referenced by Model::init_serial(), RecastModel::local_eval_synchronization(), Model::local_eval_synchronization(), and Model::set_communicators().

43.59.3.9 int local_eval_concurrency () [virtual]

return derived model asynchronous evaluation concurrency SingleModels and HierarchSurrModels redefine this virtual function.

Reimplemented in RecastModel, and SingleModel.

References Model::local_eval_concurrency(), and Model::modelRep.

Referenced by RecastModel::local_eval_concurrency(), Model::local_eval_concurrency(), and Model::set_communicators().

43.59.3.10 const String & interface_id () const [virtual]

return the interface identifier return by reference requires use of dummy objects, but is important to allow use of assign_rep() since this operation must be performed on the original envelope object.

Reimplemented in DataFitSurrModel, NestedModel, RecastModel, and SingleModel.

References Dakota::dummy_interface, Interface::interface_id(), Model::interface_id(), and Model::modelRep.

Referenced by DataFitSurrModel::build_global(), DataFitSurrModel::DataFitSurrModel(), Model::estimate_derivatives(), Model::estimate_message_lengths(), SurrBasedLocalMinimizer::find_center_approx(),

RecastModel::interface_id(), Model::interface_id(), Optimizer::local_objective_recast_retrieve(), SNLLLeastSq::post_run(), COLINOptimizer::post_run(), SurrBasedMinimizer::print_results(), Optimizer::print_results(), LeastSq::print_results(), SequentialHybridStrategy::run_sequential(), DiscrepancyCorrection::search_db(), Analyzer::update_best(), SequentialHybridStrategy::update_local_results(), ConcurrentStrategy::update_local_results(), and NonDLocalReliability::update_mpp_search_data().

43.59.3.11 bool evaluation_cache () const `[virtual]`

Indicates the usage of an evaluation cache by the Model. Only Models including ApplicationInterfaces support an evaluation cache: surrogate, nested, and recast mappings are not stored in the cache. Possible exceptions: HierarchSurrModel, NestedModel::optionalInterface.

Reimplemented in SingleModel.

References Model::evaluation_cache(), and Model::modelRep.

Referenced by DataFitSurrModel::DataFitSurrModel(), and Model::evaluation_cache().

43.59.3.12 ModelList & subordinate_models (bool *recurse_flag* = `true`)

return the sub-models in nested and surrogate models since modelList is built with list insertions (using envelope copies), these models may not be used for model.assign_rep() since this operation must be performed on the original envelope object. They may, however, be used for letter-based operations (including assign_rep() on letter contents such as an interface).

References Model::derived_subordinate_models(), Model::modelList, Model::modelRep, and Model::subordinate_models().

Referenced by NLPQLPOptimizer::initialize(), NCSUOptimizer::initialize(), DOTOptimizer::initialize(), CONMINOptimizer::initialize(), NonDLocalInterval::NonDLocalInterval(), NonDLocalReliability::NonDLocalReliability(), SOLBase::SOLBase(), Model::subordinate_models(), and SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.59.3.13 void init_communicators (const int & *max_iterator_concurrency*, bool *recurse_flag* = `true`)

allocate communicator partitions for a model and store configuration in modelPCIterMap The init_communicators() and derived_init_communicators() functions are stuctured to avoid performing the messageLengths estimation more than once. init_communicators() (not virtual) performs the estimation and then forwards the results to derived_init_communicators (virtual) which uses the data in different contexts.

References ParallelLibrary::bcast_i(), Model::derived_init_communicators(), Model::estimate_message_lengths(), ParallelLibrary::increment_parallel_configuration(), Model::init_communicators(), Model::initCommsBcastFlag, Model::messageLengths, Model::modelPCIter, Model::modelPCIterMap, Model::modelRep, ParallelLibrary::parallel_configuration_iterator(), and Model::parallelLib.

Referenced by APPSOptimizer::APPSOptimizer(), COLINOptimizer::COLINOptimizer(), NonDExpansion::construct_expansion_sampler(), RecastModel::derived_init_communicators(), NestedModel::derived_init_communicators(), HierarchSurrModel::derived_init_communicators(), DataFitSurrModel::derived_init_communicators(), EffGlobalMinimizer::EffGlobalMinimizer(), Model::init_communicators(), Strategy::init_iterator(), JEGAOptimizer::JEGAOptimizer(), LeastSq::LeastSq(),

NonDLocalReliability::method_recourse(), NonDLocalInterval::method_recourse(), NonDBayesCalibration::NonDBayesCalibration(), NonDGlobalInterval::NonDGlobalInterval(), NonDGlobalReliability::NonDGlobalReliability(), NonDGPImpSampling::NonDGPImpSampling(), NonDGPMSABayesCalibration::NonDGPMSABayesCalibration(), NonDLHSInterval::NonDLHSInterval(), NonDLocalInterval::NonDLocalInterval(), NonDLocalReliability::NonDLocalReliability(), NonDPolynomialChaos::NonDPolynomialChaos(), NonDStochCollocation::NonDStochCollocation(), Optimizer::Optimizer(), Model::serve_configurations(), SNLLOptimizer::SNLLOptimizer(), SurrBasedGlobalMinimizer::SurrBasedGlobalMinimizer(), and SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.59.3.14 void init_serial ()

for cases where init_communicators() will not be called, modify some default settings to behave properly in serial. The init_serial() and derived_init_serial() functions are stuctured to separate base class (common) operations from derived class (specialized) operations.

References Model::asynchEvalFlag, Model::derived_init_serial(), Model::init_serial(), Model::local_eval_synchronization(), and Model::modelRep.

Referenced by RecastModel::derived_init_serial(), NestedModel::derived_init_serial(), HierarchSurrModel::derived_init_serial(), DataFitSurrModel::derived_init_serial(), and Model::init_serial().

43.59.3.15 void estimate_message_lengths ()

estimate messageLengths for a model This functionality has been pulled out of init_communicators() and defined separately so that it may be used in those cases when messageLengths is needed but model.init_communicators() is not called, e.g., for the master processor in the self-scheduling of a concurrent iterator strategy.

References Response::active_set_derivative_vector(), Response::copy(), Model::currentResponse, Model::currentVariables, Model::estimate_message_lengths(), Model::interface_id(), Model::messageLengths, Model::modelRep, Model::numFns, Model::parallelLib, MPIPackBuffer::reset(), MPIPackBuffer::size(), and ParallelLibrary::world_size().

Referenced by ConcurrentStrategy::ConcurrentStrategy(), Model::estimate_message_lengths(), and Model::init_communicators().

43.59.3.16 void assign_rep (Model * *model_rep*, bool *ref_count_incr* = `true`)

replaces existing letter with a new one Similar to the assignment operator, the assign_rep() function decrements referenceCount for the old modelRep and assigns the new modelRep. It is different in that it is used for publishing derived class letters to existing envelopes, as opposed to sharing representations among multiple envelopes (in particular, assign_rep is passed a letter object and operator= is passed an envelope object). Letter assignment supports two models as governed by ref_count_incr:

- ref_count_incr = true (default): the incoming letter belongs to another envelope. In this case, increment the reference count in the normal manner so that deallocation of the letter is handled properly.
- ref_count_incr = false: the incoming letter is instantiated on the fly and has no envelope. This case is modeled after get_model(): a letter is dynamically allocated using new and passed into assign_rep, the letter's reference count is not incremented, and the letter is not remotely deleted (its memory management is passed over to the envelope).

References Dakota::abort_handler(), Model::modelRep, and Model::referenceCount.

Referenced by NonD::construct_u_space_model(), EffGlobalMinimizer::EffGlobalMinimizer(), LeastSq::LeastSq(), NonDBayesCalibration::NonDBayesCalibration(), NonDGlobalInterval::NonDGlobalInterval(), NonDGlobalReliability::NonDGlobalReliability(), NonDGPImpSampling::NonDGPImpSampling(), NonDLocalInterval::NonDLocalInterval(), NonDLocalReliability::NonDLocalReliability(), NonDPolynomialChaos::NonDPolynomialChaos(), NonDStochCollocation::NonDStochCollocation(), Optimizer::Optimizer(), and SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.59.3.17 int derivative_concurrency () const

return the gradient concurrency for use in parallel configuration logic This function assumes derivatives with respect to the active continuous variables. Therefore, concurrency with respect to the inactive continuous variables is not captured.

References Dakota::contains(), Model::derivative_concurrency(), Model::gradIdAnalytic, Model::gradType, Model::hessIdNumerical, Model::hessType, Model::intervalType, Model::methodSrc, Model::modelRep, and Model::numDerivVars.

Referenced by Model::derivative_concurrency(), HierarchSurrModel::derived_free_communicators(), HierarchSurrModel::derived_init_communicators(), DataFitSurrModel::derived_init_communicators(), HierarchSurrModel::derived_set_communicators(), NonDExpansion::initialize_u_space_model(), NonDPolynomialChaos::NonDPolynomialChaos(), NonDStochCollocation::NonDStochCollocation(), Iterator::num_samples(), NonDPolynomialChaos::∼NonDPolynomialChaos(), and NonDStochCollocation::∼NonDStochCollocation().

43.59.3.18 Real FDstep1 (const Real & *x0_j*, const Real & *lb_j*, const Real & *ub_j*, Real *h_mag*)

function returning finite-difference step size (affected by bounds) Auxiliary function to compute forward or first central-difference step size.

References Model::shortStep.

Referenced by Model::estimate_derivatives().

43.59.3.19 Real FDstep2 (const Real & *x0_j*, const Real & *lb_j*, const Real & *ub_j*, Real *h*)

function returning second central-difference step size (affected by bounds) Auxiliary function to second central-difference step size, honoring bounds.

References Model::ignoreBounds, and Model::shortStep.

Referenced by Model::estimate_derivatives().

43.59.3.20 Model ∗ get_model (ProblemDescDB & *problem_db*) `[private]`

Used by the envelope to instantiate the correct letter class. Used only by the envelope constructor to initialize modelRep to the appropriate derived type, as given by the modelType attribute.

References ProblemDescDB::get_string(), Model::model_type(), and Model::modelType.

Referenced by Model::Model().

43.59.3.21 int estimate_derivatives (const ShortArray & *map_asv*, const ShortArray & *fd_grad_asv*, const ShortArray & *fd_hess_asv*, const ShortArray & *quasi_hess_asv*, const ActiveSet & *original_set*, const bool *asynch_flag*) [private]

evaluate numerical gradients using finite differences. This routine is selected with "method_source dakota" (the default method_source) in the numerical gradient specification. Estimate derivatives by computing finite difference gradients, finite difference Hessians, and/or quasi-Newton Hessians. The total number of finite difference evaluations is returned for use by synchronize() to track response arrays, and it could be used to improve management of max_function_evaluations within the iterators.

! new logic

References Model::all_continuous_lower_bounds(), Model::all_continuous_upper_bounds(), Model::all_continuous_variable_ids(), Variables::all_continuous_variables(), Model::centralHess, Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::continuous_variable_ids(), Variables::continuous_variable_ids(), Variables::continuous_variables(), Response::copy(), Dakota::copy_data(), Model::currentResponse, Model::currentVariables, Dakota::data_pairs, Model::dbCaptureList, Model::dbResponseList, Model::deltaList, ActiveSet::derivative_vector(), Model::derived_asynch_compute_response(), Model::derived_compute_response(), Model::fdGradSS, Model::fdHessByFnSS, Model::fdHessByGradSS, Model::FDstep1(), Model::FDstep2(), Dakota::find_index(), Response::function_gradients(), Response::function_values(), Model::ignoreBounds, Model::inactive_continuous_lower_bounds(), Model::inactive_continuous_upper_bounds(), Model::inactive_continuous_variable_ids(), Variables::inactive_continuous_variable_ids(), Variables::inactive_continuous_variables(), Model::initialMapList, Model::interface_id(), Model::intervalType, Dakota::lookup_by_val(), Model::numFns, Model::outputLevel, ActiveSet::request_vector(), Model::shortStep, and Model::update_response().

Referenced by Model::asynch_compute_response(), and Model::compute_response().

43.59.3.22 void synchronize_derivatives (const Variables & *vars*, const IntResponseMap & *fd_responses*, Response & *new_response*, const ShortArray & *fd_grad_asv*, const ShortArray & *fd_hess_asv*, const ShortArray & *quasi_hess_asv*, const ActiveSet & *original_set*) [private]

combine results from an array of finite difference response objects (fd_grad_responses) into a single response (new_response) Merge an array of fd_responses into a single new_response. This function is used both by synchronous compute_response() for the case of asynchronous estimate_derivatives() and by synchronize() for the case where one or more asynch_compute_response() calls has employed asynchronous estimate_derivatives().

!

References Response::active_set(), Model::acv(), Variables::all_continuous_variable_ids(), Model::centralHess, Variables::continuous_variable_ids(), Response::copy(), Model::currentResponse, Model::currentVariables, Model::cv(), Model::dbCaptureList, Model::dbResponseList, Model::deltaList, ActiveSet::derivative_vector(), Dakota::find_index(), Response::function_gradients(), Response::function_values(), Model::icv(), Variables::inactive_continuous_variable_ids(), Model::initialMapList, Model::intervalType, Model::numFns, ActiveSet::request_values(), Response::reset_inactive(), and Model::update_response().

Referenced by Model::compute_response(), and Model::synchronize().

43.59.3.23 void update_response (const Variables & *vars*, Response & *new_response*, const ShortArray & *fd_grad_asv*, const ShortArray & *fd_hess_asv*, const ShortArray & *quasi_hess_asv*, const ActiveSet & *original_set*, Response & *initial_map_response*, const RealMatrix & *new_fn_grads*, const RealSymMatrixArray & *new_fn_hessians*) `[private]`

overlay results to update a response object Overlay the initial_map_response with numerically estimated new_fn_-grads and new_fn_hessians to populate new_response as governed by asv vectors. Quasi-Newton secant Hessian updates are also performed here, since this is where the gradient data needed for the updates is first consolidated. Convenience function used by estimate_derivatives() for the synchronous case and by synchronize_derivatives() for the asynchronous case.

References Response::active_set_request_vector(), Variables::continuous_variable_ids(), Response::copy(), Model::currentResponse, Model::currentVariables, ActiveSet::derivative_vector(), Response::function_-gradients(), Response::function_hessians(), Response::function_values(), Model::hessIdQuasi, Model::hessType, Response::is_null(), Model::numFns, Model::outputLevel, Model::quasiHessians, ActiveSet::request_-vector(), Response::reset_inactive(), Model::supportsEstimDerivs, Model::surrogate_response_mode(), and Model::update_quasi_hessians().

Referenced by Model::estimate_derivatives(), and Model::synchronize_derivatives().

43.59.3.24 void update_quasi_hessians (const Variables & *vars*, Response & *new_response*, const ActiveSet & *original_set*) `[private]`

perform quasi-Newton Hessian updates quasi-Newton updates are performed for approximating response function Hessians using BFGS or SR1 formulations. These Hessians are supported only for the active continuous variables, and a check is performed on the DVV prior to invoking the function.

References Dakota::contains(), Variables::continuous_variables(), Dakota::copy_data(), Model::fnGradsPrev, Response::function_gradients(), Model::hessIdQuasi, Model::hessType, Model::modelType, Model::numDerivVars, Model::numFns, Model::numQuasiUpdates, Model::outputLevel, Model::quasiHessians, Model::quasiHessType, ActiveSet::request_vector(), and Model::xPrev.

Referenced by Model::update_response().

43.59.3.25 bool manage_asv (const ShortArray & *asv_in*, ShortArray & *map_asv_out*, ShortArray & *fd_grad_asv_out*, ShortArray & *fd_hess_asv_out*, ShortArray & *quasi_hess_asv_out*) `[private]`

Coordinates usage of estimate_derivatives() calls based on asv_in. Splits asv_in total request into map_asv_out, fd_grad_asv_out, fd_hess_asv_out, and quasi_hess_asv_out as governed by the responses specification. If the returned use_est_deriv is true, then these asv outputs are used by estimate_derivatives() for the initial map, finite difference gradient evals, finite difference Hessian evals, and quasi-Hessian updates, respectively. If the returned use_est_deriv is false, then only map_asv_out is used.

References Dakota::abort_handler(), Dakota::contains(), Model::gradIdAnalytic, Model::gradIdNumerical, Model::gradType, Model::hessIdAnalytic, Model::hessIdNumerical, Model::hessIdQuasi, Model::hessType, Model::intervalType, Model::methodSrc, Model::supportsEstimDerivs, and Model::surrogate_response_mode().

Referenced by Model::asynch_compute_response(), and Model::compute_response().

The documentation for this class was generated from the following files:

- DakotaModel.H
- DakotaModel.C

43.60 MPIPackBuffer Class Reference

Class for packing MPI message buffers.

Public Member Functions

- MPIPackBuffer (int size_=1024)

  Constructor, which allows the default buffer size to be set.

- ~MPIPackBuffer ()

  Desctructor.

- const char * buf ()

  Returns a pointer to the internal buffer that has been packed.

- int size ()

  The number of bytes of packed data.

- int capacity ()

  the allocated size of Buffer.

- void reset ()

  Resets the buffer index in order to reuse the internal buffer.

- void pack (const int *data, const int num=1)

  *Pack one or more **int's**.*

- void pack (const u_int *data, const int num=1)

  *Pack one or more **unsigned int's**.*

- void pack (const long *data, const int num=1)

  *Pack one or more **long's**.*

- void pack (const u_long *data, const int num=1)

  *Pack one or more **unsigned long's**.*

- void pack (const short *data, const int num=1)

  *Pack one or more **short's**.*

- void pack (const u_short *data, const int num=1)

  *Pack one or more **unsigned short's**.*

- void pack (const char *data, const int num=1)

  *Pack one or more **char's**.*

- void pack (const u_char *data, const int num=1)

  *Pack one or more **unsigned char's**.*

- void pack (const double *data, const int num=1)

  *Pack one or more **double's**.*

- void pack (const float *data, const int num=1)

  *Pack one or more **float's**.*

- void pack (const bool *data, const int num=1)

  *Pack one or more **bool's**.*

- void pack (const int &data)

  *Pack a **int**.*

- void pack (const u_int &data)

  *Pack a **unsigned int**.*

- void pack (const long &data)

  *Pack a **long**.*

- void pack (const u_long &data)

  *Pack a **unsigned long**.*

- void pack (const short &data)

  *Pack a **short**.*

- void pack (const u_short &data)

  *Pack a **unsigned short**.*

- void pack (const char &data)

  *Pack a **char**.*

- void pack (const u_char &data)

  *Pack a **unsigned char**.*

- void pack (const double &data)

  *Pack a **double**.*

- void pack (const float &data)

  *Pack a **float**.*

- void pack (const bool &data)

  *Pack a **bool**.*

Protected Member Functions

- void resize (const int newsize)

  Resizes the internal buffer.

Protected Attributes

- char * Buffer

  The internal buffer for packing.

- int Index

  The index into the current buffer.

- int Size

  The total size that has been allocated for the buffer.

43.60.1 Detailed Description

Class for packing MPI message buffers. A class that provides a facility for packing message buffers using the MPI_Pack facility. The `MPIPackBuffer` class dynamically resizes the internal buffer to contain enough memory to pack the entire object. When deleted, the `MPIPackBuffer` object deletes this internal buffer. This class is based on the Dakota_Version_3_0 version of utilib::PackBuffer from utilib/src/io/PackBuf.[cpp,h]

The documentation for this class was generated from the following files:

- MPIPackBuffer.H
- MPIPackBuffer.C

43.61 MPIUnpackBuffer Class Reference

Class for unpacking MPI message buffers.

Public Member Functions

- void setup (char *buf_, int size_, bool flag_=false)

  Method that does the setup for the constructors.

- MPIUnpackBuffer ()

  Default constructor.

- MPIUnpackBuffer (int size_)

  Constructor that specifies the size of the buffer.

- MPIUnpackBuffer (char *buf_, int size_, bool flag_=false)

  Constructor that sets the internal buffer to the given array.

- ~MPIUnpackBuffer ()

  Destructor.

- void resize (const int newsize)

  Resizes the internal buffer.

- const char * buf ()

  Returns a pointer to the internal buffer.

- int size ()

  Returns the length of the buffer.

- int curr ()

  Returns the number of bytes that have been unpacked from the buffer.

- void reset ()

  Resets the index of the internal buffer.

- void unpack (int *data, const int num=1)

  *Unpack one or more **int's**.*

- void unpack (u_int *data, const int num=1)

  *Unpack one or more **unsigned int's**.*

- void unpack (long *data, const int num=1)

  *Unpack one or more **long's**.*

- void unpack (u_long *data, const int num=1)
  *Unpack one or more **unsigned long's**.*
- void unpack (short *data, const int num=1)
  *Unpack one or more **short's**.*
- void unpack (u_short *data, const int num=1)
  *Unpack one or more **unsigned short's**.*
- void unpack (char *data, const int num=1)
  *Unpack one or more **char's**.*
- void unpack (u_char *data, const int num=1)
  *Unpack one or more **unsigned char's**.*
- void unpack (double *data, const int num=1)
  *Unpack one or more **double's**.*
- void unpack (float *data, const int num=1)
  *Unpack one or more **float's**.*
- void unpack (bool *data, const int num=1)
  *Unpack one or more **bool's**.*
- void unpack (int &data)
  *Unpack a **int**.*
- void unpack (u_int &data)
  *Unpack a **unsigned int**.*
- void unpack (long &data)
  *Unpack a **long**.*
- void unpack (u_long &data)
  *Unpack a **unsigned long**.*
- void unpack (short &data)
  *Unpack a **short**.*
- void unpack (u_short &data)
  *Unpack a **unsigned short**.*
- void unpack (char &data)
  *Unpack a **char**.*
- void unpack (u_char &data)

*Unpack a **unsigned char**.*

- void unpack (double &data)

  *Unpack a **double**.*

- void unpack (float &data)

  *Unpack a **float**.*

- void unpack (bool &data)

  *Unpack a **bool**.*

Protected Attributes

- char * Buffer

  The internal buffer for unpacking.

- int Index

  The index into the current buffer.

- int Size

  The total size that has been allocated for the buffer.

- bool ownFlag

  If `TRUE`, then this class owns the internal buffer.

43.61.1 Detailed Description

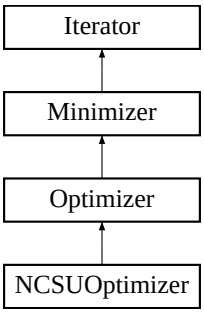
Class for unpacking MPI message buffers. A class that provides a facility for unpacking message buffers using the MPI_Unpack facility. This class is based on the Dakota_Version_3_0 version of utilib::UnPackBuffer from utilib/src/io/PackBuf.[cpp,h]

The documentation for this class was generated from the following files:

- MPIPackBuffer.H
- MPIPackBuffer.C

43.62 NCSUOptimizer Class Reference

Wrapper class for the NCSU DIRECT optimization library. Inheritance diagram for NCSUOptimizer::



Public Member Functions

- NCSUOptimizer (Model &model)

  standard constructor

- NCSUOptimizer (Model &model, const int &max_iter, const int &max_eval, double min_box_size=-1., double vol_box_size=-1., double solution_target=-DBL_MAX)

  alternate constructor for instantiations "on the fly"

- NCSUOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor for Iterator instantiations by name

- NCSUOptimizer (const RealVector &var_l_bnds, const RealVector &var_u_bnds, const int &max_iter, const int &max_eval, double(∗user_obj_eval)(const RealVector &x), double min_box_size=-1., double vol_box_size=-1., double solution_target=-DBL_MAX)

  alternate constructor for instantiations "on the fly"

- ∼NCSUOptimizer ()

  destructor

- void find_optimum ()

  Used within the optimizer branch for computing the optimal solution. Redefines the run virtual function for the optimizer branch.

Private Member Functions

- void initialize ()

  shared code among model-based constructors

- void check_inputs ()

verify problem respects NCSU DIRECT Fortran limits

Static Private Member Functions

- static int objective_eval (int ∗n, double c[ ], double l[ ], double u[ ], int point[ ], int ∗maxI, int ∗start, int ∗maxfunc, double fvec[ ], int iidata[ ], int ∗iisize, double ddata[ ], int ∗idsize, char cdata[ ], int ∗icsize)

  'fep' in Griffin-modified NCSUDirect: computes the value of the objective function (potentially at multiple points, passed by function pointer to NCSUDirect). Include unscaling from DIRECT.

Private Attributes

- short setUpType

  controls iteration mode: SETUP_MODEL (normal usage) or SETUP_USERFUNC (user-supplied functions mode for "on the fly" instantiations). see enum in NCSUOptimizer.C NonDGlobalReliability currently uses the model mode. GaussProcApproximation currently uses the user_functions mode.

- Real minBoxSize

  holds the minimum boxsize

- Real volBoxSize

  hold the minimum volume boxsize

- Real solutionTarget

  holds the solution target minimum to drive towards

- RealVector lowerBounds

  holds variable lower bounds passed in for "user_functions" mode.

- RealVector upperBounds

  holds variable upper bounds passed in for "user_functions" mode.

- double(∗ userObjectiveEval)(const RealVector &x)

  holds function pointer for objective function evaluator passed in for "user_functions" mode.

Static Private Attributes

- static NCSUOptimizer ∗ ncsudirectInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.62.1 Detailed Description

Wrapper class for the NCSU DIRECT optimization library. The NCSUOptimizer class provides a wrapper for a Fortran 77 implementation of the DIRECT algorithm developed at North Carolina State University. It uses a function pointer approach for which passed functions must be either global functions or static member functions. Any attribute used within static member functions must be either local to that function or accessed through a static pointer.

The user input mappings are as follows:

43.62.2 Constructor & Destructor Documentation

43.62.2.1 NCSUOptimizer (Model & *model*)

standard constructor This is the standard constructor with method specification support.

References NCSUOptimizer::check_inputs(), and NCSUOptimizer::initialize().

43.62.2.2 NCSUOptimizer (Model & *model*, const int & *max_iter*, const int & *max_eval*, double *min_box_size* = `-1.`, double *vol_box_size* = `-1.`, double *solution_target* = `-DBL_MAX`)

alternate constructor for instantiations "on the fly" This is an alternate constructor for instantiations on the fly using a Model but no ProblemDescDB.

References NCSUOptimizer::check_inputs(), NCSUOptimizer::initialize(), Iterator::maxFunctionEvals, and Iterator::maxIterations.

43.62.2.3 NCSUOptimizer (NoDBBaseConstructor, Model & *model*)

alternate constructor for Iterator instantiations by name This is an alternate constructor for Iterator instantiations by name using a Model but no ProblemDescDB.

References NCSUOptimizer::check_inputs(), and NCSUOptimizer::initialize().

43.62.2.4 NCSUOptimizer (const RealVector & *var_l_bnds*, const RealVector & *var_u_bnds*, const int & *max_iter*, const int & *max_eval*, double(∗)(const RealVector &x) *user_obj_eval*, double *min_box_size* = `-1.`, double *vol_box_size* = `-1.`, double *solution_target* = `-DBL_MAX`)

alternate constructor for instantiations "on the fly" This is an alternate constructor for performing an optimization using the passed in objective function pointer.

References NCSUOptimizer::check_inputs(), Iterator::maxFunctionEvals, and Iterator::maxIterations.

43.62.3 Member Function Documentation

43.62.3.1 int objective_eval (int * *n*, double *c*[ ], double *l*[ ], double *u*[ ], int *point*[ ], int * *maxI*, int * *start*, int * *maxfunc*, double *fvec*[ ], int *iidata*[ ], int * *iisize*, double *ddata*[ ], int * *idsize*, char *cdata*[ ], int * *icsize*) `[static, private]`

'fep' in Griffin-modified NCSUDirect: computes the value of the objective function (potentially at multiple points, passed by function pointer to NCSUDirect). Include unscaling from DIRECT. Modified batch evaluator that accepts multiple points and returns corresponding vector of functions in fvec. Must be used with modified DIRECT src (DIRbatch.f).

References Model::asynch_compute_response(), Model::asynch_flag(), Model::compute_response(), Model::continuous_variables(), Model::current_response(), Response::function_value(), Iterator::iteratedModel, NCSUOptimizer::ncsudirectInstance, NCSUOptimizer::setUpType, Model::synchronize(), and NCSUOptimizer::userObjectiveEval.

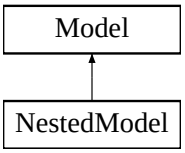
Referenced by NCSUOptimizer::find_optimum().

The documentation for this class was generated from the following files:

- NCSUOptimizer.H
- NCSUOptimizer.C

43.63 NestedModel Class Reference

Derived model class which performs a complete sub-iterator execution within every evaluation of the model. Inheritance diagram for NestedModel::



Public Member Functions

- NestedModel (ProblemDescDB &problem_db)

  constructor

- ~NestedModel ()

  destructor

Protected Member Functions

- void derived_compute_response (const ActiveSet &set)

  portion of compute_response() specific to NestedModel

- void derived_asynch_compute_response (const ActiveSet &set)

  portion of asynch_compute_response() specific to NestedModel

- Iterator & subordinate_iterator ()

  return subIterator

- Model & subordinate_model ()

  return subModel

- void derived_subordinate_models (ModelList &ml, bool recurse_flag)

  return subModel

- Interface & interface ()

  return optionalInterface

- void surrogate_response_mode (bool mode)

  pass a bypass request on to the subModel for any lower-level surrogates

- void component_parallel_mode (short mode)

  update component parallel mode for supporting parallelism in optionalInterface and subModel

- bool derived_master_overload () const

  flag which prevents overloading the master with a multiprocessor evaluation (forwarded to optionalInterface)

- void derived_init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set up optionalInterface and subModel for parallel operations

- void derived_init_serial ()

  set up optionalInterface and subModel for serial operations.

- void derived_set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set active parallel configuration within subModel

- void derived_free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  deallocate communicator partitions for the NestedModel (forwarded to optionalInterface and subModel)

- void serve ()

  Service optionalInterface and subModel job requests received from the master. Completes when a termination message is received from stop_servers().

- void stop_servers ()

  Executed by the master to terminate server operations for subModel and optionalInterface when iteration on the NestedModel is complete.

- const String & interface_id () const

  return the optionalInterface identifier

- int evaluation_id () const

  Return the current evaluation id for the NestedModel.

- void set_evaluation_reference ()

  set the evaluation counter reference points for the NestedModel (request forwarded to optionalInterface and subModel)

- void fine_grained_evaluation_counters ()

  request fine-grained evaluation reporting within optionalInterface and subModel

- void print_evaluation_summary (std::ostream &s, bool minimal_header=false, bool relative_count=true) const

  print the evaluation summary for the NestedModel (request forwarded to optionalInterface and subModel)

Private Member Functions

- void resolve_real_variable_mapping (const String &map1, const String &map2, size_t curr_index, short &inactive_sm_view)

for a named real mapping, resolve primary index and secondary target

- void resolve_integer_variable_mapping (const String &map1, const String &map2, size_t curr_index, short &inactive_sm_view)

  for a named integer mapping, resolve primary index and secondary target

- size_t sm_acv_index_map (size_t pacvm_index, short sacvm_target)

  offset pacvm_index based on sacvm_target to create mapped_index

- size_t sm_adiv_index_map (size_t padivm_index, short sadivm_target)

  offset padivm_index based on sadivm_target to create mapped_index

- size_t sm_adrv_index_map (size_t padrvm_index, short sadrvm_target)

  offset padrvm_index based on sadrvm_target to create mapped_index

- size_t cv_index_map (size_t cv_index)

  offset cv_index to create index into aggregated primary/secondary arrays

- size_t div_index_map (size_t div_index)

  offset div_index to create index into aggregated primary/secondary arrays

- size_t drv_index_map (size_t drv_index)

  offset drv_index to create index into aggregated primary/secondary arrays

- size_t ccv_index_map (size_t ccv_index)

  offset active complement ccv_index to create index into all continuous arrays

- size_t cdiv_index_map (size_t cdiv_index)

  offset active complement cdiv_index to create index into all discrete int arrays

- size_t cdrv_index_map (size_t cdrv_index)

  offset active complement cdrv_index to create index into all discrete real arrays

- void real_variable_mapping (const Real &r_var, size_t mapped_index, short svm_target)

  insert r_var into appropriate recipient

- void integer_variable_mapping (const int &i_var, size_t mapped_index, short svm_target)

  insert i_var into appropriate recipient

- void set_mapping (const ActiveSet &mapped_set, ActiveSet &interface_set, bool &opt_interface_map, ActiveSet &sub_iterator_set, bool &sub_iterator_map)

  define the evaluation requirements for the optionalInterface (interface_set) and the subIterator (sub_iterator_set) from the total model evaluation requirements (mapped_set)

- void response_mapping (const Response &interface_response, const Response &sub_iterator_response, Response &mapped_response)

combine the response from the optional interface evaluation with the response from the sub-iteration using the primaryCoeffs/secondaryCoeffs mappings to create the total response for the model

- void update_inactive_view (short new_view, short &view)

  update inactive variables view for subIterator based on new_view

- void update_inactive_view (unsigned short type, short &view)

  update inactive variables view for subIterator based on type

- void update_sub_model ()

  update subModel with current variable values/bounds/labels

Private Attributes

- int nestedModelEvalCntr

  number of calls to derived_compute_response()/ derived_asynch_compute_response()

- Iterator subIterator

  the sub-iterator that is executed on every evaluation of this model

- Model subModel

  the sub-model used in sub-iterator evaluations

- size_t numSubIterFns

  number of sub-iterator response functions prior to mapping

- size_t numSubIterMappedIneqCon

  number of top-level inequality constraints mapped from the sub-iteration results

- size_t numSubIterMappedEqCon

  number of top-level equality constraints mapped from the sub-iteration results

- Interface optionalInterface

  the optional interface contributes nonnested response data to the total model response

- String optInterfacePointer

  the optional interface pointer from the nested model specification

- Response optInterfaceResponse

  the response object resulting from optional interface evaluations

- size_t numOptInterfPrimary

  number of primary response functions (objective/least squares/generic functions) resulting from optional interface evaluations

- size_t numOptInterfIneqCon

  number of inequality constraints resulting from optional interface evaluations

- size_t numOptInterfEqCon

  number of equality constraints resulting from the optional interface evaluations

- SizetArray active1ACVarMapIndices

  "primary" variable mappings for inserting active continuous currentVariables within all continuous subModel variables. If there are no secondary mappings defined, then the insertions replace the subModel variable values.

- SizetArray active1ADIVarMapIndices

  "primary" variable mappings for inserting active discrete int currentVariables within all discrete int subModel variables. No secondary mappings are defined for discrete int variables, so the insertions replace the subModel variable values.

- SizetArray active1ADRVarMapIndices

  "primary" variable mappings for inserting active discrete real currentVariables within all discrete real subModel variables. No secondary mappings are defined for discrete real variables, so the insertions replace the subModel variable values.

- ShortArray active2ACVarMapTargets

  "secondary" variable mappings for inserting active continuous currentVariables into sub-parameters (e.g., distribution parameters for uncertain variables or bounds for continuous design/state variables) within all continuous subModel variables.

- ShortArray active2ADIVarMapTargets

  "secondary" variable mappings for inserting active discrete int currentVariables into sub-parameters (e.g., bounds for discrete design/state variables) within all discrete int subModel variables.

- ShortArray active2ADRVarMapTargets

  "secondary" variable mappings for inserting active discrete real currentVariables into sub-parameters (e.g., bounds for discrete design/state variables) within all discrete real subModel variables.

- SizetArray complement1ACVarMapIndices

  "primary" variable mappings for inserting the complement of the active continuous currentVariables within all continuous subModel variables

- SizetArray complement1ADIVarMapIndices

  "primary" variable mappings for inserting the complement of the active discrete int currentVariables within all discrete int subModel variables

- SizetArray complement1ADRVarMapIndices

  "primary" variable mappings for inserting the complement of the active discrete real currentVariables within all discrete real subModel variables

- BoolDeque extraCVarsData

  flags for updating subModel continuous bounds and labels, one for each active continuous variable in currentVariables

- BoolDeque extraDIVarsData

  flags for updating subModel discrete int bounds and labels, one for each active discrete int variable in currentVariables

- BoolDeque extraDRVarsData

  flags for updating subModel discrete real bounds and labels, one for each active discrete real variable in currentVariables

- RealMatrix primaryRespCoeffs

  "primary" response_mapping matrix applied to the sub-iterator response functions. For OUU, the matrix is applied to UQ statistics to create contributions to the top-level objective functions/least squares/ generic response terms.

- RealMatrix secondaryRespCoeffs

  "secondary" response_mapping matrix applied to the sub-iterator response functions. For OUU, the matrix is applied to UQ statistics to create contributions to the top-level inequality and equality constraints.

43.63.1 Detailed Description

Derived model class which performs a complete sub-iterator execution within every evaluation of the model. The NestedModel class nests a sub-iterator execution within every model evaluation. This capability is most commonly used for optimization under uncertainty, in which a nondeterministic iterator is executed on every optimization function evaluation. The NestedModel also contains an optional interface, for portions of the model evaluation which are independent from the sub-iterator, and a set of mappings for combining sub-iterator and optional interface data into a top level response for the model.

43.63.2 Member Function Documentation

43.63.2.1 void derived_compute_response (const ActiveSet & *set*) `[protected, virtual]`

portion of compute_response() specific to NestedModel Update subModel's inactive variables with active variables from currentVariables, compute the optional interface and sub-iterator responses, and map these to the total model response.

Reimplemented from Model.

References Response::active_set(), NestedModel::component_parallel_mode(), Model::currentResponse, Model::currentVariables, Interface::map(), NestedModel::nestedModelEvalCntr, NestedModel::optInterfaceResponse, NestedModel::optionalInterface, NestedModel::response_mapping(), Iterator::response_results(), Iterator::response_results_active_set(), Iterator::run_iterator(), NestedModel::set_mapping(), NestedModel::subIterator, and NestedModel::update_sub_model().

43.63.2.2 void derived_asynch_compute_response (const ActiveSet & *set*) `[protected, virtual]`

portion of asynch_compute_response() specific to NestedModel Not currently supported by NestedModels (need to add concurrent iterator support). As a result, derived_synchronize() and derived_synchronize_nowait() are inactive as well).

Reimplemented from Model.

References Dakota::abort_handler(), Response::active_set(), Model::currentResponse, Model::currentVariables, Interface::map(), NestedModel::nestedModelEvalCntr, NestedModel::optInterfaceResponse, NestedModel::optionalInterface, and NestedModel::set_mapping().

43.63.2.3 bool derived_master_overload () const [inline, protected, virtual]

flag which prevents overloading the master with a multiprocessor evaluation (forwarded to optionalInterface) Derived master overload for subModel is handled separately in subModel.compute_response() within subIterator.run().

Reimplemented from Model.

References Interface::iterator_eval_dedicated_master_flag(), Interface::multi_proc_eval_flag(), NestedModel::optInterfacePointer, and NestedModel::optionalInterface.

43.63.2.4 void derived_init_communicators (const int & *max_iterator_concurrency*, bool *recurse_flag* = true) [inline, protected, virtual]

set up optionalInterface and subModel for parallel operations Asynchronous flags need to be initialized for the subModel. In addition, max_iterator_concurrency is the outer level iterator concurrency, not the subIterator concurrency that subModel will see, and recomputing the message_lengths on the subModel is probably not a bad idea either. Therefore, recompute everything on subModel using init_communicators().

Reimplemented from Model.

References Model::init_communicators(), Interface::init_communicators(), Iterator::maximum_concurrency(), Model::messageLengths, NestedModel::optInterfacePointer, NestedModel::optionalInterface, NestedModel::subIterator, and NestedModel::subModel.

43.63.2.5 int evaluation_id () const [inline, protected, virtual]

Return the current evaluation id for the NestedModel. return the top level nested evaluation count. To get the lower level eval count, the subModel must be explicitly queried. This is consistent with the eval counter definitions in surrogate models.

Reimplemented from Model.

References NestedModel::nestedModelEvalCntr.

43.63.2.6 size_t cv_index_map (size_t *cv_index*) [private]

offset cv_index to create index into aggregated primary/secondary arrays maps index within active continuous variables to index within aggregated active continuous/discrete-int/discrete-real variables.

References Model::currentVariables, Variables::variables_components_totals(), and Variables::view().

Referenced by NestedModel::NestedModel(), and NestedModel::update_sub_model().

43.63.2.7 size_t div_index_map (size_t *div_index*) [private]

offset div_index to create index into aggregated primary/secondary arrays maps index within active discrete int variables to index within aggregated active continuous/discrete-int/discrete-real variables.

References Model::currentVariables, Variables::cv(), Variables::variables_components_totals(), and Variables::view().

Referenced by NestedModel::NestedModel(), and NestedModel::update_sub_model().

43.63.2.8 size_t drv_index_map (size_t *drv_index*) [private]

offset drv_index to create index into aggregated primary/secondary arrays maps index within active discrete real variables to index within aggregated active continuous/discrete-int/discrete-real variables.

References Model::currentVariables, Variables::cv(), Variables::div(), Variables::variables_components_totals(), and Variables::view().

Referenced by NestedModel::NestedModel(), and NestedModel::update_sub_model().

43.63.2.9 size_t ccv_index_map (size_t *ccv_index*) [private]

offset active complement ccv_index to create index into all continuous arrays maps index within complement of active continuous variables to index within all continuous variables.

References Dakota::abort_handler(), Model::currentVariables, Variables::variables_components_totals(), and Variables::view().

Referenced by NestedModel::NestedModel(), and NestedModel::update_sub_model().

43.63.2.10 size_t cdiv_index_map (size_t *cdiv_index*) [private]

offset active complement cdiv_index to create index into all discrete int arrays maps index within complement of active discrete int variables to index within all discrete int variables.

References Dakota::abort_handler(), Model::currentVariables, Variables::variables_components_totals(), and Variables::view().

Referenced by NestedModel::NestedModel(), and NestedModel::update_sub_model().

43.63.2.11 size_t cdrv_index_map (size_t *cdrv_index*) [private]

offset active complement cdrv_index to create index into all discrete real arrays maps index within complement of active discrete real variables to index within all discrete real variables.

References Dakota::abort_handler(), Model::currentVariables, Variables::variables_components_totals(), and Variables::view().

Referenced by NestedModel::NestedModel(), and NestedModel::update_sub_model().

43.63.2.12 void response_mapping (const Response & *opt_interface_response*, const Response & *sub_iterator_response*, Response & *mapped_response*) [private]

combine the response from the optional interface evaluation with the response from the sub-iteration using the primaryCoeffs/secondaryCoeffs mappings to create the total response for the model In the OUU case,

```
optionalInterface fns = {f}, {g} (deterministic primary functions, constraints)
subIterator fns       = {S}      (UQ response statistics)

Problem formulation for mapped functions:
                  minimize    {f} + [W]{S}
                  subject to  {g_l} <= {g}    <= {g_u}
                              {a_l} <= [A]{S} <= {a_u}
                              {g}    == {g_t}
                              [A]{S} == {a_t}
```

where [W] is the primary_mapping_matrix user input (primaryRespCoeffs class attribute), [A] is the secondary_-mapping_matrix user input (secondaryRespCoeffs class attribute), {{g_l},{a_l}} are the top level inequality constraint lower bounds, {{g_u},{a_u}} are the top level inequality constraint upper bounds, and {{g_t},{a_t}} are the top level equality constraint targets.

NOTE: optionalInterface/subIterator primary fns (obj/lsq/generic fns) overlap but optionalInterface/subIterator secondary fns (ineq/eq constraints) do not. The [W] matrix can be specified so as to allow

- some purely deterministic primary functions and some combined: [W] filled and [W].num_rows() < {f}.length() [combined first] *or* [W].num_rows() == {f}.length() and [W] contains rows of zeros [combined last]
- some combined and some purely stochastic primary functions: [W] filled and [W].num_rows() > {f}.length()
- separate deterministic and stochastic primary functions: [W].num_rows() > {f}.length() and [W] contains {f}.length() rows of zeros.

If the need arises, could change constraint definition to allow overlap as well: {g_l} <= {g} + [A]{S} <= {g_u} with [A] usage the same as for [W] above.

In the UOO case, things are simpler, just compute statistics of each optimization response function: [W] = [I], {f}/{g}/[A] are empty.

References Dakota::abort_handler(), Response::active_set_derivative_vector(), Response::active_set_-request_vector(), Dakota::copy_data(), Response::function_gradient(), Response::function_gradient_-view(), Response::function_gradients(), Response::function_hessian(), Response::function_hessian_-view(), Response::function_hessians(), Response::function_value(), Response::function_values(), Response::function_values_view(), Response::num_functions(), NestedModel::numOptInterfEqCon, NestedModel::numOptInterfIneqCon, NestedModel::numOptInterfPrimary, NestedModel::numSubIterFns, NestedModel::numSubIterMappedEqCon, NestedModel::numSubIterMappedIneqCon, NestedModel::optInterfacePointer, NestedModel::primaryRespCoeffs, Response::reset_inactive(), and NestedModel::secondaryRespCoeffs.

Referenced by NestedModel::derived_compute_response().

43.63.3 Member Data Documentation

43.63.3.1 Model subModel [private]

the sub-model used in sub-iterator evaluations There are no restrictions on subModel, so arbitrary nestings are possible. This is commonly used to support surrogate-based optimization under uncertainty by having NestedModels contain SurrogateModels and vice versa.

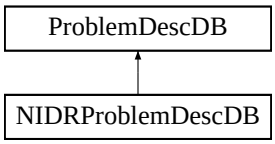
Referenced by NestedModel::component_parallel_mode(), NestedModel::derived_free_communicators(), NestedModel::derived_init_communicators(), NestedModel::derived_init_serial(), NestedModel::derived_set_communicators(), NestedModel::derived_subordinate_models(), NestedModel::fine_grained_evaluation_counters(), NestedModel::integer_variable_mapping(), NestedModel::NestedModel(), NestedModel::print_evaluation_summary(), NestedModel::real_variable_mapping(), NestedModel::resolve_integer_variable_mapping(), NestedModel::resolve_real_variable_mapping(), NestedModel::serve(), NestedModel::set_mapping(), NestedModel::sm_acv_index_map(), NestedModel::sm_adiv_index_map(), NestedModel::subordinate_model(), NestedModel::surrogate_response_mode(), NestedModel::update_inactive_view(), and NestedModel::update_sub_model().

The documentation for this class was generated from the following files:

- NestedModel.H
- NestedModel.C

43.64 NIDRProblemDescDB Class Reference

The derived input file database utilizing the new IDR parser. Inheritance diagram for NIDRProblemDescDB::



Public Member Functions

- NIDRProblemDescDB (ParallelLibrary &parallel_lib)

  constructor

- ~NIDRProblemDescDB ()

  destructor

- void derived_parse_inputs (const char *dakota_input_file, const char *parser_options)

  parses the input file and populates the problem description database using NIDR.

- void derived_broadcast ()

  perform any data processing that must be coordinated with DB buffer broadcasting (performed prior to broadcasting the DB buffer on rank 0 and after receiving the DB buffer on other processor ranks)

- void derived_post_process ()

  perform any additional data post-processing

- **KWH** (iface_Rlit)
- **KWH** (iface_false)
- **KWH** (iface_ilit)
- **KWH** (iface_pint)
- **KWH** (iface_lit)
- **KWH** (iface_start)
- **KWH** (iface_stop)
- **KWH** (iface_str)
- **KWH** (iface_str2D)
- **KWH** (iface_strL)
- **KWH** (iface_true)
- **KWH** (method_Ii)
- **KWH** (method_Real)
- **KWH** (method_Real01)
- **KWH** (method_RealDL)
- **KWH** (method_RealLlit)
- **KWH** (method_Realp)

- **KWH** (method_Realz)
- **KWH** (method_Ri)
- **KWH** (method_coliny_ea)
- **KWH** (method_false)
- **KWH** (method_ilit2)
- **KWH** (method_ilit2p)
- **KWH** (method_int)
- **KWH** (method_intDL)
- **KWH** (method_lit)
- **KWH** (method_lit2)
- **KWH** (method_litc)
- **KWH** (method_liti)
- **KWH** (method_litp)
- **KWH** (method_litpp)
- **KWH** (method_litpp_final)
- **KWH** (method_litr)
- **KWH** (method_litz)
- **KWH** (method_meritFn)
- **KWH** (method_moga_begin)
- **KWH** (method_moga_final)
- **KWH** (method_nnint)
- **KWH** (method_nnintz)
- **KWH** (method_num_resplevs)
- **KWH** (method_piecewise)
- **KWH** (method_pint)
- **KWH** (method_pintz)
- **KWH** (method_resplevs)
- **KWH** (method_resplevs01)
- **KWH** (method_shint)
- **KWH** (method_slit2)
- **KWH** (method_soga_begin)
- **KWH** (method_soga_final)
- **KWH** (method_start)
- **KWH** (method_stop)
- **KWH** (method_str)
- **KWH** (method_strL)
- **KWH** (method_true)
- **KWH** (method_tr_final)
- **KWH** (method_type)
- **KWH** (method_ushint)
- **KWH** (method_ushintL)
- **KWH** (model_Real)
- **KWH** (model_RealDL)
- **KWH** (model_false)
- **KWH** (model_int)
- **KWH** (model_intset)

- **KWH** (model_lit)
- **KWH** (model_order)
- **KWH** (model_shint)
- **KWH** (model_start)
- **KWH** (model_stop)
- **KWH** (model_str)
- **KWH** (model_strL)
- **KWH** (model_true)
- **KWH** (model_type)
- **KWH** (resp_RealDL)
- **KWH** (resp_RealL)
- **KWH** (resp_false)
- **KWH** (resp_intL)
- **KWH** (resp_lit)
- **KWH** (resp_nnintz)
- **KWH** (resp_start)
- **KWH** (resp_stop)
- **KWH** (resp_str)
- **KWH** (resp_strL)
- **KWH** (resp_true)
- **KWH** (strategy_Real)
- **KWH** (strategy_RealL)
- **KWH** (strategy_int)
- **KWH** (strategy_lit)
- **KWH** (strategy_start)
- **KWH** (strategy_str)
- **KWH** (strategy_strL)
- **KWH** (strategy_true)
- **KWH** (var_RealLb)
- **KWH** (var_RealLd)
- **KWH** (var_RealUb)
- **KWH** (var_caulbl)
- **KWH** (var_ceulbl)
- **KWH** (var_dailbl)
- **KWH** (var_darlbl)
- **KWH** (var_intDL)
- **KWH** (var_intL)
- **KWH** (var_intz)
- **KWH** (var_start)
- **KWH** (var_stop)
- **KWH** (var_str)
- **KWH** (var_strL)
- **KWH** (var_true)
- **KWH** (var_vil)
- **KWH** (var_vrl)

Static Public Member Functions

- static void **Var_boundchk** (DataVariablesRep ∗)
- static void **Var_boundgen** (DataVariablesRep ∗)
- static void **Var_iboundchk** (DataVariablesRep ∗)
- static void **Var_iboundgen** (DataVariablesRep ∗)
- static void **botch** (const char ∗fmt,...)
- static void **check_variables** (std::list< DataVariables > ∗)
- static void **check_responses** (std::list< DataResponses > ∗)
- static void **make_variable_defaults** (std::list< DataVariables > ∗)
- static void **make_response_defaults** (std::list< DataResponses > ∗)
- static void **squawk** (const char ∗fmt,...)
- static void **warn** (const char ∗fmt,...)

Static Public Attributes

- static NIDRProblemDescDB ∗ pDDBInstance

  pointer to the active object instance used within the static kwhandler functions in order to avoid the need for static data

- static int **nerr** = 0

Static Private Member Functions

- static void **var_stop1** (void ∗)

Private Attributes

- std::list< void ∗ > **VIL**

43.64.1 Detailed Description

The derived input file database utilizing the new IDR parser. The NIDRProblemDescDB class is derived from ProblemDescDB for use by the NIDR parser in processing DAKOTA input file data. For information on modifying the NIDR input parsing procedures, refer to Dakota/docs/Dev_Spec_Change.dox. For more on the parsing technology, see "Specifying and Reading Program Input with NIDR" by David M. Gay (report SAND2008-2261P, which is available in PDF form as `http://www.sandia.gov/~dmgay/nidr08.pdf`). Source for the routines declared herein is NIDRProblemDescDB.C, in which most routines are so short that a description seems unnecessary.

43.64.2 Member Function Documentation

43.64.2.1 void derived_parse_inputs (const char * *dakota_input_file*, const char * *parser_options*) [virtual]

parses the input file and populates the problem description database using NIDR. Parse the input file using the Input Deck Reader (IDR) parsing system. IDR populates the IDRProblemDescDB object with the input file data.

Reimplemented from ProblemDescDB.

References Dakota::abort_handler(), ProblemDescDB::dataInterfaceList, ProblemDescDB::dataMethodList, DataMethodRep::dlDetails, DataMethodRep::dlLib, ProblemDescDB::parallel_library(), and NIDRProblemDescDB::pDDBInstance.

The documentation for this class was generated from the following files:

- NIDRProblemDescDB.H
- NIDRProblemDescDB.C

43.65 NL2Res Struct Reference

Auxiliary information passed to calcr and calcj via ur.

Public Attributes

- Real * r

  residual r = r(x)

- Real * J

  Jacobian J = J(x).

- Real * x

  corresponding parameter vector

- int nf

  function invocation count for r(x)

43.65.1 Detailed Description

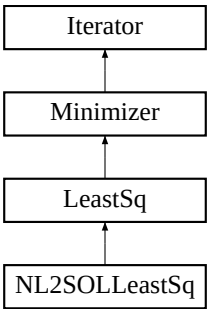
Auxiliary information passed to calcr and calcj via ur.

The documentation for this struct was generated from the following file:

- NL2SOLLeastSq.C

43.66 NL2SOLLeastSq Class Reference

Wrapper class for the NL2SOL nonlinear least squares library. Inheritance diagram for NL2SOLLeastSq::



Public Member Functions

- NL2SOLLeastSq (Model &model)

  standard constructor

- NL2SOLLeastSq (NoDBBaseConstructor, Model &model)

  alternate constructor

- ~NL2SOLLeastSq ()

  destructor

- void minimize_residuals ()

  Used within the least squares branch for minimizing the sum of squares residuals. Redefines the run virtual function for the least squares branch.

Static Private Member Functions

- static void calcr (int *np, int *pp, Real *x, int *nfp, Real *r, int *ui, void *ur, Vf vf)

  evaluator function for residual vector

- static void calcj (int *np, int *pp, Real *x, int *nfp, Real *J, int *ui, void *ur, Vf vf)

  evaluator function for residual Jacobian

Private Attributes

- int auxprt

  auxilary printing bits (see Dakota Ref Manual): sum of < 1 = x0prt (print initial guess) < 2 = solprt (print final solution) < 4 = statpr (print solution statistics) < 8 = parprt (print nondefault parameters) < 16 = dradpr (print bound constraint drops/adds) < debug/verbose/normal use default = 31 (everything), < quiet uses 3, silent uses 0.

- int outlev

  frequency of output summary lines in number of iterations < (debug/verbose/normal/quiet use default = 1, silent uses 0)

- Real dltfdj

  finite-diff step size for computing Jacobian approximation < (`fd_gradient_step_size`)

- Real delta0

  finite-diff step size for gradient differences for H < (a component of some covariance approximations, if desired) < (`fd_hessian_step_size`)

- Real dltfdc

  finite-diff step size for function differences for H < (`fd_hessian_step_size`)

- int mxfcal

  function-evaluation limit (`max_function_evaluations`)

- int mxiter

  iteration limit (`max_iterations`)

- Real rfctol

  relative fn convergence tolerance (`convergence_tolerance`)

- Real afctol

  absolute fn convergence tolerance (`absolute_conv_tol`)

- Real xctol

  x-convergence tolerance (`x_conv_tol`)

- Real sctol

  singular convergence tolerance (`singular_conv_tol`)

- Real lmaxs

  radius for singular-convergence test (`singular_radius`)

- Real xftol

  false-convergence tolerance (`false_conv_tol`)

- int covreq

  kind of covariance required (`covariance`): < 1 or -1 ==> sigma^2 H^-1 J^T J H^-1 < 2 or -2 ==> sigma^2 H^-1 < 3 or -3 ==> sigma^2 (J^T J)^-1 < 1 or 2 ==> use gradient diffs to estimate H < -1 or -2 ==> use function diffs to estimate H < default = 0 (no covariance)

- int rdreq

  whether to compute the regression diagnostic vector < (`regression_diagnostics`)

- Real fprec

  expected response function precision (`function_precision`)

- Real lmax0

  initial trust-region radius (`initial_trust_radius`)

Static Private Attributes

- static NL2SOLLeastSq * nl2solInstance

  pointer to the active object instance used within the static evaluator functions

43.66.1 Detailed Description

Wrapper class for the NL2SOL nonlinear least squares library. The NL2SOLLeastSq class provides a wrapper for NL2SOL (TOMS Algorithm 573), in the updated form of Port Library routines dn[fg][b] from Bell Labs; see http://www.netlib.org/port/readme. The Fortran from Port has been turned into C by f2c. NL2SOL uses a function pointer approach for which passed functions must be either global functions or static member functions.

43.66.2 Member Function Documentation

43.66.2.1 void minimize_residuals () [virtual]

Used within the least squares branch for minimizing the sum of squares residuals. Redefines the run virtual function for the least squares branch.

Details on the following subscript values appear in "Usage Summary for Selected Optimization Routines" by David M. Gay, Computing Science Technical Report No. 153, AT&T Bell Laboratories, 1990. http://netlib.bell-labs.com/cm/cs/cstr/153.ps.gz

Implements LeastSq.

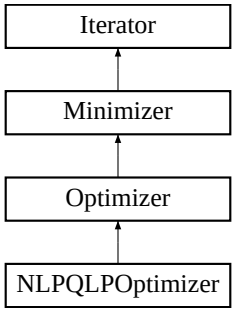
References NL2SOLLeastSq::afctol, NL2SOLLeastSq::auxprt, Iterator::bestResponseArray, Iterator::bestVariablesArray, Minimizer::boundConstraintFlag, NL2SOLLeastSq::calcj(), NL2SOLLeastSq::calcr(), Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::continuous_variables(), Dakota::copy_data(), NL2SOLLeastSq::covreq, NL2SOLLeastSq::delta0, NL2SOLLeastSq::dltfdc, NL2SOLLeastSq::dltfdj, NL2SOLLeastSq::fprec, LeastSq::get_confidence_intervals(), Iterator::gradientType, Iterator::iteratedModel, NL2SOLLeastSq::lmax0, NL2SOLLeastSq::lmaxs, NL2SOLLeastSq::mxfcal, NL2SOLLeastSq::mxiter, NL2SOLLeastSq::nl2solInstance, Iterator::numContinuousVars, LeastSq::numLeastSqTerms, NL2SOLLeastSq::outlev, NL2SOLLeastSq::rdreq, NL2SOLLeastSq::rfctol, NL2SOLLeastSq::sctol, Minimizer::speculativeFlag, Minimizer::vendorNumericalGradFlag, NL2SOLLeastSq::xctol, and NL2SOLLeastSq::xftol.

The documentation for this class was generated from the following files:

- NL2SOLLeastSq.H
- NL2SOLLeastSq.C

43.67 NLPQLPOptimizer Class Reference

Wrapper class for the NLPQLP optimization library, Version 2.0. Inheritance diagram for NLPQLPOptimizer::



Public Member Functions

- NLPQLPOptimizer (Model &model)

  standard constructor

- NLPQLPOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor

- ~NLPQLPOptimizer ()

  destructor

- void find_optimum ()

  Used within the optimizer branch for computing the optimal solution. Redefines the run virtual function for the optimizer branch.

Protected Member Functions

- void initialize_run ()

  performs run-time set up

Private Member Functions

- void initialize ()

  Shared constructor code.

- void allocate_workspace ()

  Allocates workspace for the optimizer.

- void deallocate_workspace ()

  Releases workspace memory.

- void allocate_constraints ()

  Allocates constraint mappings.

Private Attributes

- int L

  L : Number of parallel systems, i.e. function calls during line search at predetermined iterates. HINT: If only less than 10 parallel function evaluations are possible, it is recommended to apply the serial version by setting L=1.

- int numEqConstraints

  numEqConstraints : Number of equality constraints.

- int MMAX

  MMAX : Row dimension of array DG containing Jacobian of constraints. MMAX must be at least one and greater or equal to M.

- int N

  N : Number of optimization variables.

- int NMAX

  NMAX : Row dimension of C. NMAX must be at least two and greater than N.

- int MNN2

  MNN2 : Must be equal to M+N+N+2.

- double * X

  X(NMAX,L) : Initially, the first column of X has to contain starting values for the optimal solution. On return, X is replaced by the current iterate. In the driving program the row dimension of X has to be equal to NMAX. X is used internally to store L different arguments for which function values should be computed simultaneously.

- double * F

  F(L) : On return, F(1) contains the final objective function value. F is used also to store L different objective function values to be computed from L iterates stored in X.

- double * G

  G(MMAX,L) : On return, the first column of G contains the constraint function values at the final iterate X. In the driving program the row dimension of G has to be equal to MMAX. G is used internally to store L different set of constraint function values to be computed from L iterates stored in X.

- double * DF

  DF(NMAX) : DF contains the current gradient of the objective function. In case of numerical differentiation and a distributed system (L>1), it is recommended to apply parallel evaluations of F to compute DF.

- double * DG

  DG(MMAX,NMAX) : DG contains the gradients of the active constraints (ACTIVE(J)=.true.) at a current iterate X. The remaining rows are filled with previously computed gradients. In the driving program the row dimension of DG has to be equal to MMAX.

- double * U

  U(MNN2) : U contains the multipliers with respect to the actual iterate stored in the first column of X. The first M locations contain the multipliers of the M nonlinear constraints, the subsequent N locations the multipliers of the lower bounds, and the final N locations the multipliers of the upper bounds. At an optimal solution, all multipliers with respect to inequality constraints should be nonnegative.

- double * C

  C(NMAX,NMAX) : On return, C contains the last computed approximation of the Hessian matrix of the Lagrangian function stored in form of an LDL decomposition. C contains the lower triangular factor of an LDL factorization of the final quasi-Newton matrix (without diagonal elements, which are always one). In the driving program, the row dimension of C has to be equal to NMAX.

- double * D

  D(NMAX) : The elements of the diagonal matrix of the LDL decomposition of the quasi-Newton matrix are stored in the one-dimensional array D.

- double ACC

  ACC : The user has to specify the desired final accuracy (e.g. 1.0D-7). The termination accuracy should not be smaller than the accuracy by which gradients are computed.

- double ACCQP

  ACCQP : The tolerance is needed for the QP solver to perform several tests, for example whether optimality conditions are satisfied or whether a number is considered as zero or not. If ACCQP is less or equal to zero, then the machine precision is computed by NLPQLP and subsequently multiplied by 1.0D+4.

- double STPMIN

  *STPMIN : Minimum steplength in case of L>1. Recommended is any value in the order of the accuracy by which functions are computed. The value is needed to compute a steplength reduction factor by STPMIN**(1/L-1). If STPMIN<=0, then STPMIN=ACC is used.*

- int MAXFUN

  MAXFUN : The integer variable defines an upper bound for the number of function calls during the line search (e.g. 20). MAXFUN is only needed in case of L=1, and must not be greater than 50.

- int MAXIT

  MAXIT : Maximum number of outer iterations, where one iteration corresponds to one formulation and solution of the quadratic programming subproblem, or, alternatively, one evaluation of gradients (e.g. 100).

- int MAX_NM

  MAX_NM : Stack size for storing merit function values at previous iterations for non-monotone line search (e.g. 10). In case of MAX_NM=0, monotone line search is performed.

- double TOL_NM

TOL_NM : Relative bound for increase of merit function value, if line search is not successful during the very first step. Must be non-negative (e.g. 0.1).

- int IPRINT

  IPRINT : Specification of the desired output level. IPRINT = 0 : No output of the program. IPRINT = 1 : Only a final convergence analysis is given. IPRINT = 2 : One line of intermediate results is printed in each iteration. IPRINT = 3 : More detailed information is printed in each iteration step, e.g. variable, constraint and multiplier values. IPRINT = 4 : In addition to 'IPRINT=3', merit function and steplength values are displayed during the line search.

- int MODE

  MODE : The parameter specifies the desired version of NLPQLP. MODE = 0 : Normal execution (reverse communication!). MODE = 1 : The user wants to provide an initial guess for the multipliers in U and for the Hessian of the Lagrangian function in C and D in form of an LDL decomposition.

- int IOUT

  IOUT : Integer indicating the desired output unit number, i.e. all write-statements start with 'WRITE(IOUT,... '.

- int IFAIL

  IFAIL : The parameter shows the reason for terminating a solution process. Initially IFAIL must be set to zero. On return IFAIL could contain the following values: IFAIL =-2 : Compute gradient values w.r.t. the variables stored in first column of X, and store them in DF and DG. Only derivatives for active constraints ACTIVE(J)=.TRUE. need to be computed. Then call NLPQLP again, see below. IFAIL =-1 : Compute objective fn and all constraint values subject the variables found in the first L columns of X, and store them in F and G. Then call NLPQLP again, see below. IFAIL = 0 : The optimality conditions are satisfied. IFAIL = 1 : The algorithm has been stopped after MAXIT iterations. IFAIL = 2 : The algorithm computed an uphill search direction. IFAIL = 3 : Underflow occurred when determining a new approxi- mation matrix for the Hessian of the Lagrangian. IFAIL = 4 : The line search could not be terminated successfully. IFAIL = 5 : Length of a working array is too short. More detailed error information is obtained with 'IPRINT>0'. IFAIL = 6 : There are false dimensions, for example M>MMAX, N>=NMAX, or MNN2<>M+N+N+2. IFAIL = 7 : The search direction is close to zero, but the current iterate is still infeasible. IFAIL = 8 : The starting point violates a lower or upper bound. IFAIL = 9 : Wrong input parameter, i.e., MODE, LDL decomposition in D and C (in case of MODE=1), IPRINT, IOUT IFAIL = 10 : Internal inconsistency of the quadratic subproblem, division by zero. IFAIL > 100 : The solution of the quadratic programming subproblem has been terminated with an error message and IFAIL is set to IFQL+100, where IFQL denotes the index of an inconsistent constraint.

- double * WA

  WA(LWA) : WA is a real working array of length LWA.

- int LWA

  LWA : LWA value extracted from NLPQLP20.f.

- int * KWA

  KWA(LKWA) : The user has to provide working space for an integer array.

- int LKWA

  LKWA : LKWA should be at least N+10.

- int * ACTIVE

ACTIVE(LACTIV) : The logical array shows a user the constraints, which NLPQLP considers to be active at the last computed iterate, i.e. G(J,X) is active, if and only if ACTIVE(J)=.TRUE., J=1,...,M.

- int LACTIVE

  LACTIV : The length LACTIV of the logical array should be at least 2∗M+10.

- int LQL

  LQL : If LQL = .TRUE., the quadratic programming subproblem is to be solved with a full positive definite quasi-Newton matrix. Otherwise, a Cholesky decomposition is performed and updated, so that the subproblem matrix contains only an upper triangular factor.

- int numNlpqlConstr

  total number of constraints seen by NLPQL

- SizetList nonlinIneqConMappingIndices

  a list of indices for referencing the DAKOTA nonlinear inequality constraints used in computing the corresponding NLPQL constraints.

- RealList nonlinIneqConMappingMultipliers

  a list of multipliers for mapping the DAKOTA nonlinear inequality constraints to the corresponding NLPQL constraints.

- RealList nonlinIneqConMappingOffsets

  a list of offsets for mapping the DAKOTA nonlinear inequality constraints to the corresponding NLPQL constraints.

- SizetList linIneqConMappingIndices

  a list of indices for referencing the DAKOTA linear inequality constraints used in computing the corresponding NLPQL constraints.

- RealList linIneqConMappingMultipliers

  a list of multipliers for mapping the DAKOTA linear inequality constraints to the corresponding NLPQL constraints.

- RealList linIneqConMappingOffsets

  a list of offsets for mapping the DAKOTA linear inequality constraints to the corresponding NLPQL constraints.

43.67.1 Detailed Description

Wrapper class for the NLPQLP optimization library, Version 2.0. **********

AN IMPLEMENTATION OF A SEQUENTIAL QUADRATIC PROGRAMMING METHOD FOR SOLVING NONLINEAR OPTIMIZATION PROBLEMS BY DISTRIBUTED COMPUTING AND NON-MONOTONE LINE SEARCH

This subroutine solves the general nonlinear programming problem

minimize F(X) subject to G(J,X) = 0 , J=1,...,ME G(J,X) >= 0 , J=ME+1,...,M XL <= X <= XU

and is an extension of the code NLPQLD. NLPQLP is specifically tuned to run under distributed systems. A new input parameter L is introduced for the number of parallel computers, that is the number of function calls to be

executed simultaneously. In case of L=1, NLPQLP is identical to NLPQLD. Otherwise the line search is modified to allow L parallel function calls in advance. Moreover the user has the opportunity to used distributed function calls for evaluating gradients.

The algorithm is a modification of the method of Wilson, Han, and Powell. In each iteration step, a linearly constrained quadratic programming problem is formulated by approximating the Lagrangian function quadratically and by linearizing the constraints. Subsequently, a one-dimensional line search is performed with respect to an augmented Lagrangian merit function to obtain a new iterate. Also the modified line search algorithm guarantees convergence under the same assumptions as before.

For the new version, a non-monotone line search is implemented which allows to increase the merit function in case of instabilities, for example caused by round-off errors, errors in gradient approximations, etc.

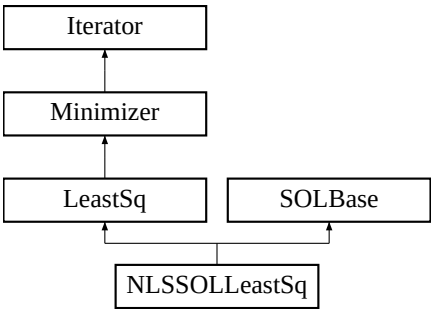
The subroutine contains the option to predetermine initial guesses for the multipliers or the Hessian of the Lagrangian function and is called by reverse communication.

The documentation for this class was generated from the following files:

- NLPQLPOptimizer.H
- NLPQLPOptimizer.C

43.68 NLSSOLLeastSq Class Reference

Wrapper class for the NLSSOL nonlinear least squares library. Inheritance diagram for NLSSOLLeastSq::



Public Member Functions

- NLSSOLLeastSq (Model &model)

  standard constructor

- NLSSOLLeastSq (NoDBBaseConstructor, Model &model)

  alternate constructor

- ~NLSSOLLeastSq ()

  destructor

- void minimize_residuals ()

  Used within the least squares branch for minimizing the sum of squares residuals. Redefines the run virtual function for the least squares branch.

Static Private Member Functions

- static void least_sq_eval (int &mode, int &m, int &n, int &nrowfj, double *x, double *f, double *gradf, int &nstate)

  Evaluator for NLSSOL: computes the values and first derivatives of the least squares terms (passed by function pointer to NLSSOL).

Static Private Attributes

- static NLSSOLLeastSq * nlssolInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.68.1 Detailed Description

Wrapper class for the NLSSOL nonlinear least squares library. The NLSSOLLeastSq class provides a wrapper for NLSSOL, a Fortran 77 sequential quadratic programming library from Stanford University marketed by Stanford Business Associates. It uses a function pointer approach for which passed functions must be either global functions or static member functions. Any nonstatic attribute used within static member functions must be either local to that function or accessed through a static pointer.

The user input mappings are as follows: `max_function_evaluations` is implemented directly in NLSSOLLeastSq's evaluator functions since there is no NLSSOL parameter equivalent, and `max_iterations`, `convergence_tolerance`, `output` verbosity, `verify_level`, `function_precision`, and `linesearch_tolerance` are mapped into NLSSOL's "Major Iteration Limit", "Optimality Tolerance", "Major Print Level" (`verbose`: Major Print Level = 20; `quiet`: Major Print Level = 10), "Verify Level", "Function Precision", and "Linesearch Tolerance" parameters, respectively, using NLSSOL's npoptn() subroutine (as wrapped by npoptn2() from the npoptn_wrapper.f file). Refer to [Gill, P.E., Murray, W., Saunders, M.A., and Wright, M.H., 1986] for information on NLSSOL's optional input parameters and the npoptn() subroutine.

43.68.2 Constructor & Destructor Documentation

43.68.2.1 NLSSOLLeastSq (Model & *model*)

standard constructor This is the primary constructor. It accepts a Model reference.

References Minimizer::constraintTol, Iterator::convergenceTol, Iterator::fdGradStepSize, ProblemDescDB::get_int(), ProblemDescDB::get_real(), Iterator::gradientType, Iterator::maxIterations, Iterator::outputLevel, Iterator::probDescDB, SOLBase::set_options(), Minimizer::speculativeFlag, and Minimizer::vendorNumericalGradFlag.

43.68.2.2 NLSSOLLeastSq (NoDBBaseConstructor, Model & *model*)

alternate constructor This is an alternate constructor which accepts a Model but does not have a supporting method specification from the ProblemDescDB.

References Minimizer::constraintTol, Iterator::convergenceTol, Iterator::fdGradStepSize, Iterator::gradientType, Iterator::maxIterations, Iterator::outputLevel, SOLBase::set_options(), Minimizer::speculativeFlag, and Minimizer::vendorNumericalGradFlag.

The documentation for this class was generated from the following files:

- NLSSOLLeastSq.H
- NLSSOLLeastSq.C

43.69 NoDBBaseConstructor Struct Reference

Dummy struct for overloading constructors used in on-the-fly instantiations.

Public Member Functions

- NoDBBaseConstructor (int=0)

  C++ structs can have constructors.

43.69.1 Detailed Description

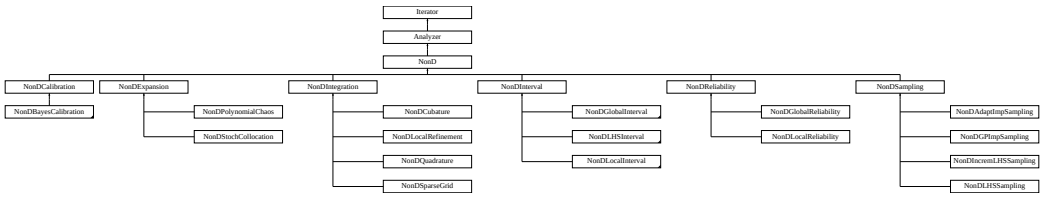
Dummy struct for overloading constructors used in on-the-fly instantiations. NoDBBaseConstructor is used to overload the constructor used for on-the-fly instantiations in which ProblemDescDB queries cannot be used. Putting this struct here avoids circular dependencies.

The documentation for this struct was generated from the following file:

- global_defs.h

43.70 NonD Class Reference

Base class for all nondetermistic iterators (the DAKOTA/UQ branch). Inheritance diagram for NonD::



Public Member Functions

- void initialize_random_variables (short u_space_type)

  initialize natafTransform based on distribution data from iteratedModel

- void initialize_random_variables (const Pecos::ProbabilityTransformation &transform)

  alternate form: initialize natafTransform based on incoming data

- void requested_levels (const RealVectorArray &req_resp_levels, const RealVectorArray &req_prob_levels, const RealVectorArray &req_rel_levels, const RealVectorArray &req_gen_rel_levels, short resp_lev_-target, bool cdf_flag)

  set requestedRespLevels, requestedProbLevels, requestedRelLevels, requestedGenRelLevels, respLevelTarget, and cdfFlag (used in combination with alternate ctors)

- void distribution_parameter_derivatives (bool dist_param_derivs)

  set distParamDerivs

- bool pdf_output () const

  get pdfOutput

- void pdf_output (bool output)

  set pdfOutput

- Pecos::ProbabilityTransformation & variable_transformation ()

  return natafTransform

Protected Member Functions

- NonD (Model &model)

  constructor

- NonD (NoDBBaseConstructor, Model &model)

  alternate constructor for sample generation and evaluation "on the fly"

- NonD (NoDBBaseConstructor, const RealVector &lower_bnds, const RealVector &upper_bnds)

  alternate constructor for sample generation "on the fly"

- ~NonD ()

  destructor

- void initialize_run ()

  utility function to perform common operations prior to pre_run(); typically memory initialization; setting of instance pointers

- void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- void finalize_run ()

  utility function to perform common operations following post_run(); deallocation and resetting of instance pointers

- const Response & response_results () const

  return the final statistics from the nondeterministic iteration

- void response_results_active_set (const ActiveSet &set)

  set the active set within finalStatistics

- virtual void quantify_uncertainty ()=0

  performs a forward uncertainty propagation of parameter distributions into response statistics

- virtual void initialize_final_statistics ()

  initializes finalStatistics for storing NonD final results

- virtual void update_final_statistics ()

  update finalStatistics::functionValues

- void initialize_random_variable_transformation ()

  instantiate natafTransform

- void initialize_random_variable_types (short u_space_type)

  initializes ranVarTypesX and ranVarTypesU within natafTransform

- void initialize_random_variable_parameters ()

  initializes ranVarMeansX, ranVarStdDevsX, ranVarLowerBndsX, ranVarUpperBndsX, and ranVarAddtlParamsX within natafTransform

- void initialize_random_variable_correlations ()

  propagate iteratedModel correlations to natafTransform

- void verify_correlation_support ()

  verify that correlation warping supported by Der Kiureghian & Liu for given variable types

- void initialize_final_statistics_gradients ()

  initializes finalStatistics::functionGradients

- void update_aleatory_final_statistics ()

  update finalStatistics::functionValues from momentStats and computed{Prob,Rel,GenRel,Resp}Levels

- void update_system_final_statistics ()

  update system metrics from component metrics within finalStatistics

- void update_system_final_statistics_gradients ()

  update finalStatistics::functionGradients

- void initialize_distribution_mappings ()

  size computed{Resp,Prob,Rel,GenRel}Levels

- void print_distribution_mappings (std::ostream &s) const

  prints the z/p/beta/beta∗ mappings reflected in {requested,computed}{Resp,Prob,Rel,GenRel}Levels

- void print_system_mappings (std::ostream &s) const

  print system series/parallel mappings for response levels

- void construct_u_space_model (Model &x_model, Model &u_model, bool global_bounds=false, Real bound=10.)

  recast x_model from x-space to u-space to create u_model

- void construct_lhs (Iterator &u_space_sampler, Model &u_model, const String &sample_type, int num_samples, int seed, const String &rng, bool vary_pattern)

  assign a NonDLHSSampling instance within u_space_sampler

Static Protected Member Functions

- static void vars_u_to_x_mapping (const Variables &u_vars, Variables &x_vars)

  static function for RecastModels used to map u-space variables from NonD Iterators to x-space variables for Model evaluations.

- static void set_u_to_x_mapping (const Variables &u_vars, const ActiveSet &u_set, ActiveSet &x_set)

  static function for RecastModels used to map u-space ActiveSets from NonD Iterators to x-space ActiveSets for Model evaluations.

- static void resp_x_to_u_mapping (const Variables &x_vars, const Variables &u_vars, const Response &x_response, Response &u_response)

  static function for RecastModels used to map x-space responses from Model evaluations to u-space responses for return to NonD Iterators.

Protected Attributes

- NonD * prevNondInstance

  pointer containing previous value of nondInstance

- Pecos::ProbabilityTransformation natafTransform

  Nonlinear variable transformation that encapsulates the required data for performing transformations from X -> Z -> U and back.

- size_t numContDesVars

  number of continuous design variables (modeled using uniform distribution for All view modes)

- size_t numDiscIntDesVars

  number of discrete integer design variables (modeled using discrete histogram distributions for All view modes)

- size_t numDiscRealDesVars

  number of discrete real design variables (modeled using discrete histogram distributions for All view modes)

- size_t numDesignVars

  total number of design variables

- size_t numContStateVars

  number of continuous state variables (modeled using uniform distribution for All view modes)

- size_t numDiscIntStateVars

  number of discrete integer state variables (modeled using discrete histogram distributions for All view modes)

- size_t numDiscRealStateVars

  number of discrete real state variables (modeled using discrete histogram distributions for All view modes)

- size_t numStateVars

  total number of state variables

- size_t numNormalVars

  number of normal uncertain variables (native space)

- size_t numLognormalVars

  number of lognormal uncertain variables (native space)

- size_t numUniformVars

  number of uniform uncertain variables (native space)

- size_t numLoguniformVars

  number of loguniform uncertain variables (native space)

- size_t numTriangularVars

number of triangular uncertain variables (native space)

- size_t numExponentialVars

  number of exponential uncertain variables (native space)

- size_t numBetaVars

  number of beta uncertain variables (native space)

- size_t numGammaVars

  number of gamma uncertain variables (native space)

- size_t numGumbelVars

  number of gumbel uncertain variables (native space)

- size_t numFrechetVars

  number of frechet uncertain variables (native space)

- size_t numWeibullVars

  number of weibull uncertain variables (native space)

- size_t numHistogramBinVars

  number of histogram bin uncertain variables (native space)

- size_t numPoissonVars

  number of Poisson uncertain variables (native space)

- size_t numBinomialVars

  number of binomial uncertain variables (native space)

- size_t numNegBinomialVars

  number of negative binomial uncertain variables (native space)

- size_t numGeometricVars

  number of geometric uncertain variables (native space)

- size_t numHyperGeomVars

  number of hypergeometric uncertain variables (native space)

- size_t numHistogramPtVars

  number of histogram point uncertain variables (native space)

- size_t numIntervalVars

  number of interval uncertain variables (native space)

- size_t numContAleatUncVars

  total number of aleatory uncertain variables (native space)

- size_t numDiscIntAleatUncVars

  total number of aleatory uncertain variables (native space)

- size_t numDiscRealAleatUncVars

  total number of aleatory uncertain variables (native space)

- size_t numAleatoryUncVars

  total number of aleatory uncertain variables (native space)

- size_t numContEpistUncVars

  total number of epistemic uncertain variables (native space)

- size_t numDiscIntEpistUncVars

  total number of epistemic uncertain variables (native space)

- size_t numDiscRealEpistUncVars

  total number of epistemic uncertain variables (native space)

- size_t numEpistemicUncVars

  total number of epistemic uncertain variables (native space)

- size_t numUncertainVars

  total number of uncertain variables (native space)

- RealMatrix momentStats

  moments of response functions (mean, std deviation, skewness, and kurtosis calculated in compute_moments()), indexed as (moment,fn)

- RealVectorArray requestedRespLevels

  requested response levels for all response functions

- RealVectorArray computedProbLevels

  output probability levels for all response functions resulting from requestedRespLevels

- RealVectorArray computedRelLevels

  output reliability levels for all response functions resulting from requestedRespLevels

- RealVectorArray computedGenRelLevels

  output generalized reliability levels for all response functions resulting from requestedRespLevels

- short respLevelTarget

  indicates mapping of z->p (PROBABILITIES), z->beta (RELIABILITIES), or z->beta∗ (GEN_RELIABILITIES)

- short respLevelTargetReduce

  indicates component or system series/parallel failure metrics

- RealVectorArray requestedProbLevels

  requested probability levels for all response functions

- RealVectorArray requestedRelLevels

  requested reliability levels for all response functions

- RealVectorArray requestedGenRelLevels

  requested generalized reliability levels for all response functions

- RealVectorArray computedRespLevels

  output response levels for all response functions resulting from requestedProbLevels, requestedRelLevels, or requestedGenRelLevels

- size_t totalLevelRequests

  total number of levels specified within requestedRespLevels, requestedProbLevels, and requestedRelLevels

- bool cdfFlag

  flag for type of probabilities/reliabilities used in mappings: cumulative/CDF (true) or complementary/CCDF (false)

- bool pdfOutput

  flag for managing output of response probability density functions (PDFs)

- Response finalStatistics

  final statistics from the uncertainty propagation used in strategies: response means, standard deviations, and probabilities of failure

Static Protected Attributes

- static NonD * nondInstance

  pointer to the active object instance used within static evaluator functions in order to avoid the need for static data

Private Member Functions

- void distribute_levels (RealVectorArray &levels, bool ascending=true)

  convenience function for distributing a vector of levels among multiple response functions if a short-hand specification is employed.

Private Attributes

- bool distParamDerivs

flags calculation of derivatives with respect to distribution parameters s within resp_x_to_u_mapping() using the chain rule df/dx dx/ds. The default is to calculate derivatives with respect to standard random variables u using the chain rule df/dx dx/du.

43.70.1 Detailed Description

Base class for all nondetermistic iterators (the DAKOTA/UQ branch). The base class for nondeterministic iterators consolidates uncertain variable data and probabilistic utilities for inherited classes.

43.70.2 Member Function Documentation

43.70.2.1 void initialize_random_variables (short *u_space_type*)

initialize natafTransform based on distribution data from iteratedModel Build ProbabilityTransformation::ranVar arrays containing the uncertain variable distribution types and their corresponding means/standard deviations. This function is used when the Model variables are in x-space.

References NonD::initialize_random_variable_correlations(), NonD::initialize_random_variable_parameters(), NonD::initialize_random_variable_transformation(), NonD::initialize_random_variable_types(), NonD::natafTransform, and NonD::verify_correlation_support().

Referenced by NonDExpansion::compute_statistics(), NonDGlobalReliability::importance_sampling(), NonDLocalReliability::initialize_class_data(), NonDExpansion::initialize_expansion(), NonDAdaptImpSampling::NonDAdaptImpSampling(), and NonDGlobalReliability::optimize_gaussian_process().

43.70.2.2 void initialize_random_variables (const Pecos::ProbabilityTransformation & *transform*)

alternate form: initialize natafTransform based on incoming data This function is commonly used to publish tranformation data when the Model variables are in a transformed space (e.g., u-space) and ProbabilityTransformation::ranVarTypes et al. may not be generated directly. This allows for the use of inverse transformations to return the transformed space variables to their original states.

References NonD::initialize_random_variable_transformation(), NonD::natafTransform, NonD::numContDesVars, and NonD::numContStateVars.

43.70.2.3 void initialize_run () `[inline, protected, virtual]`

utility function to perform common operations prior to pre_run(); typically memory initialization; setting of instance pointers Perform initialization phases of run sequence, like allocating memory and setting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's initialize_run(), typically _before_ performing its own implementation steps.

Reimplemented from Iterator.

References NonD::nondInstance, and NonD::prevNondInstance.

43.70.2.4 void run () [inline, protected, virtual]

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented from Iterator.

References Analyzer::bestVarsRespMap, and NonD::quantify_uncertainty().

43.70.2.5 void finalize_run () [inline, protected, virtual]

utility function to perform common operations following post_run(); deallocation and resetting of instance pointers Optional: perform finalization phases of run sequence, like deallocating memory and resetting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's finalize_run(), typically _after_ performing its own implementation steps.

Reimplemented from Iterator.

References NonD::nondInstance, and NonD::prevNondInstance.

43.70.2.6 void initialize_final_statistics () [protected, virtual]

initializes finalStatistics for storing NonD final results Default definition of virtual function (used by sampling, reliability, and stochastic expansion methods) defines the set of statistical results to include means, standard deviations, and level mappings.

Reimplemented in NonDInterval.

References Dakota::abort_handler(), NonD::cdfFlag, Model::cv(), ActiveSet::derivative_vector(), NonD::finalStatistics, Response::function_labels(), Model::inactive_continuous_variable_ids(), Iterator::iteratedModel, NonD::numEpistemicUncVars, Iterator::numFunctions, NonD::requestedGenRelLevels, NonD::requestedProbLevels, NonD::requestedRelLevels, NonD::requestedRespLevels, NonD::respLevelTarget, NonD::respLevelTargetReduce, and NonD::totalLevelRequests.

Referenced by NonDExpansion::NonDExpansion(), NonDIntegration::NonDIntegration(), NonDReliability::NonDReliability(), NonDSampling::NonDSampling(), and NonD::requested_levels().

43.70.2.7 void initialize_random_variable_types (short *u_space_type*) [protected]

initializes ranVarTypesX and ranVarTypesU within natafTransform Build ProbabilityTransformation::ranVar arrays containing the uncertain variable distribution types and their corresponding means/standard deviations. This function is used when the Model variables are in x-space.

References Dakota::abort_handler(), Model::cv(), Model::distribution_parameters(), Iterator::iteratedModel, NonD::natafTransform, NonD::numBetaVars, NonD::numContDesVars, NonD::numContStateVars, NonD::numExponentialVars, NonD::numFrechetVars, NonD::numGammaVars, NonD::numGumbelVars, NonD::numHistogramBinVars, NonD::numHistogramPtVars, NonD::numIntervalVars, NonD::numLognormalVars, NonD::numLoguniformVars, NonD::numNormalVars, NonD::numTriangularVars, NonD::numUniformVars, and NonD::numWeibullVars.

Referenced by NonDExpansion::initialize(), NonD::initialize_random_variables(), NonDBayesCalibration::NonDBayesCalibration(), NonDIntegration::NonDIntegration(), and NonDReliability::NonDReliability().

43.70.2.8 void initialize_random_variable_parameters () [protected]

initializes ranVarMeansX, ranVarStdDevsX, ranVarLowerBndsX, ranVarUpperBndsX, and ranVarAddtlParamsX within natafTransform Build ProbabilityTransformation::ranVar arrays containing the uncertain variable distribution types and their corresponding means/standard deviations. This function is used when the Model variables are in x-space.

References Dakota::abort_handler(), Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::cv(), Model::distribution_parameters(), Iterator::iteratedModel, NonD::natafTransform, NonD::numBetaVars, NonD::numContDesVars, NonD::numContStateVars, NonD::numExponentialVars, NonD::numFrechetVars, NonD::numGammaVars, NonD::numGumbelVars, NonD::numHistogramBinVars, NonD::numHistogramPtVars, NonD::numIntervalVars, NonD::numLognormalVars, NonD::numLoguniformVars, NonD::numNormalVars, NonD::numTriangularVars, NonD::numUniformVars, and NonD::numWeibullVars.

Referenced by NonDExpansion::initialize_expansion(), NonD::initialize_random_variables(), NonDLocalReliability::quantify_uncertainty(), NonDGlobalReliability::quantify_uncertainty(), and NonDBayesCalibration::quantify_uncertainty().

43.70.2.9 void vars_u_to_x_mapping (const Variables & *u_vars*, Variables & *x_vars*) [static, protected]

static function for RecastModels used to map u-space variables from NonD Iterators to x-space variables for Model evaluations. Map the variables from iterator space (u) to simulation space (x).

References Variables::continuous_variables(), NonD::natafTransform, and NonD::nondInstance.

Referenced by NonD::construct_u_space_model().

43.70.2.10 void set_u_to_x_mapping (const Variables & *u_vars*, const ActiveSet & *u_set*, ActiveSet & *x_set*) [static, protected]

static function for RecastModels used to map u-space ActiveSets from NonD Iterators to x-space ActiveSets for Model evaluations. Define the DVV for x-space derivative evaluations by augmenting the iterator requests to account for correlations.

References Dakota::_NPOS, Variables::all_continuous_variable_ids(), Dakota::contains(), Variables::continuous_variable_ids(), ActiveSet::derivative_vector(), Dakota::find_index(), Variables::inactive_continuous_variable_ids(), NonD::natafTransform, and NonD::nondInstance.

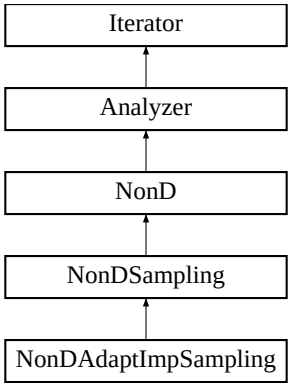
Referenced by NonD::construct_u_space_model().

The documentation for this class was generated from the following files:

- DakotaNonD.H
- DakotaNonD.C

43.71 NonDAdaptImpSampling Class Reference

Class for the Adaptive Importance Sampling methods within DAKOTA. Inheritance diagram for NonDAdaptImpSampling::



Public Member Functions

- NonDAdaptImpSampling (Model &model)

  constructors

- NonDAdaptImpSampling (Model &model, const String &sample_type, int samples, int seed, const String &rng, bool vary_pattern, short is_type, bool cdf_flag, bool x_space_data, bool x_space_model, bool bounded_model)
- ~NonDAdaptImpSampling ()

  destructor

- void quantify_uncertainty ()

  performs an adaptive importance sampling and returns probability of failure.

- void initialize (const RealVectorArray &initial_points, int resp_fn, const Real &initial_prob, const Real &failure_threshold)

  initializes data needed for importance sampling: an initial set of points around which to sample, a failure threshold, an initial probability to refine, and flags to control transformations

- void initialize (const RealVector &initial_point, int resp_fn, const Real &initial_prob, const Real &failure_threshold)

  initializes data needed for importance sampling: an initial point around which to sample, a failure threshold, an initial probability to refine, and flags to control transformations

- const Real & get_probability ()

  returns the probability calculated by the importance sampling

Private Member Functions

- void converge_cov ()

  iteratively generate samples and select representative points until coefficient of variation converges

- void converge_probability ()

  iteratively generate samples from final set of representative points until probability converges

- void select_init_rep_points (const RealVectorArray &samples)

  select representative points from initial set of samples

- void select_rep_points (const RealVectorArray &samples)

  select representative points from a set of samples

- void calculate_rep_weights ()

  calculate relative weights of representative points

- void generate_samples (RealVectorArray &samples)

  generate a set of samples based on multimodal sampling density

- void calculate_statistics (const RealVectorArray &samples, const size_t &total_sample_number, Real &probability_sum, Real &probability, bool cov_flag, Real &variance_sum, Real &coeff_of_variation)

  calculate the probability of exceeding the failure threshold and the coefficent of variation (if requested)

Private Attributes

- short importanceSamplingType

  integration type (is, ais, mmais) provided by input specification

- bool invertProb

  flag for inversion of probability values using 1.-p

- size_t numRepPoints

  the number of representative points around which to sample

- size_t respFn

  the response function in the model to be sampled

- RealVectorArray initPoints

  the original set of samples passed into the MMAIS routine

- RealVectorArray repPoints

  the set of representative points around which to sample

- RealVector repWeights

the weight associated with each representative point

- RealVector designPoint

  design point at which uncertain space is being sampled

- bool transInitPoints

  flag to control if x->u transformation should be performed for initial points

- bool transPoints

  flag to control if u->x transformation should be performed before evaluation

- bool useModelBounds

  flag to control if the sampler should respect the model bounds

- bool initLHS

  flag to identify if initial points are generated from an LHS sample

- Real initProb

  the initial probability (from FORM or SORM)

- Real finalProb

  the final calculated probability (p)

- Real failThresh

  the failure threshold (z-bar) for the problem.

43.71.1 Detailed Description

Class for the Adaptive Importance Sampling methods within DAKOTA. The NonDAdaptImpSampling implements the multi-modal adaptive importance sampling used for reliability calculations. (eventually we will want to broaden this). Need to add more detail to this description.

43.71.2 Constructor & Destructor Documentation

43.71.2.1 NonDAdaptImpSampling (Model & *model*)

constructors standard constructor

This is the primary constructor. It accepts a Model reference.

References NonD::initialize_random_variables(), and NonDSampling::samplingVarsMode.

43.71.2.2 NonDAdaptImpSampling (Model & *model*, const String & *sample_type*, int *samples*, int *seed*, const String & *rng*, bool *vary_pattern*, short *is_type*, bool *cdf_flag*, bool *x_space_data*, bool *x_space_model*, bool *bounded_model*)

This is an alternate constructor for instantiations on the fly using a Model but no ProblemDescDB.

References NonD::cdfFlag, and NonDSampling::samplingVarsMode.

43.71.3 Member Function Documentation

43.71.3.1 void initialize (const RealVectorArray & *initial_points*, int *resp_fn*, const Real & *initial_prob*, const Real & *failure_threshold*)

initializes data needed for importance sampling: an initial set of points around which to sample, a failure threshold, an initial probability to refine, and flags to control transformations Initializes data using a set of starting points.

References NonDAdaptImpSampling::designPoint, NonDAdaptImpSampling::failThresh, NonDAdaptImpSampling::initPoints, NonDAdaptImpSampling::initProb, NonD::natafTransform, NonD::numContDesVars, Iterator::numContinuousVars, NonD::numUncertainVars, NonDAdaptImpSampling::respFn, and NonDAdaptImpSampling::transInitPoints.

Referenced by NonDExpansion::compute_statistics(), NonDGlobalReliability::importance_sampling(), NonDLocalReliability::probability(), and NonDAdaptImpSampling::quantify_uncertainty().

43.71.3.2 void initialize (const RealVector & *initial_point*, int *resp_fn*, const Real & *initial_prob*, const Real & *failure_threshold*)

initializes data needed for importance sampling: an initial point around which to sample, a failure threshold, an initial probability to refine, and flags to control transformations Initializes data using only one starting point.

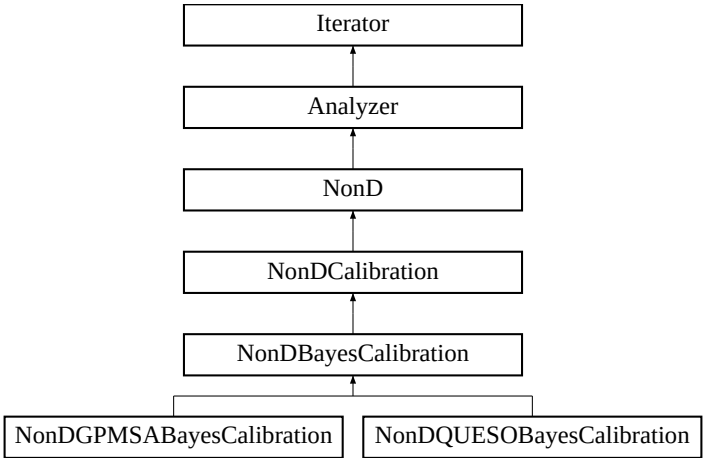
References NonDAdaptImpSampling::designPoint, NonDAdaptImpSampling::failThresh, NonDAdaptImpSampling::initPoints, NonDAdaptImpSampling::initProb, NonD::natafTransform, NonD::numContDesVars, Iterator::numContinuousVars, NonD::numUncertainVars, NonDAdaptImpSampling::respFn, and NonDAdaptImpSampling::transInitPoints.

The documentation for this class was generated from the following files:

- NonDAdaptImpSampling.H
- NonDAdaptImpSampling.C

43.72 NonDBayesCalibration Class Reference

Base class for Bayesian inference: generates posterior distribution on model parameters given experimental data. Inheritance diagram for NonDBayesCalibration::



Public Member Functions

- NonDBayesCalibration (Model &model)

  standard constructor

- ~NonDBayesCalibration ()

  destructor

Protected Member Functions

- void quantify_uncertainty ()

  performs a forward uncertainty propagation of parameter distributions into response statistics

- const Model & algorithm_space_model () const

  return the result of any recasting or surrogate model recursion layered on top of iteratedModel by the derived Iterator ctor chain

Protected Attributes

- Model emulatorModel

  Model instance employed in the likelihood function; provides response function values from Gaussian processes, stochastic expansions (PCE/SC), or direct access to simulations (no surrogate option).

- bool standardizedSpace

  flag indicating use of a variable transformation to standardized probability space

- Iterator stochExpIterator

  NonDPolynomialChaos or NonDStochCollocation instance for defining a PCE/SC-based emulatorModel.

Private Attributes

- short emulatorType

  the emulator type: NO_EMULATOR, GAUSSIAN_PROCESS, POLYNOMIAL_CHAOS, or STOCHASTIC_-COLLOCATION

43.72.1 Detailed Description

Base class for Bayesian inference: generates posterior distribution on model parameters given experimental data. This class will eventually provide a general-purpose framework for Bayesian inference. In the short term, it only collects shared code between QUESO and GPMSA implementations.

43.72.2 Constructor & Destructor Documentation

43.72.2.1 NonDBayesCalibration (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification.

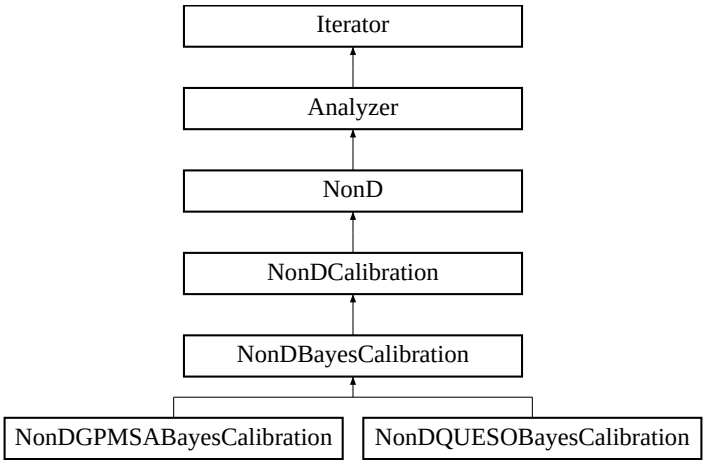
References Iterator::algorithm_space_model(), Model::assign_rep(), Iterator::assign_rep(), NonD::cdfFlag, NonD::construct_lhs(), NonD::construct_u_space_model(), NonDBayesCalibration::emulatorModel, NonDBayesCalibration::emulatorType, ProblemDescDB::get_bool(), ProblemDescDB::get_dusa(), ProblemDescDB::get_int(), ProblemDescDB::get_string(), Iterator::gradientType, Iterator::hessianType, Model::init_communicators(), NonD::initialize_random_variable_correlations(), NonD::initialize_random_-variable_transformation(), NonD::initialize_random_variable_types(), Iterator::iteratedModel, Iterator::iterator_-rep(), Iterator::probDescDB, NonD::requested_levels(), NonD::respLevelTarget, NonDBayesCalibration::standardizedSpace, NonDBayesCalibration::stochExpIterator, and NonD::verify_correlation_support().

The documentation for this class was generated from the following files:

- NonDBayesCalibration.H
- NonDBayesCalibration.C

43.73 NonDCalibration Class Reference

Inheritance diagram for NonDCalibration::



Public Member Functions

- NonDCalibration (Model &model)

  standard constructor

- ~NonDCalibration ()

  destructor

Protected Member Functions

- void set_configuration_vars (Model &model, const RealVector &x)

  set the passed configuration variables into the model's state vars

Protected Attributes

- RealVector expStdDeviations

  1 or numFunctions standard deviations

- String expDataFileName

  filename from which to read experimental data; optionally configuration vars x and standard deviations sigma

- bool expDataFileAnnotated

  whether the data file is in annotated format

- size_t numExperiments

  number of experiments to read from data file

- size_t numExpConfigVars

  number of columns in data file which are state variables

- size_t numExpStdDeviationsRead

  how many sigmas to read from the data file (1 or numFunctions)

Private Member Functions

- bool find_state_index (unsigned short state_type, UShortMultiArrayConstView variable_types, std::string context_message, size_t &start_index)

  helper function to lookup a state_type enum variable type in the array of variables_types to find its start_index into the all array

Private Attributes

- size_t continuousConfigVars

  number of continuous configuration variables

- size_t discreteIntConfigVars

  number of discrete integer configuration variables

- size_t discreteRealConfigVars

  number of discrete real configuration variables

- size_t continuousConfigStart

  index of configuration variables in all continuous array

- size_t discreteIntConfigStart

  index of configuration variables in all discrete integer array

- size_t discreteRealConfigStart

  index of configuration variables in all discrete real array

43.73.1 Detailed Description

This class ...

43.73.2 Constructor & Destructor Documentation

43.73.2.1 NonDCalibration (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification.

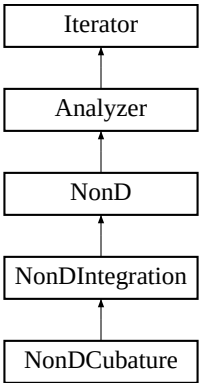
References Dakota::abort_handler(), Model::all_continuous_variable_types(), Model::all_discrete_int_variable_-types(), Model::all_discrete_real_variable_types(), NonDCalibration::continuousConfigStart, NonDCalibration::continuousConfigVars, NonDCalibration::discreteIntConfigStart, NonDCalibration::discreteIntConfigVars, NonDCalibration::discreteRealConfigStart, NonDCalibration::discreteRealConfigVars, NonDCalibration::expDataFileName, NonDCalibration::expStdDeviations, NonDCalibration::find_state_index(), ProblemDescDB::get_sizet(), Iterator::iteratedModel, NonDCalibration::numExpConfigVars, NonDCalibration::numExperiments, Iterator::numFunctions, and Iterator::probDescDB.

The documentation for this class was generated from the following files:

- NonDCalibration.H
- NonDCalibration.C

43.74 NonDCubature Class Reference

Derived nondeterministic class that generates N-dimensional numerical cubature points for evaluation of expectation integrals. Inheritance diagram for NonDCubature::



Public Member Functions

- NonDCubature (Model &model, const Pecos::ShortArray &u_types, unsigned short cub_int_order)
- unsigned short integrand_order () const

  return cubIntOrder

Protected Member Functions

- NonDCubature (Model &model)

  constructor

- ~NonDCubature ()

  destructor

- void initialize_grid (const std::vector< Pecos::BasisPolynomial > &poly_basis)

  initialize integration grid by drawing from polynomial basis settings

- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)
- void increment_grid ()

  increment SSG level/TPQ order

- void increment_grid_preference (const RealVector &dim_pref)
- int num_samples () const

get the current number of samples

Private Member Functions

- void anisotropic_preference (const RealVector &dim_pref)

  update cubIntOrder based on an updated dimension preference

- void check_integration (const Pecos::ShortArray &u_types, const Pecos::DistributionParams &dp)

  verify self-consistency of integration specification

- void increment_reference ()

  increment each cubIntOrderRef entry by 1

Private Attributes

- Pecos::CubatureDriver * cubDriver

  convenience pointer to the numIntDriver representation

- unsigned short cubIntOrderRef

  reference point for Pecos::CubatureDriver::cubIntOrder: the original user specification for the number of Gauss points per dimension, plus any refinements posted by increment_grid()

- unsigned short cubIntRule

  the isotropic cubature integration rule

43.74.1 Detailed Description

Derived nondeterministic class that generates N-dimensional numerical cubature points for evaluation of expectation integrals. This class is used by NonDPolynomialChaos, but could also be used for general numerical integration of moments. It employs Stroud cubature rules and extensions by D. Xiu.

43.74.2 Constructor & Destructor Documentation

43.74.2.1 NonDCubature (Model & *model*, const Pecos::ShortArray & *u_types*, unsigned short *cub_int_order*)

This alternate constructor is used for on-the-fly generation and evaluation of numerical cubature points.

References NonDCubature::check_integration(), NonDCubature::cubDriver, NonDCubature::cubIntOrderRef, Model::distribution_parameters(), Iterator::iteratedModel, and NonDIntegration::numIntDriver.

43.74.2.2 NonDCubature (Model & *model*) [protected]

constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_-list_nodes has been called and probDescDB can be queried for settings from the method specification. It is not currently used, as there is not yet a separate nond_cubature method specification.

References NonDCubature::check_integration(), NonDIntegration::check_variables(), NonDCubature::cubDriver, NonDCubature::cubIntOrderRef, NonDCubature::cubIntRule, Model::distribution_parameters(), Iterator::iteratedModel, Iterator::maxConcurrency, NonD::natafTransform, and NonDIntegration::numIntDriver.

43.74.3 Member Function Documentation

43.74.3.1 void sampling_reset (int *min_samples*, bool *all_data_flag*, bool *stats_flag*) [protected, virtual]

used by DataFitSurrModel::build_global() to publish the minimum number of points needed from the cubature routine in order to build a particular global approximation.

Reimplemented from Iterator.

References NonDCubature::cubDriver, and NonDCubature::cubIntOrderRef.

43.74.3.2 void increment_grid_preference (const RealVector & *dim_pref*) [inline, protected, virtual]

Should not be used, but pure virtual must be defined.

Reimplemented from NonDIntegration.

References NonDCubature::increment_grid().

43.74.3.3 int num_samples () const [inline, protected, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References NonDCubature::cubDriver.

43.74.3.4 void increment_reference () [inline, private]

increment each cubIntOrderRef entry by 1 cubIntOrderRef is a reference point for CubatureDriver::cubIntOrder, e.g., a lower bound

References NonDCubature::cubIntOrderRef.

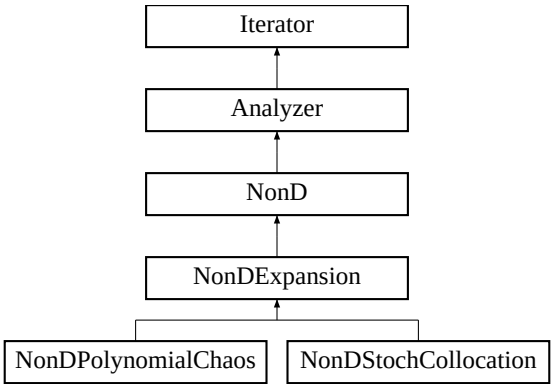
Referenced by NonDCubature::increment_grid().

The documentation for this class was generated from the following files:

- NonDCubature.H
- NonDCubature.C

43.75 NonDExpansion Class Reference

Base class for polynomial chaos expansions (PCE) and stochastic collocation (SC). Inheritance diagram for NonDExpansion::



Public Member Functions

- NonDExpansion (Model &model)

  standard constructor

- NonDExpansion (Model &model, short exp_coeffs_approach, short u_space_type, bool piecewise_basis, bool use_derivs)

  alternate constructor

- ~NonDExpansion ()

  destructor

- void quantify_uncertainty ()

  perform a forward uncertainty propagation using PCE/SC methods

- void print_results (std::ostream &s)

  print the final statistics

- const Model & algorithm_space_model () const

  return the result of any recasting or surrogate model recursion layered on top of iteratedModel by the derived Iterator ctor chain

Protected Member Functions

- virtual void resolve_inputs (short &u_space_type, short &data_order)

  perform error checks and mode overrides

- virtual void initialize_u_space_model ()

  initialize uSpaceModel polynomial approximations with PCE/SC data

- virtual void initialize_expansion ()

  initialize random variable definitions and final stats arrays

- virtual void compute_expansion ()

  form the expansion by calling uSpaceModel.build_approximation()

- virtual void increment_expansion ()

  uniformly increment the expansion order (PCE only)

- virtual void print_coefficients (std::ostream &s)

  print expansion coefficients, as supported by derived instance

- void update_final_statistics ()

  update function values within finalStatistics

- void update_final_statistics_gradients ()

  update function gradients within finalStatistics

- void initialize (short u_space_type)

  common constructor code for initialization of natafTransform

- void refine_expansion ()

  refine the reference expansion found by compute_expansion() using uniform/adaptive p-/h-refinement strategies

- void update_expansion ()

  update the expansion by calling uSpaceModel.build_approximation(); avoids unnecessary overhead in compute_-expansion()

- void update_hierarchy ()

  update settings for subsequent passes in the case of multifidelity models

- void construct_cubature (Iterator &u_space_sampler, Model &g_u_model, unsigned short cub_int_order)

  assign a NonDCubature instance within u_space_sampler

- void construct_quadrature (Iterator &u_space_sampler, Model &g_u_model, const UShortArray &quad_-order, const RealVector &dim_pref)

  assign a NonDQuadrature instance within u_space_sampler based on a quad_order specification

- void construct_quadrature (Iterator &u_space_sampler, Model &g_u_model, int filtered_samples, const RealVector &dim_pref)

  assign a NonDQuadrature instance within u_space_sampler based on the size of a filtered tensor product sample set

- void construct_sparse_grid (Iterator &u_space_sampler, Model &g_u_model, const UShortArray &ssg_-level, const RealVector &ssg_dim_pref)

  assign a NonDSparseGrid instance within u_space_sampler

- void construct_local_refinement (Iterator &u_space_sampler, Model &g_u_model, const UShortArray &lr_level, const RealVector &dim_pref)

  assign a NonDLocalRefinement instance within u_space_sampler

- void construct_expansion_sampler ()

  construct the expansionSampler operating on uSpaceModel

- void compute_statistics ()

  calculate analytic and numerical statistics from the expansion

Protected Attributes

- Model uSpaceModel

  Model representing the approximate response function in u-space, after u-space recasting and orthogonal polynomial data fit recursions.

- short expansionCoeffsApproach

  method for collocation point generation and subsequent calculation of the expanion coefficients

- size_t numUncertainQuant

  number of invocations of quantify_uncertainty()

- int numSamplesOnModel

  number of truth samples performed on g_u_model to form the expansion

- int numSamplesOnExpansion

  number of approximation samples performed on the polynomial expansion in order to estimate probabilities

- bool nestedRules

  flag for indicating state of `nested` *and* `non_nested` *overrides of default rule nesting, which depends on the type of integration driver*

- bool piecewiseBasis

  flag for `piecewise` *specification, indicating usage of local basis polynomials within the stochastic expansion*

- bool useDerivs

  flag for `use_derivatives` *specification, indicating usage of derivative data (with respect to expansion variables) to enhance the calculation of the stochastic expansion.*

- short refineType

refinement type: NO_REFINEMENT, P_REFINEMENT, or H_REFINEMENT

- short refineControl

  refinement control: NO_CONTROL, UNIFORM_CONTROL, LOCAL_ADAPTIVE_CONTROL, DIMENSION_-ADAPTIVE_CONTROL_SOBOL, DIMENSION_ADAPTIVE_CONTROL_DECAY, or DIMENSION_ADAPTIVE_-CONTROL_GENERALIZED

Private Member Functions

- void reduce_total_sobol_sets (RealVector &avg_sobol)

  compute average of total Sobol' indices (from VBD) across the response set for use as an anisotropy indicator

- void reduce_decay_rate_sets (RealVector &min_decay)

  compute minimum of spectral coefficient decay rates across the response set for use as an anisotropy indicator

- void initialize_sets ()

  initialization of adaptive refinement using generalized sparse grids

- Real increment_sets ()

  perform an adaptive refinement increment using generalized sparse grids

- void finalize_sets (bool converged_within_tol)

  finalization of adaptive refinement using generalized sparse grids

- Real compute_covariance_metric (const RealSymMatrix &resp_covar_ref)

  compute 2-norm of change in response covariance

- Real compute_final_statistics_metric (const RealVector &final_stats_ref)

  compute 2-norm of change in final statistics

- void compute_covariance ()

  calculate respCovariance

- void compute_off_diagonal_covariance ()

  calculate respCovariance(i,j) for j<i

- void print_moments (std::ostream &s)

  print expansion and numerical moments

- void print_covariance (std::ostream &s)

  print respCovariance

- void print_sobol_indices (std::ostream &s)

  print global sensitivity indices

- void print_local_sensitivity (std::ostream &s)

  print local sensitivities evaluated at initialPtU

- void compute_print_increment_results ()

  manage print of results following a refinement increment

- void compute_print_iteration_results (bool initialize)

  manage print of results following a refinement increment

- void compute_print_converged_results (bool print_override=false)

  manage print of results following convergence of iterative refinement

Private Attributes

- short ruleNestingOverride

  user override of default rule nesting: NO_NESTING_OVERRIDE, NESTED, or NON_NESTED

- short ruleGrowthOverride

  user override of default rule growth: NO_GROWTH_OVERRIDE, RESTRICTED, or UNRESTRICTED

- Iterator expansionSampler

  Iterator used for sampling on the uSpaceModel to generate approximate probability/reliability/response level statistics. Currently this is an LHS sampling instance, but AIS could also be used.

- Iterator importanceSampler

  Iterator used to refine the approximate probability estimates generated by the expansionSampler using importance sampling.

- bool expSampling

  flag to indicate calculation of numerical statistics by sampling on the expansion

- bool impSampling

  flag to use LHS sampling or MMAIS sampling on the expansion

- RealVector initialPtU

  stores the initial variables data in u-space

- RealMatrix expGradsMeanX

  derivative of the expansion with respect to the x-space variables evaluated at the means (used as uncertainty importance metrics)

- RealSymMatrix respCovariance

  symmetric matrix of analytic response covariance

- short vbdControl

enumeration for controlling VBD calculation and output: NO_VBD, UNIVARIATE_VBD, or ALL_VBD

- Real vbdDropTol

  tolerance for omitting output of small VBD indices

43.75.1 Detailed Description

Base class for polynomial chaos expansions (PCE) and stochastic collocation (SC). The NonDExpansion class provides a base class for methods that use polynomial expansions to approximate the effect of parameter uncertainties on response functions of interest.

43.75.2 Member Function Documentation

43.75.2.1 void compute_statistics () [protected]

calculate analytic and numerical statistics from the expansion Calculate analytic and numerical statistics from the expansion and log results within final_stats for use in OUU.

References Dakota::abort_handler(), Iterator::active_set(), Response::active_set_derivative_vector(), Response::active_set_request_vector(), Iterator::all_responses(), Iterator::all_samples(), Model::approximation_data(), Model::approximations(), NonD::cdfFlag, PecosApproximation::compute_component_effects(), PecosApproximation::compute_moments(), NonDExpansion::compute_off_diagonal_covariance(), PecosApproximation::compute_total_effects(), NonD::computedGenRelLevels, NonD::computedProbLevels, NonD::computedRelLevels, NonD::computedRespLevels, Model::continuous_variable_ids(), Model::continuous_variables(), Dakota::copy_data(), PecosApproximation::expansion_coefficient_flag(), NonDExpansion::expansionSampler, NonDExpansion::expGradsMeanX, NonDExpansion::expSampling, NonD::finalStatistics, Response::function_gradient(), Response::function_value(), Response::function_values(), NonDAdaptImpSampling::get_probability(), NonDExpansion::importanceSampler, NonDExpansion::impSampling, Iterator::initial_points(), NonDAdaptImpSampling::initialize(), NonD::initialize_distribution_mappings(), NonD::initialize_random_variables(), NonDExpansion::initialPtU, Iterator::iteratedModel, Iterator::iterator_rep(), PecosApproximation::mean_gradient(), PecosApproximation::moments(), NonD::natafTransform, NonD::numContDesVars, NonD::numContEpistUncVars, Iterator::numContinuousVars, NonD::numContStateVars, Iterator::numFunctions, NonDExpansion::numSamplesOnExpansion, Iterator::outputLevel, NonDExpansion::refineControl, ActiveSet::request_vector(), NonD::requestedGenRelLevels, NonD::requestedProbLevels, NonD::requestedRelLevels, NonD::requestedRespLevels, NonDExpansion::respCovariance, NonD::respLevelTarget, Iterator::response_results(), Iterator::run_iterator(), Iterator::subIteratorFlag, NonD::totalLevelRequests, NonDSampling::update_final_statistics(), NonDExpansion::uSpaceModel, PecosApproximation::variance_gradient(), and NonDExpansion::vbdControl.

Referenced by NonDExpansion::compute_final_statistics_metric(), NonDExpansion::compute_print_converged_results(), NonDExpansion::compute_print_increment_results(), and NonDExpansion::compute_print_iteration_results().

43.75.2.2 Real compute_final_statistics_metric (const RealVector & *final_stats_ref*) `[private]`

compute 2-norm of change in final statistics computes a "goal-oriented" refinement metric employing finalStatistics

References NonDExpansion::compute_statistics(), NonD::finalStatistics, Response::function_values(), Iterator::numFunctions, NonD::requestedGenRelLevels, NonD::requestedProbLevels, NonD::requestedRelLevels, and NonD::requestedRespLevels.

Referenced by NonDExpansion::increment_sets().

43.75.3 Member Data Documentation

43.75.3.1 bool useDerivs `[protected]`

flag for `use_derivatives` specification, indicating usage of derivative data (with respect to expansion variables) to enhance the calculation of the stochastic expansion. This is part of the method specification since the instantiation of the global data fit surrogate is implicit with no user specification. This behavior is distinct from the usage of response derivatives with respect to auxilliary variables (design, epistemic) for computing derivatives of aleatory expansion statistics with respect to these variables.

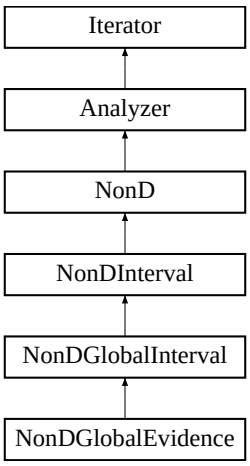
Referenced by NonDExpansion::compute_expansion(), NonDStochCollocation::initialize_u_space_model(), NonDPolynomialChaos::initialize_u_space_model(), NonDStochCollocation::resolve_inputs(), NonDPolynomialChaos::resolve_inputs(), NonDPolynomialChaos::terms_ratio_to_samples(), and NonDPolynomialChaos::terms_samples_to_ratio().

The documentation for this class was generated from the following files:

- NonDExpansion.H
- NonDExpansion.C

43.76 NonDGlobalEvidence Class Reference

Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ. Inheritance diagram for NonDGlobalEvidence::



Public Member Functions

- NonDGlobalEvidence (Model &model)

  constructor

- ~NonDGlobalEvidence ()

  destructor

- void initialize ()

  perform any required initialization

- void set_cell_bounds ()

  set the optimization variable bounds for each cell

- void get_best_sample (bool find_max, bool eval_approx)

  determine truthFnStar and approxFnStar

- void post_process_cell_results (bool minimize)

  post-process a cell minimization/maximization result

- void post_process_response_fn_results ()

  post-process the interval computed for a response function

- void post_process_final_results ()

  perform final post-processing

43.76.1 Detailed Description

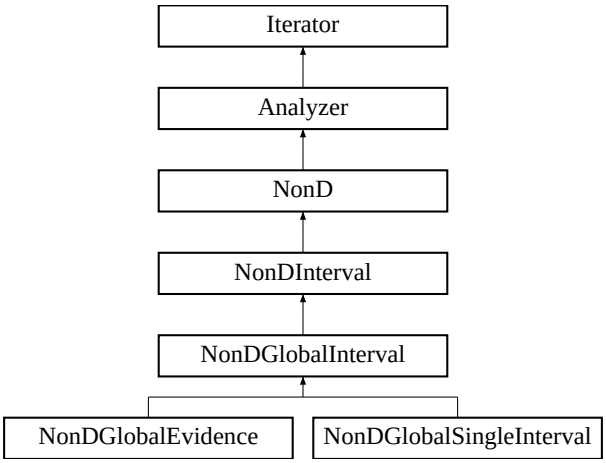
Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ. The NonDEvidence class implements the propagation of epistemic uncertainty using Dempster-Shafer theory of evidence. In this approach, one assigns a set of basic probability assignments (BPA) to intervals defined for the uncertain variables. Input interval combinations are calculated, along with their BPA. Currently, the response function is evaluated at a set of sample points, then a response surface is constructed which is sampled extensively to find the minimum and maximum within each input interval cell, corresponding to the belief and plausibility within that cell, respectively. This data is then aggregated to calculate cumulative distribution functions for belief and plausibility.

The documentation for this class was generated from the following files:

- NonDGlobalEvidence.H
- NonDGlobalEvidence.C

43.77 NonDGlobalInterval Class Reference

Class for using global nongradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. Inheritance diagram for NonDGlobalInterval::



Public Member Functions

- NonDGlobalInterval (Model &model)

  constructor

- ~NonDGlobalInterval ()

  destructor

- void quantify_uncertainty ()

  Performs an optimization to determine interval bounds for an entire function or interval bounds on a particular statistical estimator.

- const Model & algorithm_space_model () const

  return the result of any recasting or surrogate model recursion layered on top of iteratedModel by the derived Iterator ctor chain

Protected Member Functions

- virtual void initialize ()

  perform any required initialization

- virtual void set_cell_bounds ()

  set the optimization variable bounds for each cell

- virtual void get_best_sample (bool find_max, bool eval_approx)

  determine truthFnStar and approxFnStar

- virtual void post_process_cell_results (bool minimize)

  post-process a cell minimization/maximization result

- virtual void post_process_response_fn_results ()

  post-process the interval computed for a response function

- virtual void post_process_final_results ()

  perform final post-processing

- void post_process_gp_results ()

  post-process a GP-based optimization iteration: output EIF maximization results, update convergence controls, and update GP approximation

Protected Attributes

- Iterator daceIterator

  LHS iterator for constructing initial GP for all response functions.

- Iterator gpOptimizer

  NCSU DIRECT optimizer for maximizing expected improvement.

- Model fHatModel

  GP model of response, one approximation per response function.

- Model eifModel

  recast model which assimilates mean and variance to solve the max(EIF) sub-problem

- Real approxFnStar

  approximate response corresponding to minimum/maximum truth response

- Real truthFnStar

  minimum/maximum truth response function value

Static Private Member Functions

- static void EIF_objective_min (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in the Expected Improvement Function (EIF) for minimizing the GP

- static void EIF_objective_max (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

static function used as the objective function in the Expected Improvement Function (EIF) for maximizing the GP

Private Attributes

- const int seedSpec

  the user seed specification (default is 0)

- int numSamples

  the number of samples used in the surrogate

- String rngName

  name of the random number generator

- size_t eifConvergenceCntr

  counter for number of successive iterations that the optimal EIF is less than the convergenceTol

- size_t distConvergenceCntr

  counter for number of successive iterations that the L_2 change in optimal solution is less than the convergenceTol

- RealVector prevCStar

  stores previous optimal points for convergence

- size_t sbIterNum

  surrogate-based minimization/maximization iteration count

- bool approxConverged

  flag indicating convergence of a GP minimization or maximization

- bool allResponsesPerIter

  flag for maximal response extraction

- short dataOrder

  order of the data used for surrogate construction, in ActiveSet request vector 3-bit format; user may override responses spec

Static Private Attributes

- static NonDGlobalInterval * nondGIInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.77.1 Detailed Description

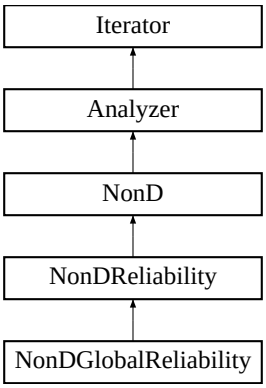
Class for using global nongradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. The NonDGlobalInterval class supports global nongradient-based optimization approaches to determining interval bounds for epistemic UQ. The interval bounds may be on the entire function in the case of pure interval analysis (e.g. intervals on input = intervals on output), or the intervals may be on statistics of an "inner loop" aleatory analysis such as intervals on means, variances, or percentile levels. The preliminary implementation will use a Gaussian process surrogate to determine interval bounds.

The documentation for this class was generated from the following files:

- NonDGlobalInterval.H
- NonDGlobalInterval.C

43.78 NonDGlobalReliability Class Reference

Class for global reliability methods within DAKOTA/UQ. Inheritance diagram for NonDGlobalReliability::



Public Member Functions

- NonDGlobalReliability (Model &model)

  constructor

- ~NonDGlobalReliability ()

  destructor

- void quantify_uncertainty ()

  performs an uncertainty propagation using analytical reliability methods which solve constrained optimization problems to obtain approximations of the cumulative distribution function of response

- void print_results (std::ostream &s)

  print the approximate mean, standard deviation, and importance factors when using the mean value method or the CDF/CCDF information when using MPP-search-based reliability methods

Private Member Functions

- void optimize_gaussian_process ()

  construct the GP using EGO/SKO

- void importance_sampling ()

  perform multimodal adaptive importance sampling on the GP

- void get_best_sample ()

  determine current best solution from among sample data for expected imporovement function in Performance Measure Approach (PMA)

- Real constraint_penalty (const Real &constraint, const RealVector &c_variables)

  calculate the penalty to be applied to the PMA constraint value

- Real expected_improvement (const RealVector &expected_values, const RealVector &c_variables)

  expected improvement function for the GP

- Real expected_feasibility (const RealVector &expected_values, const RealVector &c_variables)

  expected feasibility function for the GP

Static Private Member Functions

- static void EIF_objective_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in the Expected Improvement (EIF) problem formulation for PMA

- static void EFF_objective_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in the Expected Feasibility (EFF) problem formulation for RIA

Private Attributes

- Real fnStar

  minimum penalized response from among true function evaluations

- short meritFunctionType

  type of merit function used to penalize sample data

- Real lagrangeMult

  Lagrange multiplier for standard Lagrangian merit function.

- Real augLagrangeMult

  Lagrange multiplier for augmented Lagrangian merit function.

- Real penaltyParameter

  penalty parameter for augmented Lagrangian merit funciton

- Real lastConstraintViolation

  constraint violation at last iteration, used to determine if the current iterate should be accepted (must reduce violation)

- bool lastIterateAccepted

  flag to determine if last iterate was accepted this controls update of parameters for augmented Lagrangian merit fn

- short dataOrder

  order of the data used for surrogate construction, in ActiveSet request vector 3-bit format; user may override responses spec

Static Private Attributes

- static NonDGlobalReliability * nondGlobRelInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.78.1 Detailed Description

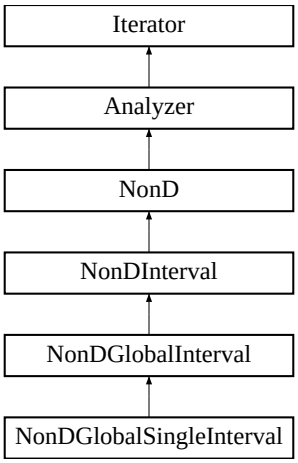
Class for global reliability methods within DAKOTA/UQ. The NonDGlobalReliability class implements EGO/SKO for global MPP search, which maximizes an expected improvement function derived from Gaussian process models. Once the limit state has been characterized, a multimodal importance sampling approach is used to compute probabilities.

The documentation for this class was generated from the following files:

- NonDGlobalReliability.H
- NonDGlobalReliability.C

43.79 NonDGlobalSingleInterval Class Reference

Class for using global nongradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. Inheritance diagram for NonDGlobalSingleInterval::



Public Member Functions

- NonDGlobalSingleInterval (Model &model)
  constructor
- ~NonDGlobalSingleInterval ()
  destructor

Protected Member Functions

- void initialize ()
  perform any required initialization
- void post_process_cell_results (bool minimize)
  post-process a cell minimization/maximization result
- void get_best_sample (bool find_max, bool eval_approx)
  determine truthFnStar and approxFnStar

Private Attributes

- size_t statCntr
  counter for finalStatistics

43.79.1 Detailed Description

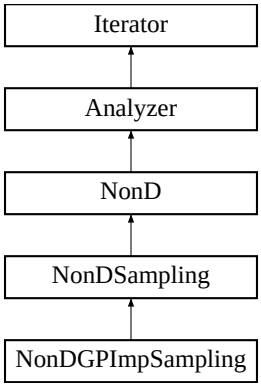
Class for using global nongradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. The NonDGlobalSingleInterval class supports global nongradient-based optimization apporaches to determining interval bounds for epistemic UQ. The interval bounds may be on the entire function in the case of pure interval analysis (e.g. intervals on input = intervals on output), or the intervals may be on statistics of an "inner loop" aleatory analysis such as intervals on means, variances, or percentile levels. The preliminary implementation will use a Gaussian process surrogate to determine interval bounds.

The documentation for this class was generated from the following files:

- NonDGlobalSingleInterval.H
- NonDGlobalSingleInterval.C

43.80 NonDGPImpSampling Class Reference

Class for the Gaussian Process-based Importance Sampling method. Inheritance diagram for NonDGPImpSampling::



Public Member Functions

- NonDGPImpSampling (Model &model)

  standard constructor

- ~NonDGPImpSampling ()

  alternate constructor for sample generation and evaluation "on the fly"

Protected Member Functions

- void quantify_uncertainty ()

  perform the GP importance sampling and return probability of failure.

- const Real & get_probability ()

  returns the probability calculated by the importance sampling

Private Member Functions

- RealVector calcExpIndicator (const int respFnCount, const Real respThresh)

  function to calculate the expected indicator probabilities

- Real calcExpIndPoint (const int respFnCount, const Real respThresh, const RealVector this_mean, const RealVector this_var)

  function to calculate the expected indicator probabilities for one point

- void calcRhoDraw ()

  function to update the rhoDraw data, adding x values and rho draw values

- RealVector drawNewX (int this_k)

  function to pick the next X value to be evaluated by the Iterated model

Private Attributes

- Iterator gpBuild

  LHS iterator for building the initial GP.

- Iterator gpEval

  LHS iterator for sampling on the GP.

- Model gpModel

  GP model of response, one approximation per response function.

- Iterator sampleRhoOne

  LHS iterator for sampling from the rhoOneDistribution.

- int numPtsAdd

  the number of points added to the original set of LHS samples

- int numPtsTotal

  the total number of points

- int numEmulEval

  the number of points evaluated by the GP each iteration

- Real finalProb

  the final calculated probability (p)

- RealVectorArray gpCvars

  Vector to hold the current values of the current sample inputs on the GP.

- RealVectorArray gpMeans

  Vector to hold the current values of the current mean estimates for the sample values on the GP.

- RealVectorArray gpVar

  Vector to hold the current values of the current variance estimates for the sample values on the GP.

- RealVector expIndicator

  Vector to hold the expected indicator values for the current GP samples.

- RealVector normConst

Vector to hold the normalization constant calculated for each point added.

- IntVector indicator

  IntVector to hold indicator for actual simulation values vs. threshold.

- RealVectorArray xDrawThis

  xDrawThis, appended to locally to hold the X values of emulator points chosen

- RealVector expIndThis

  expIndThis, appended locally to hold the expected indicator

- RealVector rhoDrawThis

  rhoDrawThis, appended locally to hold the rhoDraw density for calculating draws

- RealVector rhoMix

  rhoMix, mixture density

- RealVector rhoOne

  rhoOne, original importance density

43.80.1 Detailed Description

Class for the Gaussian Process-based Importance Sampling method. The NonDGPImpSampling implements a method developed by Keith Dalbey that uses a Gaussian process surrogate in the calculation of the importance density. Specifically, the mean and variance of the GP prediction are used to calculate an expected value that a particular point fails, and that is used as part of the computation of the "draw distribution." The normalization constants and the mixture distribution used are defined in (need to get SAND report).

43.80.2 Constructor & Destructor Documentation

43.80.2.1 NonDGPImpSampling (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification.

References Model::assign_rep(), NonD::construct_lhs(), ProblemDescDB::get_bool(), NonDGPImpSampling::gpBuild, NonDGPImpSampling::gpEval, NonDGPImpSampling::gpModel, Iterator::gradientType, Iterator::hessianType, Model::init_communicators(), Iterator::iteratedModel, Iterator::maximum_concurrency(), NonDGPImpSampling::numEmulEval, NonDSampling::numSamples, Iterator::probDescDB, NonDSampling::randomSeed, NonDSampling::rngName, NonDGPImpSampling::sampleRhoOne, NonDSampling::samplingVarsMode, and NonDSampling::vary_pattern().

43.80.2.2 ~NonDGPImpSampling ()

alternate constructor for sample generation and evaluation "on the fly" destructor

References Model::free_communicators(), NonDGPImpSampling::gpEval, NonDGPImpSampling::gpModel, and Iterator::maximum_concurrency().

43.80.3 Member Function Documentation

43.80.3.1 void quantify_uncertainty () [protected, virtual]

perform the GP importance sampling and return probability of failure. Calculate the failure probabilities for specified probability levels using Gaussian process based importance sampling.

Implements NonD.

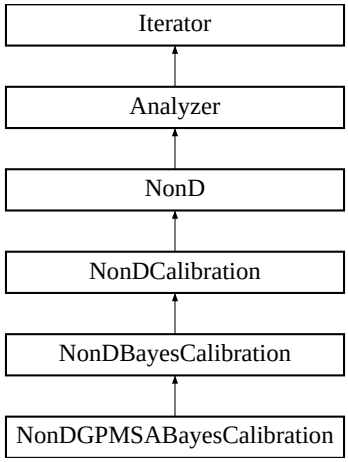
References Model::acv(), Iterator::all_responses(), Iterator::all_samples(), Analyzer::all_samples(), Model::append_approximation(), Model::approximation_data(), Model::approximation_variances(), Model::build_approximation(), NonDGPImpSampling::calcExpIndicator(), NonDGPImpSampling::calcExpIndPoint(), NonDGPImpSampling::calcRhoDraw(), Model::compute_response(), Model::continuous_variables(), Model::current_response(), Model::current_variables(), NonDGPImpSampling::drawNewX(), Model::evaluation_id(), NonDGPImpSampling::expIndicator, NonDGPImpSampling::expIndThis, Response::function_values(), NonDGPImpSampling::gpCvars, NonDGPImpSampling::gpEval, NonDGPImpSampling::gpMeans, NonDGPImpSampling::gpModel, NonDGPImpSampling::gpVar, NonDGPImpSampling::indicator, Iterator::iteratedModel, NonDGPImpSampling::normConst, NonDGPImpSampling::numEmulEval, Iterator::numFunctions, NonDGPImpSampling::numPtsAdd, NonDGPImpSampling::numPtsTotal, NonDSampling::numSamples, Model::pop_approximation(), NonD::requestedRespLevels, NonDGPImpSampling::rhoDrawThis, NonDGPImpSampling::rhoMix, NonDGPImpSampling::rhoOne, Iterator::run_iterator(), NonDGPImpSampling::sampleRhoOne, and NonDGPImpSampling::xDrawThis.

The documentation for this class was generated from the following files:

- NonDGPImpSampling.H
- NonDGPImpSampling.C

43.81 NonDGPMSABayesCalibration Class Reference

Generates posterior distribution on model parameters given experiment data. Inheritance diagram for NonDGPMSABayesCalibration::



Public Member Functions

- NonDGPMSABayesCalibration (Model &model)

  standard constructor

- ~NonDGPMSABayesCalibration ()

  destructor

Protected Member Functions

- void quantify_uncertainty ()

  performs a forward uncertainty propagation by using GPM/SA to generate a posterior distribution on parameters given a set of simulation parameter/response data, a set of experimental data, and additional variables to be specified here.

- void print_results (std::ostream &s)

  print the final statistics

Private Attributes

- Iterator lhsSampler

  LHS sampling iterator.

- int numEmulatorSamples

  number of samples to construct the GP emulator

- int numDraws

  number of draws from the MCMC chain

- const int seedSpec

  the user seed specification (default is 0)

- String rngName

  name of the random number generator Storage for the observed x data (inputs) provided by the user

43.81.1 Detailed Description

Generates posterior distribution on model parameters given experiment data. This class provides a wrapper for the functionality provided in the Los Alamos National Laboratory code called GPM/SA (Gaussian Process Models for Simulation Analysis). Although this is a code that provides input/output mapping, it DOES NOT provide the mapping that we usually think of in the NonDeterministic class hierarchy in DAKOTA, where uncertainty in parameter inputs are mapped to uncertainty in simulation responses. Instead, this class takes a pre-existing set of simulation data as well as experimental data, and maps priors on input parameters to posterior distributions on those input parameters, according to a likelihood function. The goal of the MCMC sampling is to produce posterior values of parameter estimates which will produce simulation response values that "match well" to the experimental data. The MCMC is an integral part of the calibration. The data structures in GPM/SA are fairly detailed and nested. Part of this prototyping exercise is to determine what data structures need to be specified and initialized in DAKOTA and sent to GPM/SA, and what data structures will be returned.

43.81.2 Constructor & Destructor Documentation

43.81.2.1 NonDGPMSABayesCalibration (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification.

References Iterator::assign_rep(), Model::init_communicators(), Iterator::iteratedModel, NonDGPMSABayesCalibration::lhsSampler, Iterator::maximum_concurrency(), NonDGPMSABayesCalibration::numEmulatorSamples, NonDGPMSABayesCalibration::rngName, and NonDGPMSABayesCalibration::seedSpec.

43.81.3 Member Function Documentation

43.81.3.1 void quantify_uncertainty () `[protected, virtual]`

performs a forward uncertainty propagation by using GPM/SA to generate a posterior distribution on parameters given a set of simulation parameter/response data, a set of experimental data, and additional variables to be specified here. This method does all the pre-processing necessary to call the GPM/SA code, including running

LHS on the model to generate the initial samples, doing some normalization, calling the GPM/SA functions, and returning the posterior parameter distributions.

Reimplemented from NonDBayesCalibration.

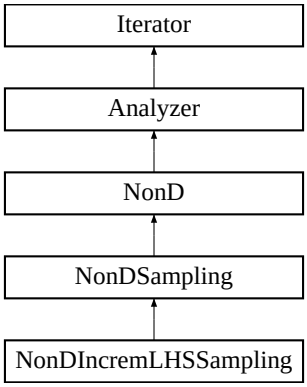
References Dakota::abort_handler(), Model::acv(), Iterator::all_responses(), Iterator::all_samples(), Analyzer::all_samples(), NonDCalibration::expDataFileAnnotated, NonDCalibration::expDataFileName, NonDCalibration::expStdDeviations, Iterator::iteratedModel, NonDGPMSABayesCalibration::lhsSampler, Model::num_functions(), NonDGPMSABayesCalibration::numDraws, NonDGPMSABayesCalibration::numEmulatorSamples, NonDCalibration::numExpConfigVars, NonDCalibration::numExperiments, NonDCalibration::numExpStdDeviationsRead, Iterator::numFunctions, Dakota::read_data_tabular(), and Iterator::run_iterator().

The documentation for this class was generated from the following files:

- NonDGPMSABayesCalibration.H
- NonDGPMSABayesCalibration.C

43.82 NonDIncremLHSSampling Class Reference

Performs icremental LHS sampling for uncertainty quantification. Inheritance diagram for NonDIncremLHSSampling::



Public Member Functions

- NonDIncremLHSSampling (Model &model)

  constructor

- ~NonDIncremLHSSampling ()

  destructor

- void quantify_uncertainty ()

  performs a forward uncertainty propagation by using LHS to generate a set of parameter samples, performing function evaluations on these parameter samples, and computing statistics on the ensemble of results.

- void print_results (std::ostream &s)

  print the final statistics

Static Protected Member Functions

- static bool rank_sort (const int &x, const int &y)

  sort algorithm to compute ranks for rank correlations

Private Attributes

- int previousSamples

  number of samples in previous LHS run

- bool varBasedDecompFlag

  flags computation of VBD

Static Private Attributes

- static RealArray rawData

  static data used by static rank_sort() fn

43.82.1 Detailed Description

Performs icremental LHS sampling for uncertainty quantification. The Latin Hypercube Sampling (LHS) package from Sandia Albuquerque's Risk and Reliability organization provides comprehensive capabilities for Monte Carlo and Latin Hypercube sampling within a broad array of user-specified probabilistic parameter distributions. The icremental LHS sampling capability allows one to supplement an initial sample of size n to size 2n while maintaining the correct stratification of the 2n samples and also maintaining the specified correlation structure. The icremental version of LHS will return a sample of size n, which when combined with the original sample of size n, allows one to double the size of the sample.

43.82.2 Constructor & Destructor Documentation

43.82.2.1 NonDIncremLHSSampling (Model & *model*)

constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_-list_nodes has been called and probDescDB can be queried for settings from the method specification.

References NonDSampling::samplingVarsMode.

43.82.3 Member Function Documentation

43.82.3.1 void quantify_uncertainty () `[virtual]`

performs a forward uncertainty propagation by using LHS to generate a set of parameter samples, performing function evaluations on these parameter samples, and computing statistics on the ensemble of results. Generate incremental samples. Loop over the set of samples and compute responses. Compute statistics on the set of responses if statsFlag is set.

Implements NonD.

References Dakota::abort_handler(), Analyzer::allResponses, Analyzer::allSamples, NonDSampling::compute_-statistics(), Dakota::copy_data(), Dakota::data_pairs, Model::distribution_parameters(), Analyzer::evaluate_parameter_sets(), NonDSampling::get_parameter_sets(), Iterator::iteratedModel, NonD::numBetaVars, Iterator::numContinuousVars, NonD::numExponentialVars, NonD::numGammaVars, NonD::numLognormalVars, NonD::numLoguniformVars, NonD::numNormalVars, NonDSam-pling::numSamples, NonD::numTriangularVars, NonD::numUniformVars, NonD::numWeibullVars, NonD-IncremLHSSampling::previousSamples, NonDIncremLHSSampling::rank_sort(), NonDIncremLHSSam-

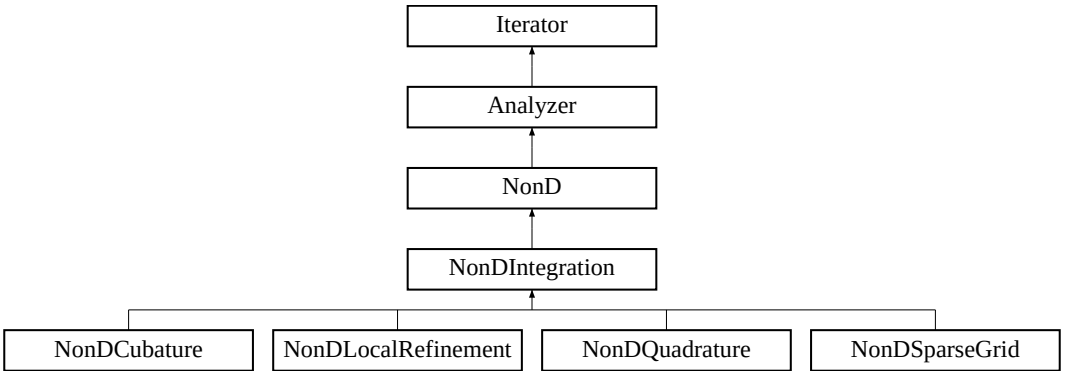
pling::rawData, NonDSampling::sampleRanks, NonDSampling::sampleRanksMode, NonDSampling::samplesRef, NonDSampling::sampleType, NonDSampling::varyPattern, and Dakota::write_data().

The documentation for this class was generated from the following files:

- NonDIncremLHSSampling.H
- NonDIncremLHSSampling.C

43.83 NonDIntegration Class Reference

Derived nondeterministic class that generates N-dimensional numerical integration points for evaluation of expectation integrals. Inheritance diagram for NonDIntegration::



Public Member Functions

- virtual void initialize_grid (const std::vector< Pecos::BasisPolynomial > &poly_basis)=0

  initialize integration grid by drawing from polynomial basis settings

- virtual void increment_grid ()=0

  increment SSG level/TPQ order

- virtual void increment_grid_preference (const RealVector &dim_pref)

  increment SSG level/TPQ order and update anisotropy

- virtual void increment_grid_weights (const RealVector &aniso_wts)

  increment SSG level/TPQ order and update anisotropy

- virtual void increment_refinement_sequence ()

  increment sequenceIndex and update active orders/levels

- const Pecos::IntegrationDriver & driver () const

  return numIntDriver

Protected Member Functions

- NonDIntegration (Model &model)

  constructor

- NonDIntegration (NoDBBaseConstructor, Model &model)

alternate constructor for instantiations "on the fly"

- NonDIntegration (NoDBBaseConstructor, Model &model, const RealVector &dim_pref)
  alternate constructor for instantiations "on the fly"
- ~NonDIntegration ()
  destructor
- void quantify_uncertainty ()
  performs a forward uncertainty propagation of parameter distributions into response statistics
- void check_variables (const Pecos::ShortArray &x_types)
  verify self-consistency of variables data
- void print_points_weights (const String &tabular_name)
  output integration points and weights to a tabular file

Protected Attributes

- Pecos::IntegrationDriver numIntDriver
  Pecos utlity class for managing interface to tensor-product grids and VPISparseGrid utilities for Smolyak sparse grids and cubature.
- size_t numIntegrations
  counter for number of integration executions for this object
- size_t sequenceIndex
  index into NonDQuadrature::quadOrderSpec and NonDSparseGrid::ssgLevelSpec that defines the current instance of several possible refinement levels
- RealVector dimPrefSpec
  the user specification for anisotropic dimension preference

43.83.1 Detailed Description

Derived nondeterministic class that generates N-dimensional numerical integration points for evaluation of expectation integrals. This class provides a base class for shared code among NonDQuadrature and NonDSparseGrid.

43.83.2 Constructor & Destructor Documentation

43.83.2.1 NonDIntegration (Model & *model*) `[protected]`

constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_-list_nodes has been called and probDescDB can be queried for settings from the method specification. It is not currently used, as there are not yet separate nond_quadrature/nond_sparse_grid method specifications.

References Dakota::abort_handler(), NonD::initialize_final_statistics(), NonD::initialize_random_variable_correlations(), NonD::initialize_random_variable_transformation(), NonD::initialize_random_variable_types(), Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, and NonD::verify_correlation_support().

43.83.2.2 NonDIntegration (NoDBBaseConstructor, Model & *model*) [protected]

alternate constructor for instantiations "on the fly" This alternate constructor is used for on-the-fly generation and evaluation of numerical integration points.

43.83.2.3 NonDIntegration (NoDBBaseConstructor, Model & *model*, const RealVector & *dim_pref*) [protected]

alternate constructor for instantiations "on the fly" This alternate constructor is used for on-the-fly generation and evaluation of numerical integration points.

43.83.3 Member Function Documentation

43.83.3.1 void check_variables (const Pecos::ShortArray & *x_types*) [protected]

verify self-consistency of variables data Virtual function called from probDescDB-based constructors and from NonDIntegration::quantify_uncertainty()

References Dakota::abort_handler(), NonD::numContAleatUncVars, NonD::numContDesVars, NonD::numContEpistUncVars, Iterator::numContinuousVars, and NonD::numContStateVars.

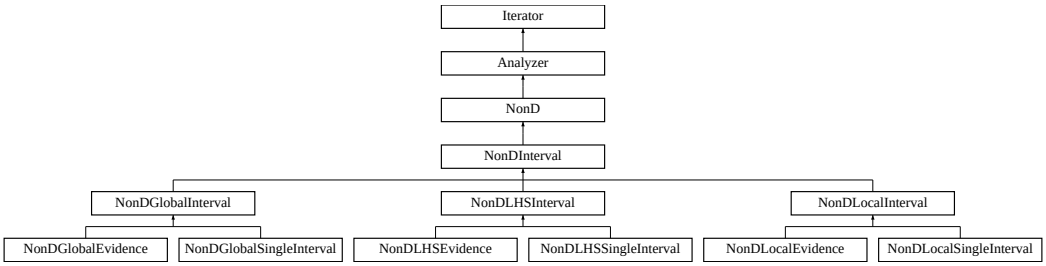
Referenced by NonDCubature::NonDCubature(), NonDQuadrature::NonDQuadrature(), NonDSparseGrid::NonDSparseGrid(), and NonDIntegration::quantify_uncertainty().

The documentation for this class was generated from the following files:

- NonDIntegration.H
- NonDIntegration.C

43.84 NonDInterval Class Reference

Base class for interval-based methods within DAKOTA/UQ. Inheritance diagram for NonDInterval::



Public Member Functions

- NonDInterval (Model &model)

  constructor

- ~NonDInterval ()

  destructor

- void print_results (std::ostream &s)

  performs an epistemic uncertainty propagation using Dempster-Shafer evidence theory methods which solve for cumulative distribution functions of belief and plausibility

Protected Member Functions

- void initialize_final_statistics ()

  initialize finalStatistics for belief/plausibility results sets

- void compute_evidence_statistics ()

  method for computing belief and plausibility values for response levels or vice-versa

- void calculate_cells_and_bpas ()

  computes the interval combinations (cells) and their bpas replaces CBPIIC_F77 from wrapper calculate_basic_-prob_intervals()

- void calculate_cbf_cpf (bool complementary=true)

  function to compute (complementary) distribution functions on belief and plausibility replaces CCBFPF_F77 from wrapper calculate_cum_belief_plaus()

Protected Attributes

- bool singleIntervalFlag

  flag for SingleInterval derived class

- RealVectorArray ccBelFn

  Storage array to hold CCBF values.

- RealVectorArray ccPlausFn

  Storage array to hold CCPF values.

- RealVectorArray ccBelVal

  Storage array to hold CCB response values.

- RealVectorArray ccPlausVal

  Storage array to hold CCP response values.

- RealVectorArray cellLowerBounds

  Storage array to hold cell lower bounds.

- RealVectorArray cellUpperBounds

  Storage array to hold cell upper bounds.

- Real2DArray cellFnLowerBounds

  Storage array to hold cell min.

- Real2DArray cellFnUpperBounds

  Storage array to hold cell max.

- RealArray cellBPA

  Storage array to hold cell bpa.

- size_t respFnCntr

  response function counter

- size_t cellCntr

  cell counter

- size_t numCells

  total number of interval combinations

43.84.1 Detailed Description

Base class for interval-based methods within DAKOTA/UQ. The NonDInterval class implements the propagation of epistemic uncertainty using either pure interval propagation or Dempster-Shafer theory of evidence. In the latter approach, one assigns a set of basic probability assignments (BPA) to intervals defined for the uncertain variables. Input interval combinations are calculated, along with their BPA. Currently, the response function is evaluated at a set of sample points, then a response surface is constructed which is sampled extensively to find the minimum and maximum within each input interval cell, corresponding to the belief and plausibility within that cell, respectively. This data is then aggregated to calculate cumulative distribution functions for belief and plausibility.

43.84.2 Member Function Documentation

43.84.2.1 void print_results (std::ostream & *s*) `[virtual]`

performs an epistemic uncertainty propagation using Dempster-Shafer evidence theory methods which solve for cumulative distribution functions of belief and plausibility print the cumulative distribution functions for belief and plausibility

Reimplemented from Analyzer.

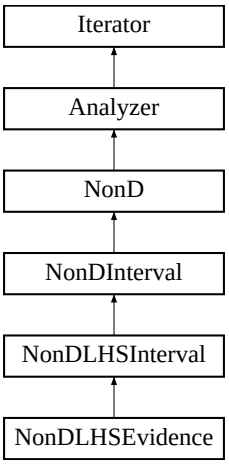
References NonDInterval::ccBelFn, NonDInterval::ccBelVal, NonDInterval::ccPlausFn, NonDInterval::ccPlausVal, NonD::cdfFlag, NonDInterval::cellBPA, NonDInterval::cellFnLowerBounds, NonDInterval::cellFnUpperBounds, NonD::computedGenRelLevels, NonD::computedProbLevels, NonD::computedRespLevels, NonD::finalStatistics, Response::function_values(), Iterator::iteratedModel, NonDInterval::numCells, Iterator::numFunctions, NonD::requestedGenRelLevels, NonD::requestedProbLevels, NonD::requestedRespLevels, NonD::respLevelTarget, Model::response_labels(), NonDInterval::singleIntervalFlag, and Dakota::write_precision.

The documentation for this class was generated from the following files:

- NonDInterval.H
- NonDInterval.C

43.85 NonDLHSEvidence Class Reference

Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ. Inheritance diagram for NonDLHSEvidence::



Public Member Functions

- NonDLHSEvidence (Model &model)

  constructor

- ~NonDLHSEvidence ()

  destructor

- void initialize ()

  perform any required initialization

- void post_process_samples ()

  post-process the output from executing lhsSampler

43.85.1 Detailed Description

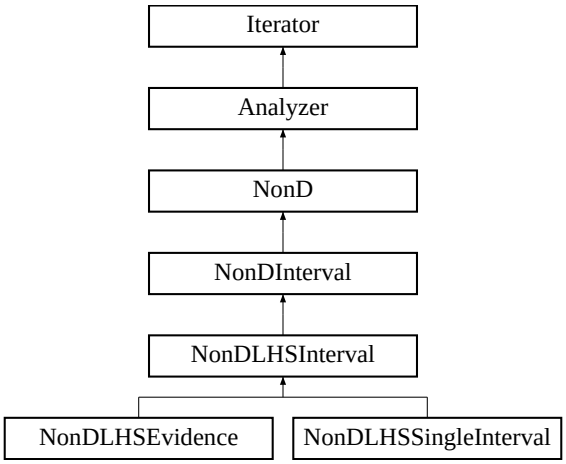
Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ. The NonDEvidence class implements the propagation of epistemic uncertainty using Dempster-Shafer theory of evidence. In this approach, one assigns a set of basic probability assignments (BPA) to intervals defined for the uncertain variables. Input interval combinations are calculated, along with their BPA. Currently, the response function is evaluated at a set of sample points, then a response surface is constructed which is sampled extensively to find the minimum and maximum within each input interval cell, corresponding to the belief and plausibility within that cell, respectively. This data is then aggregated to calculate cumulative distribution functions for belief and plausibility.

The documentation for this class was generated from the following files:

- NonDLHSEvidence.H
- NonDLHSEvidence.C

43.86 NonDLHSInterval Class Reference

Class for the LHS-based interval methods within DAKOTA/UQ. Inheritance diagram for NonDLHSInterval::



Public Member Functions

- NonDLHSInterval (Model &model)

  constructor

- ~NonDLHSInterval ()

  destructor

- void quantify_uncertainty ()

  performs an epistemic uncertainty propagation using LHS samples

Protected Member Functions

- virtual void initialize ()

  perform any required initialization

- virtual void post_process_samples ()=0

  post-process the output from executing lhsSampler

Protected Attributes

- Iterator lhsSampler

  the LHS sampler instance

- const int seedSpec

  the user seed specification (default is 0)

- int numSamples

  the number of samples used

- String rngName

  name of the random number generator

43.86.1 Detailed Description

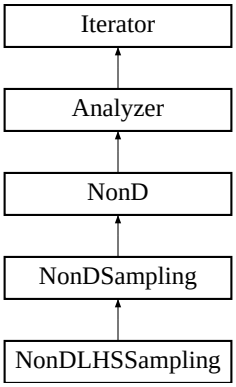
Class for the LHS-based interval methods within DAKOTA/UQ. The NonDLHSInterval class implements the propagation of epistemic uncertainty using LHS-based methods.

The documentation for this class was generated from the following files:

- NonDLHSInterval.H
- NonDLHSInterval.C

43.87 NonDLHSSampling Class Reference

Performs LHS and Monte Carlo sampling for uncertainty quantification. Inheritance diagram for NonDLHSSampling::



Public Member Functions

- NonDLHSSampling (Model &model)

  standard constructor

- NonDLHSSampling (Model &model, const String &sample_type, int samples, int seed, const String &rng, bool vary_pattern=true, short sampling_vars_mode=ACTIVE)

  alternate constructor for sample generation and evaluation "on the fly"

- NonDLHSSampling (const String &sample_type, int samples, int seed, const String &rng, const RealVector &lower_bnds, const RealVector &upper_bnds)

  alternate constructor for sample generation "on the fly"

- ~NonDLHSSampling ()

  destructor

Protected Member Functions

- void pre_run ()

  generate LHS samples in non-VBD cases

- void post_input ()

  read tabular data for post-run mode

- void quantify_uncertainty ()

  perform the evaluate parameter sets portion of run

- void post_run (std::ostream &s)

  generate statistics for LHS runs in non-VBD cases

- void print_results (std::ostream &s)

  print the final statistics

Private Attributes

- size_t numResponseFunctions

  number of response functions; used to distinguish NonD from opt/NLS usage

- bool varBasedDecompFlag

  flags computation of variance-based decomposition indices

43.87.1 Detailed Description

Performs LHS and Monte Carlo sampling for uncertainty quantification. The Latin Hypercube Sampling (LHS) package from Sandia Albuquerque's Risk and Reliability organization provides comprehensive capabilities for Monte Carlo and Latin Hypercube sampling within a broad array of user-specified probabilistic parameter distributions. It enforces user-specified rank correlations through use of a mixing routine. The NonDLHSSampling class provides a C++ wrapper for the LHS library and is used for performing forward propagations of parameter uncertainties into response statistics.

43.87.2 Constructor & Destructor Documentation

43.87.2.1 NonDLHSSampling (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification.

References NonDSampling::samplingVarsMode.

43.87.2.2 NonDLHSSampling (Model & *model*, const String & *sample_type*, int *samples*, int *seed*, const String & *rng*, bool *vary_pattern* = `true`, short *sampling_vars_mode* = `ACTIVE`)

alternate constructor for sample generation and evaluation "on the fly" This alternate constructor is used for generation and evaluation of Model-based sample sets. A set_db_list_nodes has not been performed so required data must be passed through the constructor. It's purpose is to avoid the need for a separate LHS specification within methods that use LHS sampling.

References NonDSampling::samplingVarsMode.

43.87.2.3 NonDLHSSampling (const String & *sample_type*, int *samples*, int *seed*, const String & *rng*, const RealVector & *lower_bnds*, const RealVector & *upper_bnds*)

alternate constructor for sample generation "on the fly" This alternate constructor is used by ConcurrentStrategy for generation of uniform, uncorrelated sample sets. It is _not_ a letter-envelope instantiation and a set_db_list_-nodes has not been performed. It is called with all needed data passed through the constructor and is designed to allow more flexibility in variables set definition (i.e., relax connection to a variables specification and allow sampling over parameter sets such as multiobjective weights). In this case, a Model is not used and the object must only be used for sample generation (no evaluation).

References NonDSampling::get_parameter_sets(), and NonDSampling::samplingVarsMode.

43.87.3 Member Function Documentation

43.87.3.1 void quantify_uncertainty () `[protected, virtual]`

perform the evaluate parameter sets portion of run Loop over the set of samples and compute responses. Compute statistics on the set of responses if statsFlag is set.

Implements NonD.

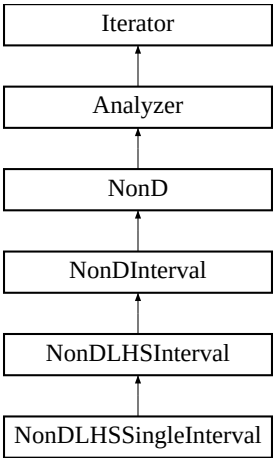
References NonDSampling::allDataFlag, Analyzer::evaluate_parameter_sets(), Iterator::iteratedModel, Iterator::numContinuousVars, Iterator::numDiscreteIntVars, Iterator::numDiscreteRealVars, NonDLHSSampling::numResponseFunctions, NonDSampling::numSamples, NonDSampling::statsFlag, NonDLHSSampling::varBasedDecompFlag, and Analyzer::variance_based_decomp().

The documentation for this class was generated from the following files:

- NonDLHSSampling.H
- NonDLHSSampling.C

43.88 NonDLHSSingleInterval Class Reference

Class for pure interval propagation using LHS. Inheritance diagram for NonDLHSSingleInterval::



Public Member Functions

- NonDLHSSingleInterval (Model &model)

  constructor

- ~NonDLHSSingleInterval ()

  destructor

Protected Member Functions

- void initialize ()

  perform any required initialization

- void post_process_samples ()

  post-process the output from executing lhsSampler

Private Attributes

- size_t statCntr

  counter for finalStatistics

43.88.1 Detailed Description

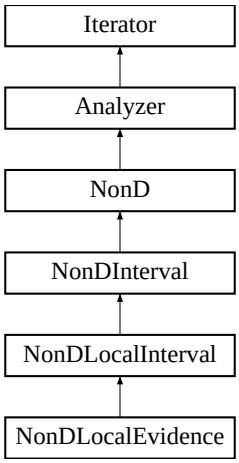
Class for pure interval propagation using LHS. The NonDSingleInterval class implements the propagation of epistemic uncertainty using ...

The documentation for this class was generated from the following files:

- NonDLHSSingleInterval.H
- NonDLHSSingleInterval.C

43.89 NonDLocalEvidence Class Reference

Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ. Inheritance diagram for NonDLocalEvidence::



Public Member Functions

- NonDLocalEvidence (Model &model)

  constructor

- ~NonDLocalEvidence ()

  destructor

Protected Member Functions

- void initialize ()

  perform any required initialization

- void set_cell_bounds ()

  set the optimization variable bounds for each cell

- void truncate_to_cell_bounds (RealVector &initial_pt)

  truncate initial_pt to respect current cell lower/upper bounds

- void post_process_cell_results (bool minimize)

  post-process a cell minimization/maximization result

- void post_process_response_fn_results ()

  post-process the interval computed for a response function

- void post_process_final_results ()

  perform final post-processing

43.89.1 Detailed Description

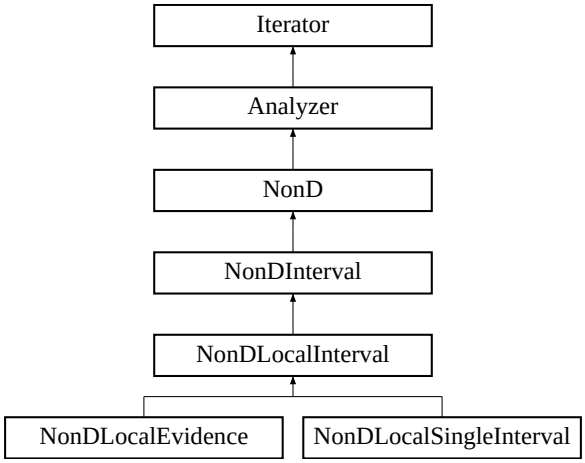
Class for the Dempster-Shafer Evidence Theory methods within DAKOTA/UQ. The NonDEvidence class implements the propagation of epistemic uncertainty using Dempster-Shafer theory of evidence. In this approach, one assigns a set of basic probability assignments (BPA) to intervals defined for the uncertain variables. Input interval combinations are calculated, along with their BPA. Currently, the response function is evaluated at a set of sample points, then a response surface is constructed which is sampled extensively to find the minimum and maximum within each input interval cell, corresponding to the belief and plausibility within that cell, respectively. This data is then aggregated to calculate cumulative distribution functions for belief and plausibility.

The documentation for this class was generated from the following files:

- NonDLocalEvidence.H
- NonDLocalEvidence.C

43.90 NonDLocalInterval Class Reference

Class for using local gradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. Inheritance diagram for NonDLocalInterval::



Public Member Functions

- NonDLocalInterval (Model &model)

  constructor

- ~NonDLocalInterval ()

  destructor

- void quantify_uncertainty ()

  Performs an optimization to determine interval bounds for an entire function or interval bounds on a particular statistical estimator.

- String uses_method () const

  return name of active optimizer method

- void method_recourse ()

  perform an MPP optimizer method switch due to a detected conflict

Protected Member Functions

- virtual void initialize ()

  perform any required initialization

- virtual void set_cell_bounds ()

set the optimization variable bounds for each cell

- virtual void truncate_to_cell_bounds (RealVector &initial_pt)

  truncate initial_pt to respect current cell lower/upper bounds

- virtual void post_process_cell_results (bool minimize)

  post-process a cell minimization/maximization result

- virtual void post_process_response_fn_results ()

  post-process the interval computed for a response function

- virtual void post_process_final_results ()

  perform final post-processing

Protected Attributes

- Iterator minMaxOptimizer

  local gradient-based optimizer

- Model minMaxModel

  recast model with sign flip for maximizing

Static Private Member Functions

- static void objective_min (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in minimizing for the interval lower bound

- static void objective_max (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in maximizing for the interval upper bound

Private Attributes

- bool npsolFlag

  flag representing the gradient-based optimization algorithm selection (NPSOL SQP or OPT++ NIP)

Static Private Attributes

- static NonDLocalInterval * nondLIInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.90.1 Detailed Description

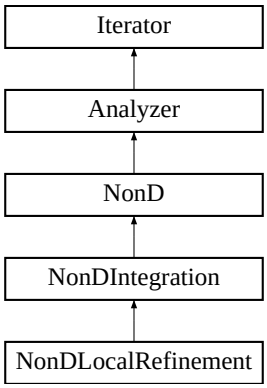
Class for using local gradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. The NonDLocalInterval class supports local gradient-based optimization apporaches to determining interval bounds for epistemic UQ. The interval bounds may be on the entire function in the case of pure interval analysis (e.g. intervals on input = intervals on output), or the intervals may be on statistics of an "inner loop" aleatory analysis such as intervals on means, variances, or percentile levels.

The documentation for this class was generated from the following files:

- NonDLocalInterval.H
- NonDLocalInterval.C

43.91 NonDLocalRefinement Class Reference

Derived nondeterministic class that generates locally refined grids. Inheritance diagram for NonDLocalRefinement::



Public Member Functions

- NonDLocalRefinement (Model &model, const UShortArray &lr_level, const RealVector &dim_pref)

  alternate constructor for instantiations "on the fly" based on a local refinement level specification

Protected Member Functions

- ~NonDLocalRefinement ()

  destructor

- void initialize_grid (const std::vector< Pecos::BasisPolynomial > &poly_basis)
- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

- void reset ()

  restore initial state for repeated sub-iterator executions

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)
- void increment_grid ()

  increment SSG level/TPQ order

- void increment_refinement_sequence ()

  increment sequenceIndex and update active orders/levels

- int num_samples () const

  get the current number of samples

Private Attributes

- Pecos::LocalRefinableDriver * lrDriver

  convenience pointer to the numIntDriver representation

- UShortArray lrLevelSpec

  a sequence of scalar local refinement levels, one per grid specification

43.91.1 Detailed Description

Derived nondeterministic class that generates locally refined grids. This class is used by NonDStochCollocation for hierarchical refinement.

43.91.2 Constructor & Destructor Documentation

43.91.2.1 NonDLocalRefinement (Model & *model*, const UShortArray & *lr_level*, const RealVector & *dim_pref*)

alternate constructor for instantiations "on the fly" based on a local refinement level specification This alternate constructor is used for on-the-fly generation and evaluation of numerical integration points.

References NonDLocalRefinement::lrDriver, and NonDIntegration::numIntDriver.

43.91.3 Member Function Documentation

43.91.3.1 void initialize_grid (const std::vector< Pecos::BasisPolynomial > & *poly_basis*) `[protected, virtual]`

Used in combination with alternate NonDLocalRefinement constructor.

Implements NonDIntegration.

References Dakota::abort_handler(), Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Dakota::copy_data(), Iterator::iteratedModel, NonDLocalRefinement::lrDriver, NonDLocalRefinement::lrLevelSpec, Iterator::maxConcurrency, Iterator::numContinuousVars, and NonDIntegration::sequenceIndex.

43.91.3.2 void sampling_reset (int *min_samples*, bool *all_data_flag*, bool *stats_flag*) `[protected, virtual]`

used by DataFitSurrModel::build_global() to publish the minimum number of points needed to build a particular global approximation.

Reimplemented from Iterator.

References NonDLocalRefinement::lrDriver.

43.91.3.3 int num_samples () const [inline, protected, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

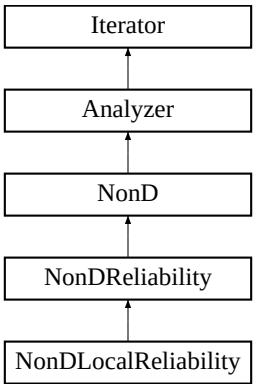
References NonDLocalRefinement::lrDriver.

The documentation for this class was generated from the following files:

- NonDLocalRefinement.H
- NonDLocalRefinement.C

43.92 NonDLocalReliability Class Reference

Class for the reliability methods within DAKOTA/UQ. Inheritance diagram for NonDLocalReliability::



Public Member Functions

- NonDLocalReliability (Model &model)

  constructor

- ~NonDLocalReliability ()

  destructor

- void quantify_uncertainty ()

  performs an uncertainty propagation using analytical reliability methods which solve constrained optimization problems to obtain approximations of the cumulative distribution function of response

- void print_results (std::ostream &s)

  print the approximate mean, standard deviation, and importance factors when using the mean value method or the CDF/CCDF information when using MPP-search-based reliability methods

- String uses_method () const

  return name of active MPP optimizer

- void method_recourse ()

  perform an MPP optimizer method switch due to a detected conflict

Private Member Functions

- void initial_taylor_series ()

  convenience function for performing the initial limit state Taylor-series approximation

- void mean_value ()

  convenience function for encapsulating the simple Mean Value computation of approximate statistics and importance factors

- void mpp_search ()

  convenience function for encapsulating the reliability methods that employ a search for the most probable point (AMV, AMV+, FORM, SORM)

- void initialize_class_data ()

  convenience function for initializing class scope arrays

- void initialize_level_data ()

  convenience function for initializing/warm starting MPP search data for each response function prior to level 0

- void initialize_mpp_search_data ()

  convenience function for initializing/warm starting MPP search data for each z/p/beta level for each response function

- void update_mpp_search_data (const Variables &vars_star, const Response &resp_star)

  convenience function for updating MPP search data for each z/p/beta level for each response function

- void update_level_data ()

  convenience function for updating z/p/beta level data and final statistics following MPP convergence

- void update_pma_reliability_level ()

  update requestedCDFRelLevel from prescribed probabilities or prescribed generalized reliabilities by inverting second-order integrations

- void update_limit_state_surrogate ()

  convenience function for passing the latest variables/response data to the data fit embedded within uSpaceModel

- void assign_mean_data ()

  update mostProbPointX/U, computedRespLevel, fnGradX/U, and fnHessX/U from ranVarMeansX/U, fnValsMeanX, fnGradsMeanX, and fnHessiansMeanX

- void dg_ds_eval (const RealVector &x_vars, const RealVector &fn_grad_x, RealVector &final_stat_grad)

  convenience function for evaluating dg/ds

- Real probability (const Real &beta, bool cdf_flag)

  Convert beta to a probability using either a first-order or second-order integration.

- Real reliability (const Real &p, bool cdf_flag)

  Convert probability to beta using the inverse of a first-order or second-order integration.

- bool reliability_residual (const Real &p, const Real &beta, const RealVector &kappa, Real &res)

  compute the residual for inversion of second-order probability corrections using Newton's method (called by reliability(p))

- Real reliability_residual_derivative (const Real &p, const Real &beta, const RealVector &kappa)

  compute the residual derivative for inversion of second-order probability corrections using Newton's method (called by reliability(p))

- void principal_curvatures ()

  Compute the kappaU vector of principal curvatures from fnHessU.

Private Attributes

- RealVector fnGradX

  actual x-space gradient for current function from most recent response evaluation

- RealVector fnGradU

  u-space gradient for current function updated from fnGradX and Jacobian dx/du

- RealSymMatrix fnHessX

  actual x-space Hessian for current function from most recent response evaluation

- RealSymMatrix fnHessU

  u-space Hessian for current function updated from fnHessX and Jacobian dx/du

- RealVector kappaU

  principal curvatures derived from eigenvalues of orthonormal transformation of fnHessU

- RealVector fnValsMeanX

  response function values evaluated at mean x

- RealMatrix fnGradsMeanX

  response function gradients evaluated at mean x

- RealSymMatrixArray fnHessiansMeanX

  response function Hessians evaluated at mean x

- RealVector ranVarMeansU

  vector of means for all uncertain random variables in u-space

- RealVector initialPtU

  initial guess for MPP search in u-space

- RealVector mostProbPointX

  location of MPP in x-space

- RealVector mostProbPointU

  location of MPP in u-space

- RealVectorArray prevMPPULev0

  array of converged MPP's in u-space for level 0. Used for warm-starting initialPtU within RBDO.

- RealMatrix prevFnGradDLev0

  matrix of limit state sensitivities w.r.t. inactive/design variables for level 0. Used for warm-starting initialPtU within RBDO.

- RealMatrix prevFnGradULev0

  matrix of limit state sensitivities w.r.t. active/uncertain variables for level 0. Used for warm-starting initialPtU within RBDO.

- RealVector prevICVars

  previous design vector. Used for warm-starting initialPtU within RBDO.

- ShortArray prevCumASVLev0

  accumulation (using |=) of all previous design ASV's from requested finalStatistics. Used to detect availability of prevFnGradDLev0 data for warm-starting initialPtU within RBDO.

- bool npsolFlag

  flag representing the optimization MPP search algorithm selection (NPSOL SQP or OPT++ NIP)

- bool warmStartFlag

  flag indicating the use of warm starts

- bool nipModeOverrideFlag

  flag indicating the use of move overrides within OPT++ NIP

- bool curvatureDataAvailable

  flag indicating that sufficient data (i.e., fnGradU, fnHessU, mostProbPointU) is available for computing principal curvatures

- short integrationOrder

  integration order (1 or 2) provided by `integration` *specification*

- short secondOrderIntType

  type of second-order integration: Breitung, Hohenbichler-Rackwitz, or Hong

- Real curvatureThresh

  cut-off value for 1/sqrt() term in second-order probability corrections.

- short taylorOrder

  order of Taylor series approximations (1 or 2) in MV/AMV/AMV+ derived from hessianType

- RealMatrix impFactor

  importance factors predicted by MV

- int npsolDerivLevel

  derivative level for NPSOL executions (1 = analytic grads of objective fn, 2 = analytic grads of constraints, 3 = analytic grads of both).

- unsigned short warningBits

  set of warnings accumulated during execution

43.92.1 Detailed Description

Class for the reliability methods within DAKOTA/UQ. The NonDLocalReliability class implements the following reliability methods through the support of different limit state approximation and integration options: mean value (MVFOSM/MVSOSM), advanced mean value method (AMV, AMV^2) in x- or u-space, iterated advanced mean value method (AMV+, AMV^2+) in x- or u-space, two-point adaptive nonlinearity approximation (TANA) in x- or u-space, first order reliability method (FORM), and second order reliability method (SORM). All options except mean value employ an optimizer (currently NPSOL SQP or OPT++ NIP) to solve an equality-constrained optimization problem for the most probable point (MPP). The MPP search may be formulated as the reliability index approach (RIA) for mapping response levels to reliabilities/probabilities or as the performance measure approach (PMA) for performing the inverse mapping of reliability/probability levels to response levels.

43.92.2 Member Function Documentation

43.92.2.1 void initial_taylor_series () [private]

convenience function for performing the initial limit state Taylor-series approximation An initial first- or second-order Taylor-series approximation is required for MV/AMV/AMV+/TANA or for the case where momentStats (from MV) are required within finalStatistics for subIterator usage of NonDLocalReliability.

References Response::active_set_request_vector(), Iterator::activeSet, Model::component_parallel_mode(), Model::compute_response(), Model::continuous_variables(), Model::current_response(), NonD::finalStatistics, NonDLocalReliability::fnGradsMeanX, NonDLocalReliability::fnHessiansMeanX, NonDLocalReliability::fnValsMeanX, Response::function_gradients(), Response::function_hessians(), Response::function_values(), Iterator::hessianType, Iterator::iteratedModel, NonD::momentStats, NonDReliability::mppSearchType, NonD::natafTransform, Iterator::numFunctions, NonD::numUncertainVars, ActiveSet::request_vector(), NonD::requestedGenRelLevels, NonD::requestedProbLevels, NonD::requestedRelLevels, NonD::requestedRespLevels, Iterator::subIteratorFlag, NonDLocalReliability::taylorOrder, and NonDReliability::uSpaceModel.

Referenced by NonDLocalReliability::quantify_uncertainty().

43.92.2.2 void initialize_class_data () [private]

convenience function for initializing class scope arrays Initialize class-scope arrays and perform other start-up activities, such as evaluating median limit state responses.

References Response::active_set_derivative_vector(), NonD::finalStatistics, NonDReliability::importanceSampler, NonD::initialize_random_variables(), NonDReliability::integrationRefinement,

Iterator::iterator_rep(), NonDReliability::mppModel, NonD::natafTransform, Iterator::numFunctions, NonDReliability::numRelAnalyses, NonD::numUncertainVars, NonDLocalReliability::prevCumASVLev0, NonDLocalReliability::prevFnGradDLev0, NonDLocalReliability::prevFnGradULev0, NonDLocalReliability::prevMPPULev0, NonDLocalReliability::ranVarMeansU, Iterator::subIteratorFlag, Model::update_from_subordinate_model(), and NonDLocalReliability::warmStartFlag.

Referenced by NonDLocalReliability::mpp_search().

43.92.2.3 void initialize_level_data () [private]

convenience function for initializing/warm starting MPP search data for each response function prior to level 0 For a particular response function prior to the first z/p/beta level, initialize/warm-start optimizer initial guess (initialPtU), expansion point (mostProbPointX/U), and associated response data (computedRespLevel, fnGradX/U, and fnHessX/U).

References Iterator::activeSet, NonDLocalReliability::assign_mean_data(), Model::component_parallel_mode(), Model::compute_response(), NonDReliability::computedRespLevel, Model::continuous_variable_ids(), Model::continuous_variables(), Dakota::copy_data(), Model::current_response(), NonDLocalReliability::curvatureDataAvailable, NonDLocalReliability::fnGradU, NonDLocalReliability::fnGradX, NonDLocalReliability::fnHessU, NonDLocalReliability::fnHessX, Response::function_gradient_copy(), Response::function_hessian(), Response::function_value(), Model::inactive_continuous_variables(), NonDLocalReliability::initialPtU, Iterator::iteratedModel, NonDLocalReliability::mostProbPointU, NonDLocalReliability::mostProbPointX, NonDReliability::mppSearchType, NonD::natafTransform, NonDReliability::numRelAnalyses, NonD::numUncertainVars, NonDLocalReliability::prevCumASVLev0, NonDLocalReliability::prevFnGradDLev0, NonDLocalReliability::prevFnGradULev0, NonDLocalReliability::prevICVars, NonDLocalReliability::prevMPPULev0, ActiveSet::request_value(), ActiveSet::request_values(), NonD::requestedRespLevels, NonDReliability::respFnCount, Iterator::subIteratorFlag, Model::surrogate_function_indices(), NonDLocalReliability::taylorOrder, NonDLocalReliability::update_limit_state_surrogate(), NonDReliability::uSpaceModel, and NonDLocalReliability::warmStartFlag.

Referenced by NonDLocalReliability::mpp_search().

43.92.2.4 void initialize_mpp_search_data () [private]

convenience function for initializing/warm starting MPP search data for each z/p/beta level for each response function For a particular response function at a particular z/p/beta level, warm-start or reset the optimizer initial guess (initialPtU), expansion point (mostProbPointX/U), and associated response data (computedRespLevel, fnGradX/U, and fnHessX/U).

References NonDLocalReliability::assign_mean_data(), NonD::cdfFlag, NonD::computedRelLevels, NonDLocalReliability::fnGradU, NonDLocalReliability::initialPtU, NonDReliability::levelCount, NonDLocalReliability::mostProbPointU, NonDReliability::mppSearchType, NonD::numUncertainVars, NonDReliability::requestedCDFRelLevel, NonDReliability::requestedRespLevel, NonD::requestedRespLevels, NonDReliability::respFnCount, and NonDLocalReliability::warmStartFlag.

Referenced by NonDLocalReliability::mpp_search().

43.92.2.5 void update_mpp_search_data (const Variables & *vars_star*, const Response & *resp_star*) [private]

convenience function for updating MPP search data for each z/p/beta level for each response function Includes case-specific logic for updating MPP search data for the AMV/AMV+/TANA/NO_APPROX methods.

References Response::active_set(), Response::active_set_request_vector(), Iterator::activeSet, NonDReliability::approxConverged, NonDReliability::approxIters, NonD::cdfFlag, Model::component_parallel_mode(), Model::compute_response(), NonDReliability::computedRelLevel, NonDReliability::computedRespLevel, Model::continuous_variable_ids(), Model::continuous_variables(), Variables::continuous_variables(), Iterator::convergenceTol, Variables::copy(), Dakota::copy_data(), Model::current_response(), Model::current_variables(), NonDLocalReliability::curvatureDataAvailable, Dakota::data_pairs, NonD::finalStatistics, NonDLocalReliability::fnGradU, NonDLocalReliability::fnGradX, NonDLocalReliability::fnHessU, NonDLocalReliability::fnHessX, Response::function_gradient_copy(), Response::function_hessian(), Response::function_hessians(), Response::function_value(), Response::function_values(), NonDLocalReliability::initialPtU, NonDLocalReliability::integrationOrder, Model::interface_id(), Iterator::iteratedModel, NonDReliability::levelCount, Dakota::lookup_by_val(), Iterator::maxIterations, NonDLocalReliability::mostProbPointU, NonDLocalReliability::mostProbPointX, NonDReliability::mppSearchType, NonD::natafTransform, Iterator::numFunctions, NonD::numNormalVars, NonD::numUncertainVars, NonDLocalReliability::reliability(), ActiveSet::request_value(), ActiveSet::request_values(), ActiveSet::request_vector(), NonDReliability::requestedCDFProbLevel, NonDReliability::requestedCDFRelLevel, NonD::requestedProbLevels, NonD::requestedRelLevels, NonDReliability::requestedRespLevel, NonD::requestedRespLevels, NonDReliability::respFnCount, NonDReliability::statCount, NonDLocalReliability::taylorOrder, NonDLocalReliability::update_limit_state_surrogate(), NonDReliability::uSpaceModel, NonDLocalReliability::warmStartFlag, and NonDLocalReliability::warningBits.

Referenced by NonDLocalReliability::mpp_search().

43.92.2.6 void update_level_data () [private]

convenience function for updating z/p/beta level data and final statistics following MPP convergence Updates computedRespLevels/computedProbLevels/computedRelLevels, finalStatistics, warm start, and graphics data.

References Dakota::abort_handler(), Response::active_set_derivative_vector(), Response::active_set_request_vector(), Graphics::add_datapoint(), NonD::cdfFlag, NonD::computedGenRelLevels, NonD::computedProbLevels, NonDReliability::computedRelLevel, NonD::computedRelLevels, NonDReliability::computedRespLevel, NonD::computedRespLevels, NonDLocalReliability::curvatureThresh, Dakota::dakota_graphics, NonDLocalReliability::dg_ds_eval(), NonD::finalStatistics, NonDLocalReliability::fnGradU, NonDLocalReliability::fnGradX, Response::function_gradient(), NonDLocalReliability::integrationOrder, NonDLocalReliability::kappaU, NonDReliability::levelCount, NonDLocalReliability::mostProbPointU, NonDLocalReliability::mostProbPointX, Graphics::new_dataset(), Iterator::numFunctions, NonD::numUncertainVars, NonDLocalReliability::prevCumASVLev0, NonDLocalReliability::prevFnGradDLev0, NonDLocalReliability::prevFnGradULev0, NonDLocalReliability::prevMPPULev0, NonDLocalReliability::probability(), NonD::requestedGenRelLevels, NonD::requestedProbLevels, NonD::requestedRelLevels, NonD::requestedRespLevels, NonDReliability::respFnCount, NonD::respLevelTarget, NonD::respLevelTargetReduce, NonDLocalReliability::secondOrderIntType, NonDReliability::statCount, Iterator::subIteratorFlag, NonD::totalLevelRequests, NonDLocalReliability::warmStartFlag, and NonDLocalReliability::warningBits.

Referenced by NonDLocalReliability::mpp_search().

43.92.2.7 void update_pma_reliability_level () [private, virtual]

update requestedCDFRelLevel from prescribed probabilities or prescribed generalized reliabilities by inverting second-order integrations For PMA SORM with prescribed p-level or prescribed generalized beta-level, requestedCDFRelLevel must be updated. This virtual function redefinition is called from NonDReliability::PMA_constraint_eval().

Reimplemented from NonDReliability.

References Variables::continuous_variables(), Dakota::copy_data(), Model::current_response(), Model::current_variables(), NonDLocalReliability::curvatureDataAvailable, NonDLocalReliability::fnGradU, NonDLocalReliability::fnHessU, Response::function_gradient_copy(), Response::function_hessian(), NonDLocalReliability::integrationOrder, NonDReliability::levelCount, NonDLocalReliability::mostProbPointU, NonDReliability::mppSearchType, NonDLocalReliability::reliability(), NonDReliability::requestedCDFProbLevel, NonDReliability::requestedCDFRelLevel, NonD::requestedProbLevels, NonD::requestedRelLevels, NonD::requestedRespLevels, NonDReliability::respFnCount, and NonDReliability::uSpaceModel.

43.92.2.8 void dg_ds_eval (const RealVector & *x_vars*, const RealVector & *fn_grad_x*, RealVector & *final_stat_grad*) [private]

convenience function for evaluating dg/ds Computes dg/ds where s = design variables. Supports potentially overlapping cases of design variable augmentation and insertion.

References Response::active_set_derivative_vector(), Iterator::activeSet, Model::all_continuous_variable_ids(), Model::component_parallel_mode(), Model::compute_response(), Dakota::contains(), Model::continuous_variable_ids(), Model::continuous_variables(), Dakota::copy_data(), Model::current_response(), ActiveSet::derivative_vector(), NonD::finalStatistics, Response::function_gradient_copy(), Response::function_gradients(), Model::inactive_continuous_variable_ids(), Iterator::iteratedModel, NonDReliability::mppSearchType, NonD::natafTransform, Iterator::primaryACVarMapIndices, ActiveSet::request_value(), ActiveSet::request_values(), NonDReliability::respFnCount, Iterator::secondaryACVarMapTargets, and NonDReliability::uSpaceModel.

Referenced by NonDLocalReliability::mean_value(), NonDLocalReliability::mpp_search(), and NonDLocalReliability::update_level_data().

43.92.2.9 Real probability (const Real & *beta*, bool *cdf_flag*) [private]

Convert beta to a probability using either a first-order or second-order integration. Converts beta into a probability using either first-order (FORM) or second-order (SORM) integration. The SORM calculation first calculates the principal curvatures at the MPP (using the approach in Ch. 8 of Haldar & Mahadevan), and then applies correction formulations from the literature (Breitung, Hohenbichler-Rackwitz, or Hong).

References NonDLocalReliability::curvatureDataAvailable, NonDLocalReliability::curvatureThresh, NonDAdaptImpSampling::get_probability(), NonDReliability::importanceSampler, NonDAdaptImpSampling::initialize(), NonDLocalReliability::integrationOrder, NonDReliability::integrationRefinement, Iterator::iterator_rep(), NonDLocalReliability::kappaU, NonDLocalReliability::mostProbPointU, NonD::numUncertainVars, NonDLocalReliability::principal_curvatures(), NonDReliability::requestedRespLevel, NonDReliability::respFnCount, Iterator::run_iterator(), NonDLocalReliability::secondOrderIntType, and NonDLocalReliability::warningBits.

Referenced by NonDLocalReliability::mean_value(), and NonDLocalReliability::update_level_data().

43.92.2.10 Real reliability (const Real & *p*, bool *cdf_flag*) [private]

Convert probability to beta using the inverse of a first-order or second-order integration. Converts a probability into a reliability using the inverse of the first-order or second-order integrations implemented in NonDLocalReliability::probability().

References Iterator::convergenceTol, NonDLocalReliability::curvatureDataAvailable, NonDLocalReliability::integrationOrder, NonDLocalReliability::kappaU, NonDLocalReliability::principal_curvatures(), NonDLocalReliability::reliability_residual(), NonDLocalReliability::reliability_residual_derivative(), and NonDLocalReliability::warningBits.

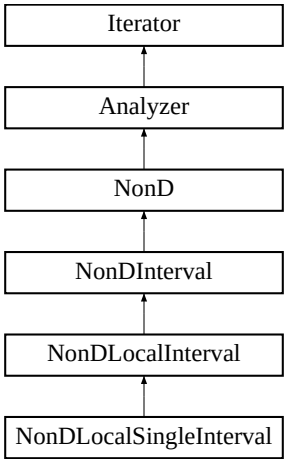
Referenced by NonDLocalReliability::mean_value(), NonDLocalReliability::mpp_search(), NonDLocalReliability::update_mpp_search_data(), and NonDLocalReliability::update_pma_reliability_level().

The documentation for this class was generated from the following files:

- NonDLocalReliability.H
- NonDLocalReliability.C

43.93 NonDLocalSingleInterval Class Reference

Class for using local gradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. Inheritance diagram for NonDLocalSingleInterval::



Public Member Functions

- NonDLocalSingleInterval (Model &model)

  constructor

- ~NonDLocalSingleInterval ()

  destructor

Protected Member Functions

- void initialize ()

  perform any required initialization

- void post_process_cell_results (bool minimize)

  post-process a cell minimization/maximization result

Private Attributes

- size_t statCntr

  counter for finalStatistics

43.93.1 Detailed Description

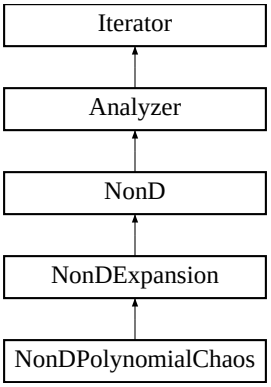
Class for using local gradient-based optimization approaches to calculate interval bounds for epistemic uncertainty quantification. The NonDLocalSingleInterval class supports local gradient-based optimization apporaches to determining interval bounds for epistemic UQ. The interval bounds may be on the entire function in the case of pure interval analysis (e.g. intervals on input = intervals on output), or the intervals may be on statistics of an "inner loop" aleatory analysis such as intervals on means, variances, or percentile levels.

The documentation for this class was generated from the following files:

- NonDLocalSingleInterval.H
- NonDLocalSingleInterval.C

43.94 NonDPolynomialChaos Class Reference

Nonintrusive polynomial chaos expansion approaches to uncertainty quantification. Inheritance diagram for NonDPolynomialChaos::



Public Member Functions

- NonDPolynomialChaos (Model &model)

  standard constructor

- NonDPolynomialChaos (Model &model, short exp_coeffs_approach, unsigned short num_int_level, short u_space_type, bool piecewise_basis, bool use_derivs)

  alternate constructor

- ~NonDPolynomialChaos ()

  destructor

- void resolve_inputs (short &u_space_type, short &data_order)

  perform error checks and mode overrides

- void initialize_u_space_model ()

  initialize uSpaceModel polynomial approximations with PCE/SC data

- void compute_expansion ()

  form or import an orthogonal polynomial expansion using PCE methods

- void increment_expansion ()

  uniformly increment the order of the polynomial chaos expansion

- void print_coefficients (std::ostream &s)

  print the PCE coefficient array for the orthogonal basis

Private Member Functions

- int terms_ratio_to_samples (size_t num_exp_terms, Real colloc_ratio, Real terms_order)

  convert number of expansion terms and collocation ratio to a number of collocation samples

- Real terms_samples_to_ratio (size_t num_exp_terms, int samples, Real terms_order)

  convert number of expansion terms and number of collocation samples to a collocation ratio

Private Attributes

- String expansionImportFile

  filename for import of chaos coefficients

- int expansionTerms

  user specification of PCE terms

- Real collocRatio

  factor applied to expansionTerms^termsOrder in computing number of regression points, either user specified or inferred

- Real termsOrder

  exponent applied to number of expansion terms for computing number of regression points

- bool tensorRegression

  option for regression PCE using a filtered set tensor-product points

- RealMatrix pceGradsMeanX

  derivative of the PCE with respect to the x-space variables evaluated at the means (used as uncertainty importance metrics)

43.94.1 Detailed Description

Nonintrusive polynomial chaos expansion approaches to uncertainty quantification. The NonDPolynomialChaos class uses a polynomial chaos expansion (PCE) approach to approximate the effect of parameter uncertainties on response functions of interest. It utilizes the OrthogPolyApproximation class to manage multiple types of orthogonal polynomials within a Wiener-Askey scheme to PCE. It supports PCE coefficient estimation via sampling, quadrature, point-collocation, and file import.

43.94.2 Constructor & Destructor Documentation

43.94.2.1 NonDPolynomialChaos (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation using the ProblemDescDB.

References Dakota::abort_handler(), Model::assign_rep(), NonDPolynomialChaos::collocRatio, NonDExpansion::construct_cubature(), NonDExpansion::construct_expansion_sampler(), NonD::construct_lhs(), NonDExpansion::construct_quadrature(), NonDExpansion::construct_sparse_grid(), NonD::construct_u_space_model(), Model::derivative_concurrency(), NonDExpansion::expansionCoeffsApproach, NonDPolynomialChaos::expansionImportFile, NonDPolynomialChaos::expansionTerms, ProblemDescDB::get_dusa(), ProblemDescDB::get_int(), ProblemDescDB::get_rdv(), ProblemDescDB::get_real(), ProblemDescDB::get_short(), ProblemDescDB::get_string(), ProblemDescDB::get_ushort(), Model::init_communicators(), NonDExpansion::initialize(), NonDPolynomialChaos::initialize_u_space_model(), Iterator::iteratedModel, Iterator::maxConcurrency, NonD::numContDesVars, NonD::numContEpistUncVars, Iterator::numContinuousVars, NonD::numContStateVars, NonDExpansion::numSamplesOnExpansion, NonDExpansion::numSamplesOnModel, Iterator::outputLevel, NonDExpansion::piecewiseBasis, Iterator::probDescDB, NonDExpansion::refineControl, NonDExpansion::refineType, NonDPolynomialChaos::resolve_inputs(), NonDPolynomialChaos::tensorRegression, NonDPolynomialChaos::terms_ratio_to_samples(), NonDPolynomialChaos::terms_samples_to_ratio(), NonDPolynomialChaos::termsOrder, NonDExpansion::uSpaceModel, and Analyzer::vary_pattern().

43.94.2.2 NonDPolynomialChaos (Model & *model*, short *exp_coeffs_approach*, unsigned short *num_int_level*, short *u_space_type*, bool *piecewise_basis*, bool *use_derivs*)

alternate constructor This constructor is used for helper iterator instantiation on the fly.

References Model::assign_rep(), NonDExpansion::construct_cubature(), NonDExpansion::construct_quadrature(), NonDExpansion::construct_sparse_grid(), NonD::construct_u_space_model(), NonDExpansion::expansionCoeffsApproach, NonDExpansion::initialize(), NonDPolynomialChaos::initialize_u_space_model(), Iterator::iteratedModel, NonD::numContDesVars, NonD::numContEpistUncVars, NonD::numContStateVars, Iterator::outputLevel, NonDExpansion::piecewiseBasis, NonDPolynomialChaos::resolve_inputs(), and NonDExpansion::uSpaceModel.

43.94.3 Member Function Documentation

43.94.3.1 void increment_expansion () `[virtual]`

uniformly increment the order of the polynomial chaos expansion Used for uniform refinement of regression-based PCE.

Reimplemented from NonDExpansion.

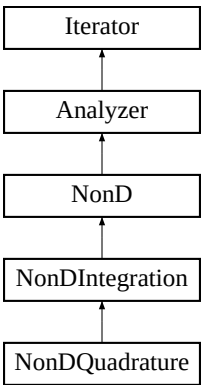
References Model::approximations(), NonDPolynomialChaos::collocRatio, NonDQuadrature::compute_minimum_quadrature_order(), PecosApproximation::expansion_terms(), NonDQuadrature::filtered_samples(), PecosApproximation::increment_order(), Iterator::iterator_rep(), Model::model_rep(), Iterator::numFunctions, NonDExpansion::numSamplesOnModel, NonDSampling::sampling_reference(), Model::subordinate_iterator(), NonDPolynomialChaos::tensorRegression, NonDPolynomialChaos::terms_ratio_to_samples(), NonDPolynomialChaos::termsOrder, DataFitSurrModel::total_points(), and NonDExpansion::uSpaceModel.

The documentation for this class was generated from the following files:

- NonDPolynomialChaos.H
- NonDPolynomialChaos.C

43.95 NonDQuadrature Class Reference

Derived nondeterministic class that generates N-dimensional numerical quadrature points for evaluation of expectation integrals over uncorrelated standard normals/uniforms/exponentials/betas/gammas. Inheritance diagram for NonDQuadrature::



Public Member Functions

- NonDQuadrature (Model &model, const UShortArray &quad_order, const RealVector &dim_pref)

  alternate constructor for instantiations "on the fly" based on a quadrature order specification

- NonDQuadrature (Model &model, int num_filt_samples, const RealVector &dim_pref)

  alternate constructor for instantiations "on the fly" based on the size of a filtered tensor product sample set

- const Pecos::UShortArray & quadrature_order () const

  return Pecos::TensorProductDriver::quadOrder

- void filtered_samples (size_t samples)

  set numFilteredSamples

- void compute_minimum_quadrature_order ()

  calculate smallest dimQuadOrderRef with at least numFilteredSamples

- void compute_minimum_quadrature_order (size_t min_samples, const RealVector &dim_pref, UShortArray &dim_quad_order)

  calculate smallest dim_quad_order with at least min_samples

Protected Member Functions

- NonDQuadrature (Model &model)

  constructor

- ~NonDQuadrature ()

  destructor

- void initialize_grid (const std::vector< Pecos::BasisPolynomial > &poly_basis)
- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

- void reset ()

  restore initial state for repeated sub-iterator executions

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)
- void increment_grid ()

  increment SSG level/TPQ order

- void increment_grid_preference (const RealVector &dim_pref)

  increment SSG level/TPQ order and update anisotropy

- void increment_refinement_sequence ()

  increment sequenceIndex and update active orders/levels

- int num_samples () const

  get the current number of samples

Private Member Functions

- void increment_grid (UShortArray &dim_quad_order)

  convenience function used to make increment_grid() more modular

- void increment_grid_preference (const RealVector &dim_pref, UShortArray &dim_quad_order)

  convenience function used to make increment_grid_preference() more modular

- void filter_parameter_sets ()

  prune allSamples back to size numFilteredSamples, retaining points with highest product weight

- void anisotropic_preference (unsigned short quad_order_spec, const RealVector &dim_pref_spec, UShortArray &quad_order)

  initialize quad_order vector based on quad_order_spec scalar and dim_pref_spec vector

- void anisotropic_preference (const RealVector &dim_pref, UShortArray &quad_order_ref)

  update quad_order_ref based on an updated dimension preference, enforcing previous values as a lower bound

- void initialize_dimension_quadrature_order (unsigned short quad_order_spec, const RealVector &dim_pref_spec, UShortArray &dim_quad_order)

  initialize dim_quad_order from quad_order_spec and dim_pref_spec

- void nested_quadrature_order (const UShortArray &quad_order_ref)

  update Pecos::TensorProductDriver::quadOrder from dimQuadOrderRef to account for nested rule constraints

- void increment_dimension_quadrature_order (UShortArray &dim_quad_order)

  increment each dim_quad_order entry by 1

- void increment_dimension_quadrature_order (const RealVector &dim_pref, UShortArray &dim_quad_-order)

  increment the dim_quad_order entry with maximum preference by 1 and then rebalance

Private Attributes

- Pecos::TensorProductDriver * tpqDriver

  convenience pointer to the numIntDriver representation

- bool nestedRules

  for studies involving refinement strategies, allow for use of nested quadrature rules such as Gauss-Patterson

- UShortArray quadOrderSpec

  a sequence of scalar quadrature orders, one per refinement level

- UShortArray dimQuadOrderRef

  reference point for Pecos::TensorProductDriver::quadOrder: the original user specification for the number of Gauss points per dimension, plus any refinements posted by increment_grid()

- size_t numFilteredSamples

  size of a filtered set of tensor quadrature points; used by the regression PCE approach known as "probabilistic collocation"

43.95.1 Detailed Description

Derived nondeterministic class that generates N-dimensional numerical quadrature points for evaluation of expectation integrals over uncorrelated standard normals/uniforms/exponentials/betas/gammas. This class is used by NonDPolynomialChaos, but could also be used for general numerical integration of moments. It employs Gauss-Hermite, Gauss-Legendre, Gauss-Laguerre, Gauss-Jacobi and generalized Gauss-Laguerre quadrature for use with normal, uniform, exponential, beta, and gamma density functions and integration bounds. The abscissas and weights for one-dimensional integration are extracted from the appropriate OrthogonalPolynomial class and are extended to n-dimensions using a tensor product approach.

43.95.2 Constructor & Destructor Documentation

43.95.2.1 NonDQuadrature (Model & *model*, const UShortArray & *quad_order*, const RealVector & *dim_pref*)

alternate constructor for instantiations "on the fly" based on a quadrature order specification This alternate constructor is used for on-the-fly generation and evaluation of numerical quadrature points.

References NonDIntegration::numIntDriver, and NonDQuadrature::tpqDriver.

43.95.2.2 NonDQuadrature (Model & *model*, int *num_filt_samples*, const RealVector & *dim_pref*)

alternate constructor for instantiations "on the fly" based on the size of a filtered tensor product sample set This alternate constructor is used for on-the-fly generation and evaluation of numerical quadrature points.

References NonDIntegration::numIntDriver, and NonDQuadrature::tpqDriver.

43.95.2.3 NonDQuadrature (Model & *model*) `[protected]`

constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification. It is not currently used, as there is not yet a separate nond_quadrature method specification.

References NonDIntegration::check_variables(), ProblemDescDB::get_bool(), ProblemDescDB::get_short(), Iterator::maxConcurrency, NonD::natafTransform, NonDQuadrature::nestedRules, NonDIntegration::numIntDriver, Iterator::probDescDB, NonDQuadrature::reset(), and NonDQuadrature::tpqDriver.

43.95.3 Member Function Documentation

43.95.3.1 void initialize_grid (const std::vector< Pecos::BasisPolynomial > & *poly_basis*) `[protected, virtual]`

Used in combination with alternate NonDQuadrature constructor.

Implements NonDIntegration.

References NonDQuadrature::compute_minimum_quadrature_order(), Iterator::maxConcurrency, NonDQuadrature::nestedRules, Iterator::numContinuousVars, NonDQuadrature::numFilteredSamples, NonDQuadrature::reset(), and NonDQuadrature::tpqDriver.

43.95.3.2 void sampling_reset (int *min_samples*, bool *all_data_flag*, bool *stats_flag*) `[protected, virtual]`

used by DataFitSurrModel::build_global() to publish the minimum number of points needed from the quadrature routine in order to build a particular global approximation.

Reimplemented from Iterator.

References NonDQuadrature::compute_minimum_quadrature_order(), NonDIntegration::dimPrefSpec,

NonDQuadrature::dimQuadOrderRef, NonDQuadrature::nested_quadrature_order(), NonDQuadrature::nestedRules, Iterator::numContinuousVars, and NonDQuadrature::tpqDriver.

43.95.3.3 int num_samples () const [inline, protected, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References NonDQuadrature::numFilteredSamples, and NonDQuadrature::tpqDriver.

43.95.3.4 void anisotropic_preference (unsigned short *quad_order_spec*, const RealVector & *dim_pref_spec*, UShortArray & *dim_quad_order*) [private]

initialize quad_order vector based on quad_order_spec scalar and dim_pref_spec vector This version of anisotropic_preference() converts a scalar quad_order_spec and a dim_pref vector into a quad_order vector. It is used for initialization and does not enforce a reference lower bound.

References Iterator::numContinuousVars.

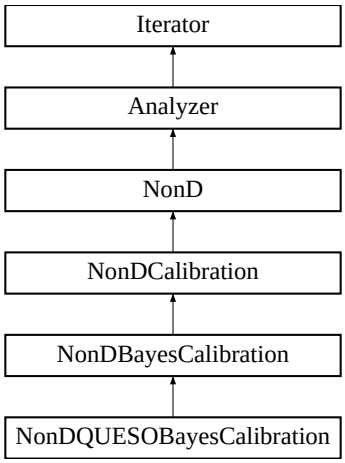
Referenced by NonDQuadrature::increment_dimension_quadrature_order(), and NonDQuadrature::initialize_dimension_quadrature_order().

The documentation for this class was generated from the following files:

- NonDQuadrature.H
- NonDQuadrature.C

43.96 NonDQUESOBayesCalibration Class Reference

Bayesian inference using the QUESO library from UT Austin. Inheritance diagram for NonDQUESOBayesCalibration::



Public Member Functions

- NonDQUESOBayesCalibration (Model &model)

  standard constructor

- ~NonDQUESOBayesCalibration ()

  destructor

Public Attributes

- String rejectionType

  Rejection type (standard or delayed, in the DRAM framework).

- String metropolisType

  Metropolis type (hastings or adaptive, in the DRAM framework).

- int numSamples

  number of samples in the chain (e.g. number of MCMC samples)

- Real proposalCovScale

  scale factor for proposal covariance

- Real likelihoodScale

  scale factor for likelihood

Protected Member Functions

- void quantify_uncertainty ()

  redefined from DakotaNonD

Static Protected Member Functions

- static double dakotaLikelihoodRoutine (const uqGslVectorClass &paramValues, const uqGslVectorClass ∗paramDirection, const void ∗functionDataPtr, uqGslVectorClass ∗gradVector, uqGslMatrixClass ∗hessianMatrix, uqGslVectorClass ∗hessianEffect)

  Likelihood function for call-back from QUESO to DAKOTA for evaluation.

Protected Attributes

- RealMatrix xObsData

  Matrix that holds the experimental realizations of state variables x.

- RealMatrix yObsData

  Matrix that holds the experimental realizations of responses y.

- RealMatrix yStdData

  Matrix that holds the experimental realizations of std deviations of responses y.

- int randomSeed

  random seed to pass to QUESO

Private Attributes

- short emulatorType

  the emulator type: NO_EMULATOR, GAUSSIAN_PROCESS, POLYNOMIAL_CHAOS, or STOCHASTIC_-COLLOCATION

Static Private Attributes

- static NonDQUESOBayesCalibration ∗ NonDQUESOInstance

  Pointer to current class instance for use in static callback functions.

43.96.1 Detailed Description

Bayesian inference using the QUESO library from UT Austin. This class provides a wrapper to the QUESO library developed as part of the Predictive Science Academic Alliance Program (PSAAP), specifically the PECOS (Predictive Engineering and Computational Sciences) Center at UT Austin. The name QUESO stands for Quantification of Uncertainty for Estimation, Simulation, and Optimization.

43.96.2 Constructor & Destructor Documentation

43.96.2.1 NonDQUESOBayesCalibration (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_list_nodes has been called and probDescDB can be queried for settings from the method specification.

43.96.3 Member Function Documentation

43.96.3.1 void quantify_uncertainty () `[protected, virtual]`

redefined from DakotaNonD Perform the uncertainty quantification

Reimplemented from NonDBayesCalibration.

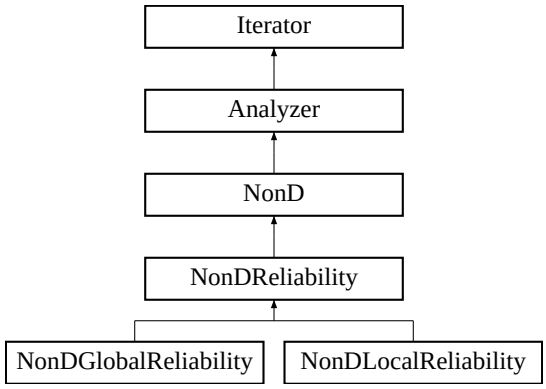
References Dakota::abort_handler(), Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), NonDQUESOBayesCalibration::dakotaLikelihoodRoutine(), NonDBayesCalibration::emulatorModel, NonDQUESOBayesCalibration::emulatorType, NonDCalibration::expDataFileAnnotated, NonDCalibration::expDataFileName, NonDCalibration::expStdDeviations, Iterator::iterator_rep(), NonDQUESOBayesCalibration::metropolisType, NonDQUESOBayesCalibration::NonDQUESOInstance, Iterator::numContinuousVars, NonDCalibration::numExpConfigVars, NonDCalibration::numExperiments, NonDCalibration::numExpStdDeviationsRead, Iterator::numFunctions, NonDQUESOBayesCalibration::numSamples, NonDQUESOBayesCalibration::proposalCovScale, NonDQUESOBayesCalibration::randomSeed, Dakota::read_data_tabular(), NonDQUESOBayesCalibration::rejectionType, NonDBayesCalibration::standardizedSpace, NonDBayesCalibration::stochExpIterator, NonDQUESOBayesCalibration::xObsData, NonDQUESOBayesCalibration::yObsData, and NonDQUESOBayesCalibration::yStdData.

The documentation for this class was generated from the following files:

- NonDQUESOBayesCalibration.H
- NonDQUESOBayesCalibration.C

43.97 NonDReliability Class Reference

Base class for the reliability methods within DAKOTA/UQ. Inheritance diagram for NonDReliability::



Protected Member Functions

- NonDReliability (Model &model)

  constructor

- ~NonDReliability ()

  destructor

- void initialize_graphics (bool graph_2d, bool tabular_data, const String &tabular_file)

  initialize graphics customized for reliability methods

- const Model & algorithm_space_model () const

  return the result of any recasting or surrogate model recursion layered on top of iteratedModel by the derived Iterator ctor chain

- virtual void update_pma_reliability_level ()

  update requestedCDFRelLevel for use in PMA_constraint_eval()

Static Protected Member Functions

- static void RIA_objective_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in the Reliability Index Approach (RIA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the objective function of (norm u)^2.

- static void RIA_constraint_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

static function used as the constraint function in the Reliability Index Approach (RIA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the constraint of G(u) = response level.

- static void PMA_objective_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the objective function in the Performance Measure Approach (PMA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the objective function of G(u).

- static void PMA_constraint_eval (const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  static function used as the constraint function in the Performance Measure Approach (PMA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the constraint of (norm u)^2 = beta^2.

- static void PMA2_set_mapping (const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set)

  static function used to augment the sub-model ASV requests when a beta-bar constraint target update is required for second-order PMA

Protected Attributes

- Model uSpaceModel

  Model representing the limit state in u-space, after any recastings and data fits.

- Model mppModel

  RecastModel which formulates the optimization subproblem: RIA, PMA, EGO.

- Iterator mppOptimizer

  Iterator which optimizes the mppModel.

- short mppSearchType

  the MPP search type selection: MV, x/u-space AMV, x/u-space AMV+, x/u-space TANA, x/u-space EGO, or NO_APPROX

- Iterator importanceSampler

  importance sampling instance used to compute/refine probabilities

- short integrationRefinement

  integration refinement type (NO_INT_REFINE, IS, AIS, or MMAIS) provided by `refinement` *specification*

- size_t numRelAnalyses

  number of invocations of quantify_uncertainty()

- size_t approxIters

number of approximation cycles for the current respFnCount/levelCount

- bool approxConverged

  indicates convergence of approximation-based iterations

- int respFnCount

  counter for which response function is being analyzed

- size_t levelCount

  counter for which response/probability level is being analyzed

- size_t statCount

  counter for which final statistic is being computed

- Real requestedRespLevel

  the response level target for the current response function

- Real requestedCDFProbLevel

  the CDF probability level target for the current response function

- Real requestedCDFRelLevel

  the CDF reliability level target for the current response function

- Real computedRespLevel

  output response level calculated

- Real computedRelLevel

  output reliability level calculated

Static Protected Attributes

- static NonDReliability * nondRelInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.97.1 Detailed Description

Base class for the reliability methods within DAKOTA/UQ. The NonDReliability class provides a base class for NonDLocalReliability, which implements traditional MPP-based reliability methods, and NonDGlobalReliability, which implements global limit state search using Gaussian process models in combination with multimodal importance sampling.

43.97.2 Member Function Documentation

43.97.2.1 void RIA_objective_eval (const Variables & *sub_model_vars*, const Variables & *recast_vars*, const Response & *sub_model_response*, Response & *recast_response*) [static, protected]

static function used as the objective function in the Reliability Index Approach (RIA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the objective function of (norm u)^2. This function recasts a G(u) response set (already transformed and approximated in other recursions) into an RIA objective function.

References Response::active_set_request_vector(), Variables::continuous_variables(), Response::function_gradient_view(), Response::function_hessian_view(), and Response::function_value().

Referenced by NonDLocalReliability::mpp_search().

43.97.2.2 void RIA_constraint_eval (const Variables & *sub_model_vars*, const Variables & *recast_vars*, const Response & *sub_model_response*, Response & *recast_response*) [static, protected]

static function used as the constraint function in the Reliability Index Approach (RIA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the constraint of G(u) = response level. This function recasts a G(u) response set (already transformed and approximated in other recursions) into an RIA equality constraint.

References Response::active_set_request_vector(), Response::function_gradient(), Response::function_gradient_view(), Response::function_hessian(), Response::function_value(), NonDReliability::nondRelInstance, NonDReliability::requestedRespLevel, and NonDReliability::respFnCount.

Referenced by NonDLocalReliability::mpp_search().

43.97.2.3 void PMA_objective_eval (const Variables & *sub_model_vars*, const Variables & *recast_vars*, const Response & *sub_model_response*, Response & *recast_response*) [static, protected]

static function used as the objective function in the Performance Measure Approach (PMA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the objective function of G(u). This function recasts a G(u) response set (already transformed and approximated in other recursions) into an PMA objective function.

References Response::active_set_request_vector(), Response::function_gradient(), Response::function_gradient_view(), Response::function_gradients(), Response::function_hessian(), Response::function_hessian_view(), Response::function_value(), NonDReliability::nondRelInstance, NonDReliability::requestedCDFRelLevel, and NonDReliability::respFnCount.

Referenced by NonDLocalReliability::mpp_search().

43.97.2.4 void PMA_constraint_eval (const Variables & *sub_model_vars*, const Variables & *recast_vars*, const Response & *sub_model_response*, Response & *recast_response*) [static, protected]

static function used as the constraint function in the Performance Measure Approach (PMA) problem formulation. This equality-constrained optimization problem performs the search for the most probable point (MPP) with the constraint of (norm u)^2 = beta^2. This function recasts a G(u) response set (already transformed and approximated in other recursions) into a PMA equality constraint.

References Response::active_set_request_vector(), Variables::continuous_variables(), Response::function_gradient_view(), Response::function_hessian_view(), Response::function_value(), NonDReliability::nondRelInstance, NonDReliability::requestedCDFRelLevel, and NonDReliability::update_pma_reliability_level().

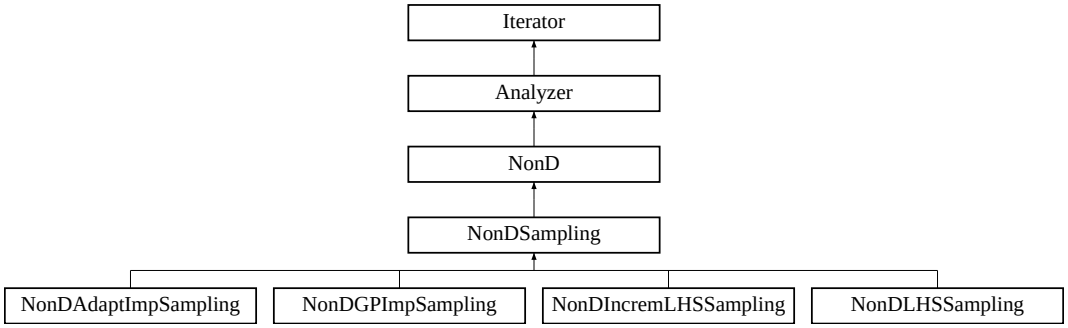
Referenced by NonDLocalReliability::mpp_search().

The documentation for this class was generated from the following files:

- NonDReliability.H
- NonDReliability.C

43.98 NonDSampling Class Reference

Base class for common code between NonDLHSSampling, NonDIncremLHSSampling, and NonDAdaptImpSampling. Inheritance diagram for NonDSampling::



Public Member Functions

- void compute_distribution_mappings (const IntResponseMap &samples)

  called by compute_statistics() to calculate CDF/CCDF mappings of z to p/beta and of p/beta to z

- void update_final_statistics ()

  update finalStatistics from minValues/maxValues, momentStats, and computedProbLevels/computedRelLevels/computedRespLevels

- void print_pdf_mappings (std::ostream &s) const

  prints the PDFs computed in compute_statistics()

- void sampling_reference (int samples_ref)

  set samplesRef

Protected Member Functions

- NonDSampling (Model &model)

  constructor

- NonDSampling (NoDBBaseConstructor, Model &model, const String &sample_type, int samples, int seed, const String &rng, bool vary_pattern)

  alternate constructor for sample generation and evaluation "on the fly"

- NonDSampling (NoDBBaseConstructor, const String &sample_type, int samples, int seed, const String &rng, const RealVector &lower_bnds, const RealVector &upper_bnds)

  alternate constructor for sample generation "on the fly"

- ~NonDSampling ()

  destructor

- int num_samples () const

  get the current number of samples

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)

  resets number of samples and sampling flags

- const String & sampling_scheme () const

  return sampleType: "lhs" or "random"

- void vary_pattern (bool pattern_flag)

  set varyPattern

- void get_parameter_sets (Model &model)

  Uses lhsDriver to generate a set of samples from the distributions/bounds defined in the incoming model.

- void get_parameter_sets (const RealVector &lower_bnds, const RealVector &upper_bnds)

  Uses lhsDriver to generate a set of uniform samples over lower_bnds/upper_bnds.

- void update_model_from_sample (Model &model, const Real *sample_vars)

  Override default update of continuous vars only.

- void initialize_lhs (bool write_message)

  increments numLHSRuns, sets random seed, and initializes lhsDriver

- void compute_statistics (const RealMatrix &vars_samples, const IntResponseMap &resp_samples)

  For the input sample set, computes mean, standard deviation, and probability/reliability/response levels (aleatory uncertainties) or intervals (epsitemic or mixed uncertainties).

- void compute_intervals (const IntResponseMap &samples)

  called by compute_statistics() to calculate min/max intervals

- void compute_moments (const IntResponseMap &samples)

  called by compute_statistics() to calculate means, std deviations, and confidence intervals

- void print_statistics (std::ostream &s) const

  prints the statistics computed in compute_statistics()

- void print_intervals (std::ostream &s) const

  prints the intervals computed in compute_intervals()

- void print_moments (std::ostream &s) const

  prints the moments computed in compute_moments()

- void view_counts (const Model &model, size_t &cv_start, size_t &num_cv, size_t &div_start, size_t &num_div, size_t &drv_start, size_t &num_drv) const

  compute sampled subsets of all cv/div/drv from samplingVarsMode and model

Protected Attributes

- const int seedSpec

  the user seed specification (default is 0)

- int randomSeed

  the current seed

- const int samplesSpec

  initial specification of number of samples

- int samplesRef

  reference number of samples updated for refinement

- int numSamples

  the current number of samples to evaluate

- String rngName

  name of the random number generator

- String sampleType

  the sample type: random, lhs, or incremental_lhs

- Pecos::LHSDriver lhsDriver

  the C++ wrapper for the F90 LHS library

- bool statsFlag

  flags computation/output of statistics

- bool allDataFlag

  flags update of allResponses < (allVariables or allSamples already defined)

- short samplingVarsMode

  the sampling mode: ACTIVE, ACTIVE_UNIFORM, ALL, or ALL_UNIFORM

- short sampleRanksMode

  mode for input/output of LHS sample ranks: IGNORE_RANKS, GET_RANKS, SET_RANKS, or SET_GET_RANKS

- bool varyPattern

  flag for generating a sequence of seed values within multiple get_parameter_sets() calls so that these executions (e.g., for SBO/SBNLS) are not repeated, but are still repeatable

- RealMatrix sampleRanks

  data structure to hold the sample ranks

- RealVector mean95CIDeltas

  Plus/minus deltas on response function means for 95% confidence intervals (calculated in compute_moments()).

- RealVector stdDev95CILowerBnds

  Lower bound for 95% confidence interval on std deviation (calculated in compute_moments()).

- RealVector stdDev95CIUpperBnds

  Upper bound for 95% confidence interval on std deviation (calculated in compute_moments()).

- SensAnalysisGlobal nonDSampCorr

  initialize statistical post processing

Private Attributes

- size_t numLHSRuns

  counter for number of executions of get_parameter_sets() for this object

- RealVector minValues

  Min values of response functions for epistemic calculations (calculated in compute_intervals()).

- RealVector maxValues

  Max values of response functions for epistemic calculations (calculated in compute_intervals()).

- RealVectorArray computedPDFAbscissas

  sorted response PDF intervals bounds extracted from min/max sample and requested/computedRespLevels (vector lengths = num bins + 1)

- RealVectorArray computedPDFOrdinates

  response PDF densities computed from bin counts divided by (unequal) bin widths (vector lengths = num bins)

43.98.1 Detailed Description

Base class for common code between NonDLHSSampling, NonDIncremLHSSampling, and NonDAdaptImpSampling. This base class provides common code for sampling methods which employ the Latin Hypercube Sampling (LHS) package from Sandia Albuquerque's Risk and Reliability organization. NonDSampling now exclusively utilizes the 1998 Fortran 90 LHS version as documented in SAND98-0210, which was converted to a UNIX link library in 2001. The 1970's vintage LHS (that had been f2c'd and converted to incomplete classes) has been removed.

43.98.2 Constructor & Destructor Documentation

43.98.2.1 NonDSampling (Model & *model*) [protected]

constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_-list_nodes has been called and probDescDB can be queried for settings from the method specification.

References Dakota::abort_handler(), NonD::initialize_final_statistics(), Iterator::maxConcurrency, NonD::numEpistemicUncVars, NonDSampling::numSamples, NonDSampling::sampleType, and NonD::totalLevelRequests.

43.98.2.2 NonDSampling (NoDBBaseConstructor, Model & *model*, const String & *sample_type*, int *samples*, int *seed*, const String & *rng*, bool *vary_pattern*) [protected]

alternate constructor for sample generation and evaluation "on the fly" This alternate constructor is used for generation and evaluation of on-the-fly sample sets.

References Iterator::maxConcurrency, NonDSampling::numSamples, NonDSampling::sampleType, and Iterator::subIteratorFlag.

43.98.2.3 NonDSampling (NoDBBaseConstructor, const String & *sample_type*, int *samples*, int *seed*, const String & *rng*, const RealVector & *lower_bnds*, const RealVector & *upper_bnds*) [protected]

alternate constructor for sample generation "on the fly" This alternate constructor is used by ConcurrentStrategy for generation of uniform, uncorrelated sample sets.

References Iterator::maxConcurrency, NonDSampling::numSamples, NonDSampling::sampleType, and Iterator::subIteratorFlag.

43.98.3 Member Function Documentation

43.98.3.1 int num_samples () const [inline, protected, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References NonDSampling::numSamples.

Referenced by NonDAdaptImpSampling::generate_samples(), NonDAdaptImpSampling::select_init_rep_-points(), and NonDAdaptImpSampling::select_rep_points().

43.98.3.2 void sampling_reset (int *min_samples*, bool *all_data_flag*, bool *stats_flag*) [inline, protected, virtual]

resets number of samples and sampling flags used by DataFitSurrModel::build_global() to publish the minimum number of samples needed from the sampling routine (to build a particular global approximation) and to set

allDataFlag and statsFlag. In this case, allDataFlag is set to true (vectors of variable and response sets must be returned to build the global approximation) and statsFlag is set to false (statistics computations are not needed).

Reimplemented from Iterator.

References NonDSampling::allDataFlag, NonDSampling::numSamples, NonDSampling::samplesRef, and NonDSampling::statsFlag.

43.98.3.3 void get_parameter_sets (Model & *model*) `[protected, virtual]`

Uses lhsDriver to generate a set of samples from the distributions/bounds defined in the incoming model. This version of get_parameter_sets() extracts data from the user-defined model in any of the four sampling modes.

Reimplemented from Analyzer.

References Dakota::abort_handler(), Model::all_continuous_lower_bounds(), Model::all_continuous_upper_bounds(), Model::all_discrete_int_lower_bounds(), Model::all_discrete_int_upper_bounds(), Analyzer::allSamples, Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::current_variables(), Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Model::discrete_int_lower_bounds(), Model::discrete_int_upper_bounds(), Model::discrete_state_set_int_values(), Model::discrete_state_set_real_values(), Model::distribution_parameters(), NonDSampling::initialize_lhs(), NonDSampling::lhsDriver, NonD::numContAleatUncVars, NonD::numContDesVars, NonD::numContEpistUncVars, NonD::numContStateVars, NonD::numDiscIntAleatUncVars, NonD::numDiscIntDesVars, NonD::numDiscIntEpistUncVars, NonD::numDiscIntStateVars, NonDSampling::numSamples, NonDSampling::sampleRanks, NonDSampling::samplingVarsMode, and Variables::view().

Referenced by NonDLHSSampling::NonDLHSSampling(), NonDLHSSampling::pre_run(), NonDIncremLHSSampling::quantify_uncertainty(), and NonDAdaptImpSampling::quantify_uncertainty().

43.98.3.4 void get_parameter_sets (const RealVector & *lower_bnds*, const RealVector & *upper_bnds*) `[protected]`

Uses lhsDriver to generate a set of uniform samples over lower_bnds/upper_bnds. This version of get_parameter_sets() does not extract data from the user-defined model, but instead relies on the incoming bounded region definition. It only support a UNIFORM sampling mode, where the distinction of ACTIVE_UNIFORM vs. ALL_UNIFORM is handled elsewhere.

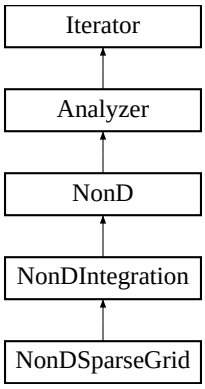
References Analyzer::allSamples, NonDSampling::initialize_lhs(), NonDSampling::lhsDriver, and NonDSampling::numSamples.

The documentation for this class was generated from the following files:

- NonDSampling.H
- NonDSampling.C

43.99 NonDSparseGrid Class Reference

Derived nondeterministic class that generates N-dimensional Smolyak sparse grids for numerical evaluation of expectation integrals over independent standard random variables. Inheritance diagram for NonDSparseGrid::



Public Member Functions

- NonDSparseGrid (Model &model, const UShortArray &ssg_level, const RealVector &dim_pref, short refine_control=Pecos::NO_CONTROL, bool track_uniq_prod_wts=true, short growth_rate=Pecos::MODERATE_RESTRICTED_GROWTH)
- void increment_grid ()

  increment ssgDriver::ssgLevel

- void increment_grid_weights (const RealVector &aniso_wts)

  update ssgDriver::ssgAnisoLevelWts and increment ssgDriver::ssgLevel based on specified anisotropic weighting

- void increment_refinement_sequence ()

  advance to next nevel in ssgLevelSpec sequence

- const std::set< UShortArray > & active_multi_index () const

  returns SparseGridDriver::active_multi_index()

- const std::set< UShortArray > & old_multi_index () const

  returns SparseGridDriver::old_multi_index()

- const UShort2DArray & smolyak_multi_index () const

  returns SparseGridDriver::smolyak_multi_index()

- const IntArray & smolyak_coefficients () const

  returns SparseGridDriver::smolyak_coefficients()

- void initialize_sets ()

  invokes SparseGridDriver::initialize_sets()

- void update_reference ()

  invokes SparseGridDriver::update_reference()

- void increment_set (const UShortArray &set)

  invokes SparseGridDriver::push_trial_set()

- int increment_size () const

  invokes SparseGridDriver::unique_trial_points()

- void restore_set ()

  invokes SparseGridDriver::restore_set()

- void evaluate_set ()

  invokes SparseGridDriver::compute_trial_grid()

- void decrement_set ()

  invokes SparseGridDriver::pop_trial_set()

- void update_sets (const UShortArray &set_star)

  invokes SparseGridDriver::update_sets()

- void print_final_sets (bool converged_within_tol)

  invokes SparseGridDriver::print_final_sets(bool)

- void finalize_sets ()

  invokes SparseGridDriver::finalize_sets()

- int num_samples () const

  get the current number of samples

Protected Member Functions

- NonDSparseGrid (Model &model)

  constructor

- ~NonDSparseGrid ()

  destructor

- void initialize_grid (const std::vector< Pecos::BasisPolynomial > &poly_basis)

  initialize integration grid by drawing from polynomial basis settings

- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

- void reset ()

  restore initial state for repeated sub-iterator executions

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)

Private Attributes

- Pecos::SparseGridDriver * ssgDriver

  convenience pointer to the numIntDriver representation

- UShortArray ssgLevelSpec

  the user specification for the Smolyak sparse grid level, defining a sequence of refinement levels.

- unsigned short ssgLevelRef

  reference point (e.g., lower bound) for the Smolyak sparse grid level maintained within ssgDriver

43.99.1 Detailed Description

Derived nondeterministic class that generates N-dimensional Smolyak sparse grids for numerical evaluation of expectation integrals over independent standard random variables. This class is used by NonDPolynomialChaos and NonDStochCollocation, but could also be used for general numerical integration of moments. It employs 1-D Clenshaw-Curtis and Gaussian quadrature rules within Smolyak sparse grids.

43.99.2 Constructor & Destructor Documentation

43.99.2.1 NonDSparseGrid (Model & *model*, const UShortArray & *ssg_level*, const RealVector & *dim_pref*, short *refine_control* = `Pecos::NO_CONTROL`, bool *track_uniq_prod_wts* = `true`, short *growth_rate* = `Pecos::MODERATE_RESTRICTED_GROWTH`)

This alternate constructor is used for on-the-fly generation and evaluation of sparse grids within PCE and SC.

References NonDIntegration::numIntDriver, and NonDSparseGrid::ssgDriver.

43.99.2.2 NonDSparseGrid (Model & *model*) `[protected]`

constructor This constructor is called for a standard letter-envelope iterator instantiation. In this case, set_db_-list_nodes has been called and probDescDB can be queried for settings from the method specification. It is not currently used, as there is not a separate sparse_grid method specification.

References NonDIntegration::check_variables(), NonDIntegration::dimPrefSpec, Model::distribution_-parameters(), ProblemDescDB::get_bool(), ProblemDescDB::get_short(), Iterator::iteratedModel, Iterator::maxConcurrency, NonD::natafTransform, NonDIntegration::numIntDriver, Iterator::probDescDB, NonDSparseGrid::ssgDriver, and NonDSparseGrid::ssgLevelRef.

43.99.3 Member Function Documentation

43.99.3.1 int num_samples () const [inline, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References NonDSparseGrid::ssgDriver.

43.99.3.2 void sampling_reset (int *min_samples*, bool *all_data_flag*, bool *stats_flag*) [protected, virtual]

used by DataFitSurrModel::build_global() to publish the minimum number of points needed from the sparse grid routine in order to build a particular global approximation.

Reimplemented from Iterator.

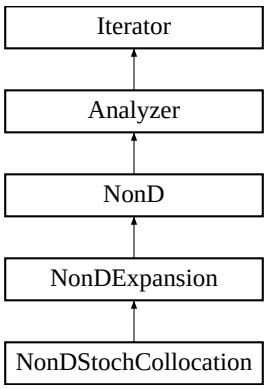
References NonDSparseGrid::ssgDriver, and NonDSparseGrid::ssgLevelRef.

The documentation for this class was generated from the following files:

- NonDSparseGrid.H
- NonDSparseGrid.C

43.100 NonDStochCollocation Class Reference

Nonintrusive stochastic collocation approaches to uncertainty quantification. Inheritance diagram for NonDStochCollocation::



Public Member Functions

- NonDStochCollocation (Model &model)

  standard constructor

- NonDStochCollocation (Model &model, short exp_coeffs_approach, unsigned short num_int_level, short u_space_type, bool piecewise_basis, bool use_derivs)

  alternate constructor

- ~NonDStochCollocation ()

  destructor

Protected Member Functions

- void resolve_inputs (short &u_space_type, short &data_order)

  perform error checks and mode overrides

- void initialize_u_space_model ()

  initialize uSpaceModel polynomial approximations with PCE/SC data

43.100.1 Detailed Description

Nonintrusive stochastic collocation approaches to uncertainty quantification. The NonDStochCollocation class uses a stochastic collocation (SC) approach to approximate the effect of parameter uncertainties on response functions of interest. It utilizes the InterpPolyApproximation class to manage multidimensional Lagrange polynomial interpolants.

43.100.2 Constructor & Destructor Documentation

43.100.2.1 NonDStochCollocation (Model & *model*)

standard constructor This constructor is called for a standard letter-envelope iterator instantiation using the ProblemDescDB.

References Model::assign_rep(), NonDExpansion::construct_expansion_sampler(), NonDExpansion::construct_local_refinement(), NonDExpansion::construct_quadrature(), NonDExpansion::construct_sparse_grid(), NonD::construct_u_space_model(), Model::derivative_concurrency(), NonDExpansion::expansionCoeffsApproach, ProblemDescDB::get_dusa(), ProblemDescDB::get_rdv(), ProblemDescDB::get_short(), Model::init_communicators(), NonDExpansion::initialize(), NonDStochCollocation::initialize_u_space_model(), Iterator::iteratedModel, NonD::numContDesVars, NonD::numContEpistUncVars, NonD::numContStateVars, NonDExpansion::numSamplesOnExpansion, Iterator::outputLevel, NonDExpansion::piecewiseBasis, Iterator::probDescDB, NonDExpansion::refineControl, NonDStochCollocation::resolve_inputs(), and NonDExpansion::uSpaceModel.

43.100.2.2 NonDStochCollocation (Model & *model*, short *exp_coeffs_approach*, unsigned short *num_int_level*, short *u_space_type*, bool *piecewise_basis*, bool *use_derivs*)

alternate constructor This constructor is used for helper iterator instantiation on the fly.

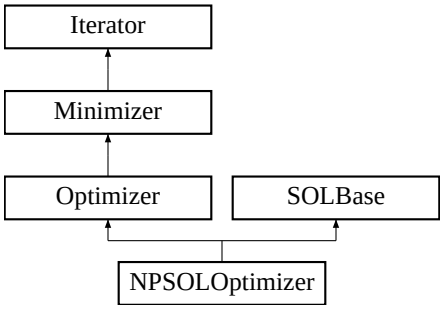
References Model::assign_rep(), NonDExpansion::construct_local_refinement(), NonDExpansion::construct_quadrature(), NonDExpansion::construct_sparse_grid(), NonD::construct_u_space_model(), NonDExpansion::expansionCoeffsApproach, NonDExpansion::initialize(), NonDStochCollocation::initialize_u_space_model(), Iterator::iteratedModel, NonD::numContDesVars, NonD::numContEpistUncVars, NonD::numContStateVars, Iterator::outputLevel, NonDExpansion::piecewiseBasis, NonDExpansion::refineType, NonDStochCollocation::resolve_inputs(), and NonDExpansion::uSpaceModel.

The documentation for this class was generated from the following files:

- NonDStochCollocation.H
- NonDStochCollocation.C

43.101 NPSOLOptimizer Class Reference

Wrapper class for the NPSOL optimization library. Inheritance diagram for NPSOLOptimizer::



Public Member Functions

- NPSOLOptimizer (Model &model)

  standard constructor

- NPSOLOptimizer (NoDBBaseConstructor, Model &model)

  alternate constructor for Iterator instantiations by name

- NPSOLOptimizer (Model &model, const int &derivative_level, const Real &conv_tol)

  alternate constructor for instantiations "on the fly"

- NPSOLOptimizer (const RealVector &initial_point, const RealVector &var_lower_bnds, const RealVector &var_upper_bnds, const RealMatrix &lin_ineq_coeffs, const RealVector &lin_ineq_lower_bnds, const RealVector &lin_ineq_upper_bnds, const RealMatrix &lin_eq_coeffs, const RealVector &lin_eq_targets, const RealVector &nonlin_ineq_lower_bnds, const RealVector &nonlin_ineq_upper_bnds, const RealVector &nonlin_eq_targets, void(∗user_obj_eval)(int &, int &, double ∗, double &, double ∗, int &), void(∗user_con_eval)(int &, int &, int &, int &, int ∗, double ∗, double ∗, double ∗, int &), const int &derivative_level, const Real &conv_tol)

  alternate constructor for instantiations "on the fly"

- ∼NPSOLOptimizer ()

  destructor

- void find_optimum ()

  Used within the optimizer branch for computing the optimal solution. Redefines the run virtual function for the optimizer branch.

Private Member Functions

- void find_optimum_on_model ()

called by find_optimum for setUpType == "model"

- void find_optimum_on_user_functions ()

  called by find_optimum for setUpType == "user_functions"

Static Private Member Functions

- static void objective_eval (int &mode, int &n, double ∗x, double &f, double ∗gradf, int &nstate)

  OBJFUN in NPSOL manual: computes the value and first derivatives of the objective function (passed by function pointer to NPSOL).

Private Attributes

- String setUpType

  controls iteration mode: "model" (normal usage) or "user_functions" (user-supplied functions mode for "on the fly" instantiations). NonDReliability currently uses the user_functions mode.

- RealVector initialPoint

  holds initial point passed in for "user_functions" mode.

- RealVector lowerBounds

  holds variable lower bounds passed in for "user_functions" mode.

- RealVector upperBounds

  holds variable upper bounds passed in for "user_functions" mode.

- void(∗ userObjectiveEval)(int &, int &, double ∗, double &, double ∗, int &)

  holds function pointer for objective function evaluator passed in for "user_functions" mode.

- void(∗ userConstraintEval)(int &, int &, int &, int &, int ∗, double ∗, double ∗, double ∗, int &)

  holds function pointer for constraint function evaluator passed in for "user_functions" mode.

Static Private Attributes

- static NPSOLOptimizer ∗ npsolInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.101.1 Detailed Description

Wrapper class for the NPSOL optimization library. The NPSOLOptimizer class provides a wrapper for NPSOL, a Fortran 77 sequential quadratic programming library from Stanford University marketed by Stanford Business Associates. It uses a function pointer approach for which passed functions must be either global functions or static member functions. Any attribute used within static member functions must be either local to that function or accessed through a static pointer.

The user input mappings are as follows: `max_function_evaluations` is implemented directly in NPSOLOptimizer's evaluator functions since there is no NPSOL parameter equivalent, and `max_iterations`, `convergence_tolerance`, `output` verbosity, `verify_level`, `function_precision`, and `linesearch_tolerance` are mapped into NPSOL's "Major Iteration Limit", "Optimality Tolerance", "Major Print Level" (`verbose:` Major Print Level = 20; `quiet:` Major Print Level = 10), "Verify Level", "Function Precision", and "Linesearch Tolerance" parameters, respectively, using NPSOL's npoptn() subroutine (as wrapped by npoptn2() from the npoptn_wrapper.f file). Refer to [Gill, P.E., Murray, W., Saunders, M.A., and Wright, M.H., 1986] for information on NPSOL's optional input parameters and the npoptn() subroutine.

43.101.2 Constructor & Destructor Documentation

43.101.2.1 NPSOLOptimizer (Model & *model*)

standard constructor This is the primary constructor. It accepts a Model reference.

References Minimizer::constraintTol, Iterator::convergenceTol, Iterator::fdGradStepSize, ProblemDescDB::get_int(), ProblemDescDB::get_real(), Iterator::gradientType, Iterator::maxIterations, Iterator::outputLevel, Iterator::probDescDB, SOLBase::set_options(), Minimizer::speculativeFlag, and Minimizer::vendorNumericalGradFlag.

43.101.2.2 NPSOLOptimizer (NoDBBaseConstructor, Model & *model*)

alternate constructor for Iterator instantiations by name This is an alternate constructor which accepts a Model but does not have a supporting method specification from the ProblemDescDB.

References Minimizer::constraintTol, Iterator::convergenceTol, Iterator::fdGradStepSize, Iterator::gradientType, Iterator::maxIterations, Iterator::outputLevel, SOLBase::set_options(), Minimizer::speculativeFlag, and Minimizer::vendorNumericalGradFlag.

43.101.2.3 NPSOLOptimizer (Model & *model*, const int & *derivative_level*, const Real & *conv_tol*)

alternate constructor for instantiations "on the fly" This is an alternate constructor for instantiations on the fly using a Model but no ProblemDescDB.

43.101.2.4 NPSOLOptimizer (const RealVector & *initial_point*, const RealVector & *var_lower_bnds*, const RealVector & *var_upper_bnds*, const RealMatrix & *lin_ineq_coeffs*, const RealVector & *lin_ineq_lower_bnds*, const RealVector & *lin_ineq_upper_bnds*, const RealMatrix & *lin_eq_coeffs*, const RealVector & *lin_eq_targets*, const RealVector & *nonlin_ineq_lower_bnds*, const RealVector & *nonlin_ineq_upper_bnds*, const RealVector & *nonlin_eq_targets*, void(∗)(int &, int &, double ∗, double &, double ∗, int &) *user_obj_eval*, void(∗)(int &, int &, int &, int &, int ∗, double ∗, double ∗, double ∗, int &) *user_con_eval*, const int & *derivative_level*, const Real & *conv_tol*)

alternate constructor for instantiations "on the fly" This is an alternate constructor for performing an optimization using the passed in objective function and constraint function pointers.

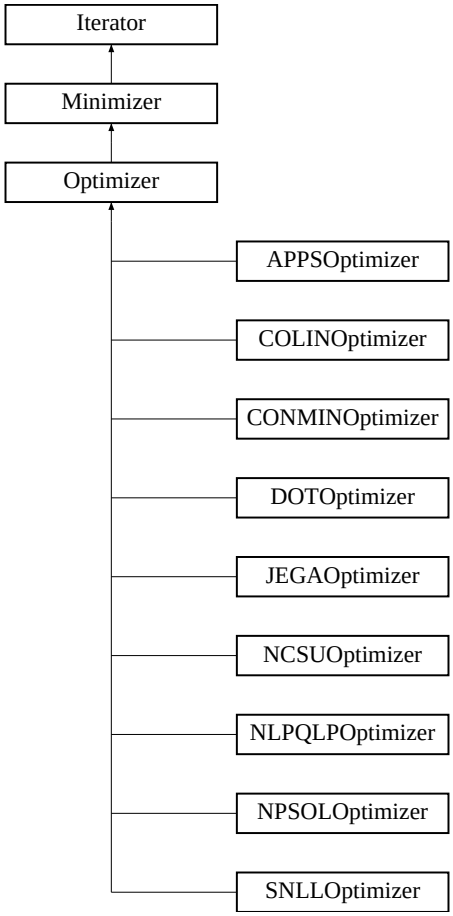
References SOLBase::allocate_arrays(), SOLBase::allocate_workspace(), SOLBase::augment_bounds(), NPSOLOptimizer::lowerBounds, Iterator::numContinuousVars, Minimizer::numLinearConstraints, Minimizer::numNonlinearConstraints, and NPSOLOptimizer::upperBounds.

The documentation for this class was generated from the following files:

- NPSOLOptimizer.H
- NPSOLOptimizer.C

43.102 Optimizer Class Reference

Base class for the optimizer branch of the iterator hierarchy. Inheritance diagram for Optimizer::



Static Public Member Functions

- static void not_available (const std::string &package_name)

  Static helper function: third-party opt packages which are not available.

Protected Member Functions

- Optimizer ()

  default constructor

- Optimizer (Model &model)

  standard constructor

- Optimizer (NoDBBaseConstructor, Model &model)

  alternate constructor for "on the fly" instantiations

- Optimizer (NoDBBaseConstructor, size_t num_cv, size_t num_div, size_t num_drv, size_t num_lin_ineq, size_t num_lin_eq, size_t num_nln_ineq, size_t num_nln_eq)

  alternate constructor for "on the fly" instantiations

- ~Optimizer ()

  destructor

- void initialize_run ()
- void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- void post_run (std::ostream &s)
- void finalize_run ()

  utility function to perform common operations following post_run(); deallocation and resetting of instance pointers

- void print_results (std::ostream &s)
- virtual void find_optimum ()=0

  Used within the optimizer branch for computing the optimal solution. Redefines the run virtual function for the optimizer branch.

Protected Attributes

- size_t numObjectiveFns

  number of objective functions (iterator view)

- bool localObjectiveRecast

  flag indicating whether local recasting to a single objective is used

- Optimizer * prevOptInstance

  pointer containing previous value of optimizerInstance

Static Protected Attributes

- static Optimizer * optimizerInstance

  pointer to Optimizer instance used in static member functions

Private Member Functions

- void objective_reduction (const Response &full_response, const RealVector &full_wts, Response &reduced_response) const

  forward mapping: maps multiple primary response functions to a single weighted objective for single-objective optimizers

- void local_objective_recast_retrieve (const Variables &vars, Response &response) const

  infers MOO/NLS solution from the solution of a single-objective optimizer

Static Private Member Functions

- static void primary_resp_recast (const Variables &native_vars, const Variables &scaled_vars, const Response &native_response, Response &scaled_response)

  primary response conversion map for RecastModel used in scaling and multiobjective: transform objectives (fns, grads, Hessians) from native (user) to iterator space

43.102.1 Detailed Description

Base class for the optimizer branch of the iterator hierarchy. The Optimizer class provides common data and functionality for DOTOptimizer, CONMINOptimizer, NPSOLOptimizer, SNLLOptimizer, NLPQLPOptimizer, COLINOptimizer, and JEGAOptimizer.

43.102.2 Constructor & Destructor Documentation

43.102.2.1 Optimizer (Model & *model*) `[protected]`

standard constructor This constructor extracts the inherited data for the optimizer branch and performs sanity checking on gradient and constraint settings.

References Dakota::abort_handler(), Iterator::activeSet, Model::assign_rep(), String::begins(), Iterator::bestVariablesArray, Minimizer::boundConstraintFlag, Variables::copy(), Model::current_response(), Model::current_variables(), Minimizer::cvScaleTypes, ProblemDescDB::get_sizet(), Minimizer::gnewton_set_recast(), Iterator::gradientType, Iterator::hessianType, Model::init_communicators(), RecastModel::initialize(), Minimizer::initialize_scaling(), Iterator::iteratedModel, Optimizer::localObjectiveRecast, Iterator::maxConcurrency, Iterator::methodName, Model::model_rep(), Model::model_type(), Iterator::numContinuousVars, Iterator::numFunctions, Minimizer::numIterPrimaryFns, Minimizer::numNonlinearConstraints, Minimizer::numNonlinearIneqConstraints, Optimizer::numObjectiveFns, Minimizer::numUserPrimaryFns, Minimizer::optimizationFlag, Optimizer::primary_resp_recast(), Minimizer::primaryRespScaleFlag, Iterator::probDescDB, ActiveSet::request_vector(), Response::reshape(), Minimizer::responseScaleTypes, Minimizer::scaleFlag, Minimizer::secondary_resp_recast(), Minimizer::secondaryRespScaleFlag, Minimizer::speculativeFlag, Minimizer::variables_recast(), and Minimizer::varsScaleFlag.

43.102.3 Member Function Documentation

43.102.3.1 void initialize_run () [protected, virtual]

Implements portions of initialize_run specific to Optimizers. This function should be invoked (or reimplemented) by any derived implementations of initialize_run() (which would otherwise hide it).

Reimplemented from Minimizer.

Reimplemented in CONMINOptimizer, DOTOptimizer, NLPQLPOptimizer, and SNLLOptimizer.

References Iterator::iteratedModel, Optimizer::localObjectiveRecast, Optimizer::optimizerInstance, Optimizer::prevOptInstance, Minimizer::scaleFlag, and Model::update_from_subordinate_model().

43.102.3.2 void run () [inline, protected, virtual]

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented from Iterator.

References Optimizer::find_optimum().

43.102.3.3 void post_run (std::ostream & *s*) [protected, virtual]

Implements portions of post_run specific to Optimizers. This function should be invoked (or reimplemented) by any derived implementations of post_run() (which would otherwise hide it).

Reimplemented from Iterator.

Reimplemented in COLINOptimizer, and SNLLOptimizer.

References Dakota::abort_handler(), Response::active_set_request_vector(), Iterator::bestResponseArray, Iterator::bestVariablesArray, Variables::continuous_variables(), Response::copy(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Optimizer::local_objective_recast_retrieve(), Optimizer::localObjectiveRecast, Minimizer::modify_s2n(), Minimizer::need_resp_trans_byvars(), Minimizer::numNonlinearConstraints, Minimizer::numUserPrimaryFns, Minimizer::primaryRespScaleFlag, Minimizer::response_modify_s2n(), Minimizer::secondaryRespScaleFlag, Response::update_partial(), and Minimizer::varsScaleFlag.

43.102.3.4 void finalize_run () [inline, protected, virtual]

utility function to perform common operations following post_run(); deallocation and resetting of instance pointers Optional: perform finalization phases of run sequence, like deallocating memory and resetting instance pointers. Commonly used in sub-iterator executions. This is a virtual function; when re-implementing, a derived class must call its nearest parent's finalize_run(), typically _after_ performing its own implementation steps.

Reimplemented from Minimizer.

Reimplemented in SNLLOptimizer.

References Optimizer::optimizerInstance, and Optimizer::prevOptInstance.

43.102.3.5 void print_results (std::ostream & *s*) [protected, virtual]

Redefines default iterator results printing to include optimization results (objective functions and constraints).

Reimplemented from Iterator.

References Dakota::abort_handler(), Iterator::bestResponseArray, Iterator::bestVariablesArray, Dakota::data_pairs, Model::interface_id(), Iterator::iteratedModel, Dakota::lookup_by_val(), Iterator::numContinuousVars, Iterator::numFunctions, Minimizer::numUserPrimaryFns, and Dakota::write_data_partial().

43.102.3.6 void primary_resp_recast (const Variables & *native_vars*, const Variables & *scaled_vars*, const Response & *native_response*, Response & *iterator_response*) [static, private]

primary response conversion map for RecastModel used in scaling and multiobjective: transform objectives (fns, grads, Hessians) from native (user) to iterator space Objective function map from user/native space to iterator/scaled/combined space using a RecastModel. If resizing the response, copies the constraint (secondary) data from native_response too

References Response::active_set_request_vector(), Response::copy(), Iterator::iteratedModel, Optimizer::localObjectiveRecast, Minimizer::need_resp_trans_byvars(), Minimizer::numUserPrimaryFns, Optimizer::objective_reduction(), Optimizer::optimizerInstance, Iterator::outputLevel, Model::primary_response_fn_weights(), Minimizer::primaryRespScaleFlag, Minimizer::response_modify_n2s(), Model::subordinate_model(), and Response::update_partial().

Referenced by Optimizer::Optimizer().

43.102.3.7 void objective_reduction (const Response & *full_response*, const RealVector & *full_wts*, Response & *reduced_response*) const [private]

forward mapping: maps multiple primary response functions to a single weighted objective for single-objective optimizers This function is responsible for the mapping of multiple objective functions into a single objective for publishing to single-objective optimizers. Used in DOTOptimizer, NPSOLOptimizer, SNLLOptimizer, and SGOPTApplication on every function evaluation. The simple weighting approach (using primaryRespFnWts) is the only technique supported currently. The weightings are used to scale function values, gradients, and Hessians as needed.

References Dakota::abort_handler(), Response::active_set_request_vector(), Response::function_gradient_view(), Response::function_gradients(), Response::function_hessian_view(), Response::function_hessians(), Response::function_value(), Response::function_values(), Minimizer::numUserPrimaryFns, Minimizer::objective(), Minimizer::objective_gradient(), Minimizer::objective_hessian(), Iterator::outputLevel, Dakota::write_col_vector_trans(), Dakota::write_data(), and Dakota::write_precision.

Referenced by Optimizer::primary_resp_recast().

43.102.3.8 void local_objective_recast_retrieve (const Variables & *vars*, Response & *response*) const [private]

infers MOO/NLS solution from the solution of a single-objective optimizer Retrieve a MOO/NLS response based on the data returned by a single objective optimizer by performing a data_pairs search.

References Response::active_set(), Dakota::data_pairs, Model::interface_id(), Iterator::iteratedModel, Dakota::lookup_by_val(), Minimizer::numUserPrimaryFns, and Response::update().

Referenced by Optimizer::post_run().

The documentation for this class was generated from the following files:

- DakotaOptimizer.H
- DakotaOptimizer.C

43.103 ParallelConfiguration Class Reference

Container class for a set of ParallelLevel list iterators that collectively identify a particular multilevel parallel configuration.

Public Member Functions

- ParallelConfiguration ()

  default constructor

- ParallelConfiguration (const ParallelConfiguration &pl)

  copy constructor

- ~ParallelConfiguration ()

  destructor

- ParallelConfiguration & operator= (const ParallelConfiguration &pl)

  assignment operator

- const ParallelLevel & w_parallel_level () const

  return the ParallelLevel corresponding to wPLIter

- const ParallelLevel & si_parallel_level () const

  return the ParallelLevel corresponding to siPLIter

- const ParallelLevel & ie_parallel_level () const

  return the ParallelLevel corresponding to iePLIter

- const ParallelLevel & ea_parallel_level () const

  return the ParallelLevel corresponding to eaPLIter

Private Member Functions

- void assign (const ParallelConfiguration &pl)

  assign the attributes of the incoming pl to this object

Private Attributes

- short numParallelLevels

  number of parallel levels

- ParLevLIter wPLIter

list iterator for MPI_COMM_WORLD (not strictly required, but improves modularity by avoiding explicit usage of MPI_COMM_WORLD)

- ParLevLIter siPLIter

  list iterator for concurrent iterator partitions (there may be more than one per parallel configuration instance)

- ParLevLIter iePLIter

  list iterator identifying the iterator-evaluation parallelLevel (there can only be one)

- ParLevLIter eaPLIter

  list iterator identifying the evaluation-analysis parallelLevel (there can only be one)

Friends

- class ParallelLibrary

  the ParallelLibrary class has special access priveleges in order to streamline implementation

43.103.1 Detailed Description

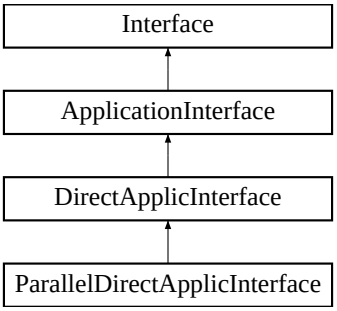
Container class for a set of ParallelLevel list iterators that collectively identify a particular multilevel parallel configuration. Rather than containing the multilevel parallel configuration directly, ParallelConfiguration instead provides a set of list iterators which point into a combined list of ParallelLevels. This approach allows different configurations to reuse ParallelLevels without copying them. A list of ParallelConfigurations is contained in ParallelLibrary (ParallelLibrary::parallelConfigurations).

The documentation for this class was generated from the following file:

- ParallelLibrary.H

43.104 ParallelDirectApplicInterface Class Reference

Sample derived interface class for testing parallel simulator plug-ins using assign_rep(). Inheritance diagram for ParallelDirectApplicInterface::



Public Member Functions

- ParallelDirectApplicInterface (const Dakota::ProblemDescDB &problem_db, const MPI_Comm &analysis_comm)

  constructor

- ~ParallelDirectApplicInterface ()

  destructor

Protected Member Functions

- int derived_map_ac (const Dakota::String &ac_name)

  execute an analysis code portion of a direct evaluation invocation

- void derived_map_asynch (const Dakota::ParamResponsePair &pair)

  no-op hides base error; job batching occurs within derived_synch()

- void derived_synch (Dakota::PRPQueue &prp_queue)

  evaluate the batch of jobs contained in prp_queue

- void derived_synch_nowait (Dakota::PRPQueue &prp_queue)

  invokes derived_synch() (no special nowait support)

- void check_configuration (int max_iterator_concurrency)

  no-op hides base error checks

Private Member Functions

- int text_book (const Dakota::RealVector &c_vars, const Dakota::ShortArray &asv, Dakota::RealVector &fn_vals, Dakota::RealMatrix &fn_grads, Dakota::RealSymMatrixArray &fn_hessians)

  demo evaluator function for parallel plug-ins

43.104.1 Detailed Description

Sample derived interface class for testing parallel simulator plug-ins using assign_rep(). The plug-in ParallelDirectApplicInterface resides in namespace SIM and uses a copy of textbook() to perform parallel parameter to response mappings. It may be activated by specifying the --with-plugin configure option, which activates the DAKOTA_PLUGIN macro in dakota_config.h used by main.C (which activates the plug-in code block within that file) and activates the PLUGIN_S declaration defined in Makefile.include and used in Makefile.source (which add this class to the build). Test input files should then use an analysis_driver of "plugin_textbook".

43.104.2 Member Function Documentation

43.104.2.1 void derived_synch_nowait (Dakota::PRPQueue & *prp_queue*) `[protected, virtual]`

invokes derived_synch() (no special nowait support) For use by ApplicationInterface::serve_evaluations_asynch(), which can provide a batch processing capability within message passing schedulers (called using chain ApplicationInterface::serve_evaluations() from Model::serve() from Strategy::run_iterator()).

Reimplemented from DirectApplicInterface.

References ParallelDirectApplicInterface::derived_synch().

The documentation for this class was generated from the following files:

- PluginParallelDirectApplicInterface.H
- PluginParallelDirectApplicInterface.C

43.105 ParallelLevel Class Reference

Container class for the data associated with a single level of communicator partitioning.

Public Member Functions

- ParallelLevel ()

  default constructor

- ParallelLevel (const ParallelLevel &pl)

  copy constructor

- ~ParallelLevel ()

  destructor

- ParallelLevel & operator= (const ParallelLevel &pl)

  assignment operator

- bool dedicated_master_flag () const

  return dedicatedMasterFlag

- bool communicator_split_flag () const

  return commSplitFlag

- bool server_master_flag () const

  return serverMasterFlag

- bool message_pass () const

  return messagePass

- const int & num_servers () const

  return numServers

- const int & processors_per_server () const

  return procsPerServer

- const int & processor_remainder () const

  return procRemainder

- const MPI_Comm & server_intra_communicator () const

  return serverIntraComm

- const int & server_communicator_rank () const

  return serverCommRank

- const int & server_communicator_size () const

  return serverCommSize

- const MPI_Comm & hub_server_intra_communicator () const

  return hubServerIntraComm

- const int & hub_server_communicator_rank () const

  return hubServerCommRank

- const int & hub_server_communicator_size () const

  return hubServerCommSize

- const MPI_Comm & hub_server_inter_communicator () const

  return hubServerInterComm

- MPI_Comm ∗ hub_server_inter_communicators () const

  return hubServerInterComms

- const int & server_id () const

  return serverId

Private Member Functions

- void assign (const ParallelLevel &pl)

  assign the attributes of the incoming pl to this object

Private Attributes

- bool dedicatedMasterFlag

  signals dedicated master partitioning

- bool commSplitFlag

  signals a communicator split was used

- bool serverMasterFlag

  identifies master server processors

- bool messagePass

  flag for message passing at this level

- int numServers

  number of servers

- int procsPerServer
  processors per server
- int procRemainder
  proc remainder after equal distribution
- MPI_Comm serverIntraComm
  intracomm. for each server partition
- int serverCommRank
  rank in serverIntraComm
- int serverCommSize
  size of serverIntraComm
- MPI_Comm hubServerIntraComm
  intracomm for all serverCommRank==0 < w/i next higher level serverIntraComm
- int hubServerCommRank
  rank in hubServerIntraComm
- int hubServerCommSize
  size of hubServerIntraComm
- MPI_Comm hubServerInterComm
  intercomm. between a server & the hub < (on server partitions only)
- MPI_Comm * hubServerInterComms
  intercomm. array on hub processor
- int serverId
  server identifier

Friends

- class ParallelLibrary
  the ParallelLibrary class has special access priveleges in order to streamline implementation

43.105.1 Detailed Description

Container class for the data associated with a single level of communicator partitioning. A list of these levels is contained in ParallelLibrary (ParallelLibrary::parallelLevels), which defines all of the parallelism levels across one or more multilevel parallelism configurations.

The documentation for this class was generated from the following file:

- ParallelLibrary.H

43.106 ParallelLibrary Class Reference

Class for partitioning multiple levels of parallelism and managing message passing within these levels.

Public Member Functions

- ParallelLibrary (int &argc, char **&argv)

  stand-alone mode constructor

- ParallelLibrary ()

  default library mode constructor (assumes MPI_COMM_WORLD)

- ParallelLibrary (MPI_Comm dakota_mpi_comm)

  library mode constructor accepting communicator

- ParallelLibrary (const std::string &dummy)

  dummy constructor (used for dummy_lib)

- ~ParallelLibrary ()

  destructor

- const ParallelLevel & init_iterator_communicators (const int &iterator_servers, const int &procs_per_iterator, const int &max_iterator_concurrency, const std::string &default_config, const std::string &iterator_scheduling)

  split MPI_COMM_WORLD into iterator communicators

- const ParallelLevel & init_evaluation_communicators (const int &evaluation_servers, const int &procs_per_evaluation, const int &max_evaluation_concurrency, const int &asynch_local_evaluation_concurrency, const std::string &default_config, const std::string &evaluation_scheduling)

  split an iterator communicator into evaluation communicators

- const ParallelLevel & init_analysis_communicators (const int &analysis_servers, const int &procs_per_analysis, const int &max_analysis_concurrency, const int &asynch_local_analysis_concurrency, const std::string &default_config, const std::string &analysis_scheduling)

  split an evaluation communicator into analysis communicators

- void free_iterator_communicators ()

  deallocate iterator communicators

- void free_evaluation_communicators ()

  deallocate evaluation communicators

- void free_analysis_communicators ()

  deallocate analysis communicators

- void print_configuration ()

print the parallel level settings for a particular parallel configuration

- void specify_outputs_restart (CommandLineHandler &cmd_line_handler)

  specify output streams and restart file(s) using command line inputs (normal mode)

- void specify_outputs_restart (const char *clh_std_output_filename=NULL, const char *clh_std_-error_filename=NULL, const char *clh_read_restart_filename=NULL, const char *clh_write_restart_-filename=NULL, int stop_restart_evals=0, bool pre_run_flag=false)

  specify output streams and restart file(s) using external inputs (library mode).

- void manage_outputs_restart (const ParallelLevel &pl)

  manage output streams and restart file(s) (both modes)

- void close_streams ()

  close streams, files, and any other services

- void abort_helper (int code) const

  finalize MPI with correct communicator for abort

- void output_helper (const std::string &s, std::ostream &outfile=Cout) const

  perform stdout on rank 0 only

- bool command_line_check () const

  return checkFlag

- bool command_line_pre_run () const

  return preRunFlag

- bool command_line_run () const

  return runFlag

- bool command_line_post_run () const

  return postRunFlag

- bool command_line_user_modes () const

  return userModesFlag

- const std::string & command_line_pre_run_input () const

  preRunInput filename

- const std::string & command_line_pre_run_output () const

  preRunOutput filename

- const std::string & command_line_run_input () const

  runInput filename

- const std::string & command_line_run_output () const
  runOutput filename
- const std::string & command_line_post_run_input () const
  postRunInput filename
- const std::string & command_line_post_run_output () const
  postRunOutput fname
- void send_si (int &send_int, int dest, int tag)
  blocking send at the strategy-iterator communication level
- void recv_si (int &recv_int, int source, int tag, MPI_Status &status)
  blocking receive at the strategy-iterator communication level
- void send_si (MPIPackBuffer &send_buff, int dest, int tag)
  blocking send at the strategy-iterator communication level
- void isend_si (MPIPackBuffer &send_buff, int dest, int tag, MPI_Request &send_req)
  nonblocking send at the strategy-iterator communication level
- void recv_si (MPIUnpackBuffer &recv_buff, int source, int tag, MPI_Status &status)
  blocking receive at the strategy-iterator communication level
- void irecv_si (MPIUnpackBuffer &recv_buff, int source, int tag, MPI_Request &recv_req)
  nonblocking receive at the strategy-iterator communication level
- void send_ie (MPIPackBuffer &send_buff, int dest, int tag)
  blocking send at the iterator-evaluation communication level
- void isend_ie (MPIPackBuffer &send_buff, int dest, int tag, MPI_Request &send_req)
  nonblocking send at the iterator-evaluation communication level
- void recv_ie (MPIUnpackBuffer &recv_buff, int source, int tag, MPI_Status &status)
  blocking receive at the iterator-evaluation communication level
- void irecv_ie (MPIUnpackBuffer &recv_buff, int source, int tag, MPI_Request &recv_req)
  nonblocking receive at the iterator-evaluation communication level
- void send_ea (int &send_int, int dest, int tag)
  blocking send at the evaluation-analysis communication level
- void isend_ea (int &send_int, int dest, int tag, MPI_Request &send_req)
  nonblocking send at the evaluation-analysis communication level
- void recv_ea (int &recv_int, int source, int tag, MPI_Status &status)

blocking receive at the evaluation-analysis communication level

- void irecv_ea (int &recv_int, int source, int tag, MPI_Request &recv_req)

  nonblocking receive at the evaluation-analysis communication level

- void bcast_w (int &data)

  broadcast an integer across MPI_COMM_WORLD

- void bcast_i (int &data)

  broadcast an integer across an iterator communicator

- void bcast_i (short &data)

  broadcast a short integer across an iterator communicator

- void bcast_e (int &data)

  broadcast an integer across an evaluation communicator

- void bcast_a (int &data)

  broadcast an integer across an analysis communicator

- void bcast_si (int &data)

  broadcast an integer across a strategy-iterator intra communicator

- void bcast_w (MPIPackBuffer &send_buff)

  broadcast a packed buffer across MPI_COMM_WORLD

- void bcast_i (MPIPackBuffer &send_buff)

  broadcast a packed buffer across an iterator communicator

- void bcast_e (MPIPackBuffer &send_buff)

  broadcast a packed buffer across an evaluation communicator

- void bcast_a (MPIPackBuffer &send_buff)

  broadcast a packed buffer across an analysis communicator

- void bcast_si (MPIPackBuffer &send_buff)

  broadcast a packed buffer across a strategy-iterator intra communicator

- void bcast_w (MPIUnpackBuffer &recv_buff)

  matching receive for packed buffer broadcast across MPI_COMM_WORLD

- void bcast_i (MPIUnpackBuffer &recv_buff)

  matching receive for packed buffer bcast across an iterator communicator

- void bcast_e (MPIUnpackBuffer &recv_buff)

  matching receive for packed buffer bcast across an evaluation communicator

- void bcast_a (MPIUnpackBuffer &recv_buff)

  matching receive for packed buffer bcast across an analysis communicator

- void bcast_si (MPIUnpackBuffer &recv_buff)

  matching recv for packed buffer bcast across a strat-iterator intra comm

- void barrier_w ()

  enforce MPI_Barrier on MPI_COMM_WORLD

- void barrier_i ()

  enforce MPI_Barrier on an iterator communicator

- void barrier_e ()

  enforce MPI_Barrier on an evaluation communicator

- void barrier_a ()

  enforce MPI_Barrier on an analysis communicator

- void reduce_sum_ea (double ∗local_vals, double ∗sum_vals, const int &num_vals)

  compute a sum over an eval-analysis intra-communicator using MPI_Reduce

- void reduce_sum_a (double ∗local_vals, double ∗sum_vals, const int &num_vals)

  compute a sum over an analysis communicator using MPI_Reduce

- void test (MPI_Request &request, int &test_flag, MPI_Status &status)

  test a nonblocking send/receive request for completion

- void wait (MPI_Request &request, MPI_Status &status)

  wait for a nonblocking send/receive request to complete

- void waitall (const int &num_recvs, MPI_Request ∗&recv_reqs)

  wait for all messages from a series of nonblocking receives

- void waitsome (const int &num_sends, MPI_Request ∗&recv_requests, int &num_recvs, int ∗&index_-array, MPI_Status ∗&status_array)

  wait for at least one message from a series of nonblocking receives but complete all that are available

- void free (MPI_Request &request)

  free an MPI_Request

- const int & world_size () const

  return worldSize

- const int & world_rank () const

  return worldRank

- bool mpirun_flag () const

  return mpirunFlag

- bool is_null () const

  return dummyFlag

- Real parallel_time () const

  returns current MPI wall clock time

- void parallel_configuration_iterator (const ParConfigLIter &pc_iter)

  set the current ParallelConfiguration node

- const ParConfigLIter & parallel_configuration_iterator () const

  return the current ParallelConfiguration node

- const ParallelConfiguration & parallel_configuration () const

  return the current ParallelConfiguration instance

- size_t num_parallel_configurations () const

  returns the number of entries in parallelConfigurations

- bool parallel_configuration_is_complete ()

  identifies if the current ParallelConfiguration has been fully populated

- void increment_parallel_configuration ()

  add a new node to parallelConfigurations and increment currPCIter

- bool w_parallel_level_defined () const

  test current parallel configuration for definition of world parallel level

- bool si_parallel_level_defined () const

  test current parallel configuration for definition of strategy-iterator parallel level

- bool ie_parallel_level_defined () const

  test current parallel configuration for definition of iterator-evaluation parallel level

- bool ea_parallel_level_defined () const

  test current parallel configuration for definition of evaluation-analysis parallel level

- std::vector< MPI_Comm > analysis_intra_communicators ()

  return the set of analysis intra communicators for all parallel configurations (used for setting up direct simulation interfaces prior to execution time).

Static Public Member Functions

- static bool detect_parallel_launch (int &argc, char **&argv)

  detect parallel launch of DAKOTA using mpirun/mpiexec/poe/etc. based on command line arguments and environment variables

Private Member Functions

- void init_mpi_comm (MPI_Comm dakota_mpi_comm)

  convenience function for initializing from specific comm

- void init_communicators (const ParallelLevel &parent_pl, const int &num_servers, const int &procs_per_server, const int &max_concurrency, const int &asynch_local_concurrency, const std::string &default_config, const std::string &scheduling_override)

  split a parent communicator into child server communicators

- void free_communicators (ParallelLevel &pl)

  deallocate intra/inter communicators for a particular ParallelLevel

- bool split_communicator_dedicated_master (const ParallelLevel &parent_pl, ParallelLevel &child_pl)

  split a parent communicator into a dedicated master processor and num_servers child communicators

- bool split_communicator_peer_partition (const ParallelLevel &parent_pl, ParallelLevel &child_pl)

  split a parent communicator into num_servers peer child communicators (no dedicated master processor)

- bool resolve_inputs (int &num_servers, int &procs_per_server, const int &avail_procs, int &proc_remainder, const int &max_concurrency, const int &capacity_multiplier, const std::string &default_config, const std::string &scheduling_override, bool print_rank)

  resolve user inputs into a sensible partitioning scheme

- void send (MPIPackBuffer &send_buff, const int &dest, const int &tag, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  blocking buffer send at the current communication level

- void send (int &send_int, const int &dest, const int &tag, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  blocking integer send at the current communication level

- void isend (MPIPackBuffer &send_buff, const int &dest, const int &tag, MPI_Request &send_req, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  nonblocking buffer send at the current communication level

- void isend (int &send_int, const int &dest, const int &tag, MPI_Request &send_req, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  nonblocking integer send at the current communication level

- void recv (MPIUnpackBuffer &recv_buff, const int &source, const int &tag, MPI_Status &status, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  blocking buffer receive at the current communication level

- void recv (int &recv_int, const int &source, const int &tag, MPI_Status &status, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  blocking integer receive at the current communication level

- void irecv (MPIUnpackBuffer &recv_buff, const int &source, const int &tag, MPI_Request &recv_req, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  nonblocking buffer receive at the current communication level

- void irecv (int &recv_int, const int &source, const int &tag, MPI_Request &recv_req, ParallelLevel &parent_pl, ParallelLevel &child_pl)

  nonblocking integer receive at the current communication level

- void bcast (int &data, const MPI_Comm &comm)

  broadcast an integer across a communicator

- void bcast (short &data, const MPI_Comm &comm)

  broadcast a short integer across a communicator

- void bcast (MPIPackBuffer &send_buff, const MPI_Comm &comm)

  send a packed buffer across a communicator using a broadcast

- void bcast (MPIUnpackBuffer &recv_buff, const MPI_Comm &comm)

  matching receive for a packed buffer broadcast

- void barrier (const MPI_Comm &comm)

  enforce MPI_Barrier on comm

- void reduce_sum (double *local_vals, double *sum_vals, const int &num_vals, const MPI_Comm &comm)

  compute a sum over comm using MPI_Reduce

- void check_error (const std::string &err_source, const int &err_code)

  check the MPI return code and abort if error

- void manage_run_modes (CommandLineHandler &cmd_line_handler)

  manage run mode information from command-line handler

- void split_filenames (const char *filenames, std::string &input_filename, std::string &output_filename)

  split a double colon separated pair of filenames (possibly empty) into input and output filename strings

Private Attributes

- std::ofstream output_ofstream

  tagged file redirection of stdout

- std::ofstream error_ofstream

  tagged file redirection of stderr

- MPI_Comm dakotaMPIComm

  MPI_Comm on which DAKOTA is running.

- int worldRank

  rank in MPI_Comm in which DAKOTA is running

- int worldSize

  size of MPI_Comm in which DAKOTA is running

- bool mpirunFlag

  flag for a parallel mpirun/yod launch

- bool ownMPIFlag

  flag for ownership of MPI_Init/MPI_Finalize

- bool dummyFlag

  prevents multiple MPI_Finalize calls due to dummy_lib

- bool stdOutputToFile

  flags redirection of DAKOTA std output to a file

- bool stdErrorToFile

  flags redirection of DAKOTA std error to a file

- bool checkFlag

  flags invocation with command line option -check

- bool preRunFlag

  flags invocation with command line option -pre_run

- bool runFlag

  flags invocation with command line option -run

- bool postRunFlag

  flags invocation with command line option -post_run

- bool userModesFlag

  whether user run mdoes are active

- std::string preRunInput

  filename for pre_run input

- std::string preRunOutput

  filename for pre_run output

- std::string runInput

  filename for run input

- std::string runOutput

  filename for run output

- std::string postRunInput

  filename for post_run input

- std::string postRunOutput

  filename for post_run output

- Real startCPUTime

  start reference for UTILIB CPU timer

- Real startWCTime

  start reference for UTILIB wall clock timer

- Real startMPITime

  start reference for MPI wall clock timer

- long startClock

  start reference for local clock() timer measuring < parent+child CPU

- std::string stdOutputFilename

  filename for redirection of stdout

- std::string stdErrorFilename

  filename for redirection of stderr

- std::string readRestartFilename

  input filename for restart

- std::string writeRestartFilename

  output filename for restart

- int stopRestartEvals

  number of evals at which to stop restart processing

- std::list< ParallelLevel > parallelLevels

  the complete set of parallelism levels for managing multilevel parallelism among one or more configurations

- std::list< ParallelConfiguration > parallelConfigurations

  the set of parallel configurations which manage list iterators for indexing into parallelLevels

- ParLevLIter currPLIter

  list iterator identifying the current node in parallelLevels

- ParConfigLIter currPCIter

  list iterator identifying the current node in parallelConfigurations

43.106.1 Detailed Description

Class for partitioning multiple levels of parallelism and managing message passing within these levels. The ParallelLibrary class encapsulates all of the details of performing message passing within multiple levels of parallelism. It provides functions for partitioning of levels according to user configuration input and functions for passing messages within and across MPI communicators for each of the parallelism levels. If support for other message-passing libraries beyond MPI becomes needed (PVM, ...), then ParallelLibrary would be promoted to a base class with virtual functions to encapsulate the library-specific syntax.

43.106.2 Constructor & Destructor Documentation

43.106.2.1 ParallelLibrary (int & *argc*, char ∗∗& *argv*)

stand-alone mode constructor This constructor is the one used by main.C. It calls MPI_Init conditionally based on whether a parallel launch is detected.

References Dakota::abort_handler(), ParallelLibrary::currPLIter, Dakota::Dak_pl, ParallelLibrary::detect_parallel_launch(), ParallelLibrary::increment_parallel_configuration(), ParallelLibrary::mpirunFlag, ParallelLibrary::ownMPIFlag, ParallelLibrary::parallelLevels, ParallelLevel::serverCommRank, ParallelLevel::serverCommSize, ParallelLevel::serverIntraComm, Dakota::start_dakota_heartbeat(), ParallelLibrary::startClock, ParallelLibrary::startCPUTime, ParallelLibrary::startMPITime, ParallelLibrary::startWCTime, ParallelLibrary::worldRank, and ParallelLibrary::worldSize.

43.106.2.2 ParallelLibrary ()

default library mode constructor (assumes MPI_COMM_WORLD) This constructor provides a library mode default ParallelLibrary. It does not call MPI_Init, but rather gathers data from MPI_COMM_WORLD if MPI_Init has been called elsewhere.

References ParallelLibrary::dakotaMPIComm, and ParallelLibrary::init_mpi_comm().

43.106.2.3 ParallelLibrary (MPI_Comm *dakota_mpi_comm*)

library mode constructor accepting communicator This constructor provides a library mode ParallelLibrary, accepting an MPI communicator that might not be MPI_COMM_WORLD. It does not call MPI_Init, but rather gathers data from dakota_mpi_comm if MPI_Init has been called elsewhere.

References ParallelLibrary::dakotaMPIComm, and ParallelLibrary::init_mpi_comm().

43.106.2.4 ParallelLibrary (const std::string & *dummy*)

dummy constructor (used for dummy_lib) This constructor is used for creation of the global dummy_lib object, which is used to satisfy initialization requirements when the real ParallelLibrary object is not available.

43.106.3 Member Function Documentation

43.106.3.1 void specify_outputs_restart (CommandLineHandler & *cmd_line_handler*)

specify output streams and restart file(s) using command line inputs (normal mode) On the rank 0 processor, get the -output, -error, -read_restart, and -write_restart filenames and the -stop_restart limit from the command line. Defaults for the filenames from the command line handler are NULL for the filenames except write which defaults to dakota.rst and 0 for read_restart_evals if no user specification. This information is Bcast from rank 0 to all iterator masters in manage_outputs_restart().

References ParallelLibrary::manage_run_modes(), CommandLineHandler::read_restart_evals(), ParallelLibrary::readRestartFilename, GetLongOpt::retrieve(), ParallelLibrary::stdErrorFilename, ParallelLibrary::stdOutputFilename, ParallelLibrary::stopRestartEvals, ParallelLibrary::worldRank, and ParallelLibrary::writeRestartFilename.

Referenced by main(), and run_dakota().

43.106.3.2 void specify_outputs_restart (const char * *clh_std_output_filename* = `NULL`, const char * *clh_std_error_filename* = `NULL`, const char * *clh_read_restart_filename* = `NULL`, const char * *clh_write_restart_filename* = `NULL`, int *stop_restart_evals* = `0`, bool *pre_run_flag* = `false`)

specify output streams and restart file(s) using external inputs (library mode). Rather than extracting from the command line, pass the std output, std error, read restart, and write restart filenames and the stop restart limit directly. This function only needs to be invoked to specify non-default values [defaults for the filenames are NULL (resulting in no output redirection, no restart read, and default restart write) and 0 for the stop restart limit (resulting in no restart read limit)].

References ParallelLibrary::postRunFlag, ParallelLibrary::preRunFlag, ParallelLibrary::readRestartFilename, ParallelLibrary::runFlag, ParallelLibrary::stdErrorFilename, ParallelLibrary::stdOutputFilename, ParallelLibrary::stopRestartEvals, ParallelLibrary::userModesFlag, and ParallelLibrary::writeRestartFilename.

43.106.3.3 void manage_outputs_restart (const ParallelLevel & *pl*)

manage output streams and restart file(s) (both modes) If the user has specified the use of files for DAKOTA standard output and/or standard error, then bind these filenames to the Cout/Cerr macros. In addition, if concurrent

iterators are to be used, create and tag multiple output streams in order to prevent jumbled output. Manage restart file(s) by processing any incoming evaluations from an old restart file and by setting up the binary output stream for new evaluations. Only master iterator processor(s) read & write restart information. This function must follow init_iterator_communicators so that restart can be managed properly for concurrent iterator strategies. In the case of concurrent iterators, each iterator has its own restart file tagged with iterator number.

References Dakota::abort_handler(), ParallelLibrary::bcast(), ParallelLibrary::checkFlag, Dakota::dakota_cerr, Dakota::dakota_cout, Dakota::data_pairs, ParallelLevel::dedicatedMasterFlag, ParallelLibrary::error_ofstream, ParallelLevel::hubServerCommSize, ParallelLevel::hubServerIntraComm, ParallelLevel::numServers, ParallelLibrary::output_ofstream, ParallelLibrary::postRunFlag, ParallelLibrary::postRunInput, ParallelLibrary::postRunOutput, ParallelLibrary::preRunFlag, ParallelLibrary::preRunInput, ParallelLibrary::preRunOutput, ParallelLibrary::readRestartFilename, ParallelLibrary::runFlag, ParallelLibrary::runInput, ParallelLibrary::runOutput, ParallelLevel::serverCommRank, ParallelLevel::serverId, ParallelLevel::serverMasterFlag, MPIPackBuffer::size(), ParallelLibrary::stdErrorFilename, ParallelLibrary::stdErrorToFile, ParallelLibrary::stdOutputFilename, ParallelLibrary::stdOutputToFile, ParallelLibrary::stopRestartEvals, ParallelLibrary::userModesFlag, ParallelLibrary::worldRank, Dakota::write_restart, and ParallelLibrary::writeRestartFilename.

Referenced by Strategy::init_iterator_parallelism().

43.106.3.4 void close_streams ()

close streams, files, and any other services Close streams associated with manage_outputs and manage_restart and terminate any additional services that may be active.

References Dakota::abort_handler(), ParallelLibrary::currPCIter, Dakota::dakota_cerr, Dakota::dakota_cout, Dakota::dc_ptr_int, ParallelLibrary::error_ofstream, Dakota::mc_ptr_int, ParallelLibrary::output_ofstream, ParallelLevel::serverMasterFlag, ParallelLibrary::stdErrorToFile, ParallelLibrary::stdOutputToFile, and Dakota::write_restart.

Referenced by ParallelLibrary::∼ParallelLibrary().

43.106.3.5 void increment_parallel_configuration () `[inline]`

add a new node to parallelConfigurations and increment currPCIter Called from the ParallelLibrary ctor and from Model::init_communicators(). An increment is performed for each Model initialization except the first (which inherits the world and strategy-iterator parallel levels from the first partial configuration).

References ParallelLibrary::currPCIter, ParallelConfiguration::eaPLIter, ParallelConfiguration::iePLIter, ParallelConfiguration::numParallelLevels, ParallelLibrary::parallelConfigurations, ParallelLibrary::parallelLevels, ParallelConfiguration::siPLIter, ParallelLibrary::worldSize, and ParallelConfiguration::wPLIter.

Referenced by Model::init_communicators(), ParallelLibrary::init_mpi_comm(), and ParallelLibrary::ParallelLibrary().

43.106.3.6 void init_mpi_comm (MPI_Comm *dakota_mpi_comm*) `[private]`

convenience function for initializing from specific comm shared function for initializing based on passed MPI_Comm

References ParallelLibrary::currPLIter, Dakota::Dak_pl, ParallelLibrary::increment_parallel_configuration(),

ParallelLibrary::mpirunFlag, ParallelLibrary::parallelLevels, ParallelLevel::serverCommRank, ParallelLevel::serverCommSize, ParallelLevel::serverIntraComm, Dakota::start_dakota_heartbeat(), ParallelLibrary::startClock, ParallelLibrary::startCPUTime, ParallelLibrary::startMPITime, ParallelLibrary::startWCTime, ParallelLibrary::worldRank, and ParallelLibrary::worldSize.

Referenced by ParallelLibrary::ParallelLibrary().

43.106.3.7 void init_communicators (const ParallelLevel & *parent_pl*, const int & *num_servers*, const int & *procs_per_server*, const int & *max_concurrency*, const int & *asynch_local_concurrency*, const std::string & *default_config*, const std::string & *scheduling_override*) `[private]`

split a parent communicator into child server communicators Split parent communicator into concurrent child server partitions as specified by the passed parameters. This constructs new child intra-communicators and parent-child inter-communicators. This function is called from the Strategy constructor for the concurrent iterator level and from ApplicationInterface::init_communicators() for the concurrent evaluation and concurrent analysis levels.

References ParallelLevel::commSplitFlag, ParallelLibrary::currPCIter, ParallelLibrary::currPLIter, ParallelLevel::dedicatedMasterFlag, ParallelLevel::numServers, ParallelLibrary::parallelLevels, ParallelLevel::procRemainder, ParallelLevel::procsPerServer, ParallelLibrary::resolve_inputs(), ParallelLevel::serverCommRank, ParallelLevel::serverCommSize, ParallelLibrary::split_communicator_dedicated_master(), and ParallelLibrary::split_communicator_peer_partition().

Referenced by ParallelLibrary::init_analysis_communicators(), ParallelLibrary::init_evaluation_communicators(), and ParallelLibrary::init_iterator_communicators().

43.106.3.8 bool resolve_inputs (int & *num_servers*, int & *procs_per_server*, const int & *avail_procs*, int & *proc_remainder*, const int & *max_concurrency*, const int & *capacity_multiplier*, const std::string & *default_config*, const std::string & *scheduling_override*, bool *print_rank*) `[private]`

resolve user inputs into a sensible partitioning scheme This function is responsible for the "auto-configure" intelligence of DAKOTA. It resolves a variety of inputs and overrides into a sensible partitioning configuration for a particular parallelism level. It also handles the general case in which a user's specification request does not divide out evenly with the number of available processors for the level. If num_servers & procs_per_server are both nondefault, then the former takes precedence.

Referenced by ParallelLibrary::init_communicators().

43.106.3.9 void split_filenames (const char * *filenames*, std::string & *input_filename*, std::string & *output_filename*) `[private]`

split a double colon separated pair of filenames (possibly empty) into input and output filename strings Tokenize colon-delimited input and output filenames, returns unchanged strings if tokens not found.

Referenced by ParallelLibrary::manage_run_modes().

The documentation for this class was generated from the following files:

- ParallelLibrary.H
- ParallelLibrary.C

43.107 ParamResponsePair Class Reference

Container class for a variables object, a response object, and an evaluation id.

Public Member Functions

- ParamResponsePair ()

  default constructor

- ParamResponsePair (const Variables &vars, const String &interface_id, const Response &response, bool deep_copy=false)

  alternate constructor for temporaries

- ParamResponsePair (const Variables &vars, const String &interface_id, const Response &response, const int eval_id, bool deep_copy=true)

  standard constructor for history uses

- ParamResponsePair (const ParamResponsePair &pair)

  copy constructor

- ~ParamResponsePair ()

  destructor

- ParamResponsePair & operator= (const ParamResponsePair &pair)

  assignment operator

- void read (std::istream &s)

  read a ParamResponsePair object from an std::istream

- void write (std::ostream &s) const

  write a ParamResponsePair object to an std::ostream

- void read_annotated (std::istream &s)

  read a ParamResponsePair object in annotated format from an std::istream

- void write_annotated (std::ostream &s) const

  write a ParamResponsePair object in annotated format to an std::ostream

- void write_tabular (std::ostream &s) const

  write a ParamResponsePair object in tabular format to an std::ostream

- void read (BiStream &s)

  read a ParamResponsePair object from the binary restart stream

- void write (BoStream &s) const

write a ParamResponsePair object to the binary restart stream

- void read (MPIUnpackBuffer &s)

  read a ParamResponsePair object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a ParamResponsePair object to a packed MPI buffer

- int eval_id () const

  return the evaluation identifier

- const String & interface_id () const

  return the interface identifier from the response object

- const IntStringPair & eval_interface_ids () const

  return the aggregate eval/interface identifier from the response object

- const Variables & prp_parameters () const

  return the parameters object

- const Response & prp_response () const

  return the response object

- void prp_response (const Response &response)

  set the response object

- const ActiveSet & active_set () const

  return the active set object from the response object

- void active_set (const ActiveSet &set)

  set the active set object within the response object

Private Attributes

- Variables prPairParameters

  the set of parameters for the function evaluation

- Response prPairResponse

  the response set for the function evaluation

- IntStringPair evalInterfaceIds

  the evalInterfaceIds aggregate

Friends

- bool operator== (const ParamResponsePair &pair1, const ParamResponsePair &pair2)

  equality operator

- bool operator!= (const ParamResponsePair &pair1, const ParamResponsePair &pair2)

  inequality operator

43.107.1 Detailed Description

Container class for a variables object, a response object, and an evaluation id. ParamResponsePair provides a container class for association of the input for a particular function evaluation (a variables object) with the output from this function evaluation (a response object), along with an evaluation identifier. This container defines the basic unit used in the data_pairs cache, in restart file operations, and in a variety of scheduling algorithm queues. With the advent of STL, replacement of arrays of this class with map<> and pair<> template constructs may be possible (using map<pair<int,String>, pair<Variables,Response> >, for example), assuming that deep copies, I/O, alternate constructors, etc., can be adequately addressed. Boost tuple<> may also be a candidate.

43.107.2 Constructor & Destructor Documentation

43.107.2.1 ParamResponsePair (const Variables & *vars*, const String & *interface_id*, const Response & *response*, bool *deep_copy* = `false`) `[inline]`

alternate constructor for temporaries Uses of this constructor often employ the standard Variables and Response copy constructors to share representations since this constructor is commonly used for search_pairs (which are local instantiations that go out of scope prior to any changes to values; i.e., they are not used for history).

43.107.2.2 ParamResponsePair (const Variables & *vars*, const String & *interface_id*, const Response & *response*, const int *eval_id*, bool *deep_copy* = `true`) `[inline]`

standard constructor for history uses Uses of this constructor often do not share representations since deep copies are used when history mechanisms (e.g., data_pairs and beforeSynchCorePRPQueue) are involved.

43.107.3 Member Function Documentation

43.107.3.1 void read (MPIUnpackBuffer & *s*) `[inline]`

read a ParamResponsePair object from a packed MPI buffer interfaceId is omitted since master processor retains interface ids and communicates asv and response data only with slaves.

References ParamResponsePair::evalInterfaceIds, ParamResponsePair::prPairParameters, and ParamResponsePair::prPairResponse.

43.107.3.2 void write (MPIPackBuffer & *s*) const [inline]

write a ParamResponsePair object to a packed MPI buffer interfaceId is omitted since master processor retains interface ids and communicates asv and response data only with slaves.

References ParamResponsePair::evalInterfaceIds, ParamResponsePair::prPairParameters, and ParamResponsePair::prPairResponse.

43.107.4 Member Data Documentation

43.107.4.1 IntStringPair evalInterfaceIds [private]

the evalInterfaceIds aggregate the function evaluation identifier (assigned from Interface::evalIdCntr) is paired with the interface used to generate the response object. Used in PRPCache id_vars_set_compare to prevent duplicate detection on results from different interfaces. evalInterfaceIds belongs here rather than in Response since some Response objects involve consolidation of several fn evals (e.g., Model::synchronize_derivatives()) that are not, in total, generated by a single interface. The prPair, on the other hand, is used for storage of all low level fn evals that get evaluated in ApplicationInterface::map().

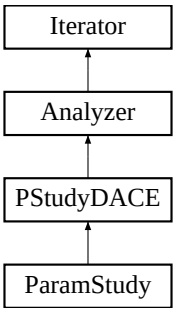
Referenced by ParamResponsePair::eval_id(), ParamResponsePair::eval_interface_ids(), ParamResponsePair::interface_id(), ParamResponsePair::operator=(), Dakota::operator==(), ParamResponsePair::read(), ParamResponsePair::read_annotated(), ParamResponsePair::write(), ParamResponsePair::write_annotated(), and ParamResponsePair::write_tabular().

The documentation for this class was generated from the following files:

- ParamResponsePair.H
- ParamResponsePair.C

43.108 ParamStudy Class Reference

Class for vector, list, centered, and multidimensional parameter studies. Inheritance diagram for ParamStudy::



Public Member Functions

- ParamStudy (Model &model)

  constructor

- ~ParamStudy ()

  destructor

- void pre_run ()

  pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori

- void extract_trends ()

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

- void post_input ()

  read tabular data for post-run mode

- void post_run (std::ostream &s)

  post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way

Private Member Functions

- void sample ()

  performs the parameter study by sampling from a list of points

- void vector_loop ()

  performs the parameter study by sampling along a vector, starting from an initial point followed by numSteps increments along continous/discrete step vectors

- void centered_loop ()

  performs a number of plus and minus offsets for each parameter centered about an initial point

- void multidim_loop ()

  performs a full factorial combination for all intersections defined by a set of multidimensional partitions

- bool distribute_list_of_points (const RealVector &list_of_pts)

  distributes incoming list_of_pts among listCVPoints, listDIVPoints, and listDRVPoints

- bool distribute_step_vector (const RealVector &step_vector)

  distributes incoming step_vector among contStepVector and discStepVector

- void final_point_to_step_vector ()

  compute step vectors from finalPoint, initial points, and numSteps

- void distribute_partitions ()

  compute step vectors from variablePartitions and global bounds

- bool check_num_steps (int num_steps)

  perform error checks on numSteps

- bool check_final_point (const RealVector &final_pt)

  perform error checks on finalPoint

- bool check_steps_per_variable (const IntVector &steps_per_var)

  perform error checks on stepsPerVariable

- bool check_variable_partitions (const UShortArray &partitions)

  perform error checks on variablePartitions

- bool check_finite_bounds ()

  check for finite variable bounds within iteratedModel, as required for computing partitions of finite ranges

- bool check_ranges_sets (int num_steps)

  sanity check for vector parameter study

- bool check_ranges_sets (const IntVector &steps)

  sanity check for centered parameter study

- bool check_sets (const IntVector &steps)

  sanity check for increments along int/real set dimensions

- int truncate (const Real &value) const

  cast Real to int and ensure no resulting change in value

- int integer_step (int range, int num_steps) const

  check for integer remainder and return step

- int index_step (size_t start, size_t end, int num_steps) const

  check for out of bounds and index remainder and return step

- void write_ordered (std::ostream &s, const RealVector &c_vector, const IntVector &di_vector, const RealVector &dr_vector)

  reorder CV/DIV/DRV into standard output order

- void write_ordered (std::ostream &s, const RealVector &c_vector, const IntVector &d_vector)

  reorder CV/DV into standard output order

- void c_step (size_t c_index, int increment, Variables &vars)

  helper function for performing a continuous step in one variable

- void dri_step (size_t d_index, size_t di_index, int increment, Variables &vars)

  helper function for performing a discrete step in an integer range variable

- void dsi_step (size_t d_index, size_t di_index, int increment, const IntSet &values, Variables &vars)

  helper function for performing a discrete step in an integer set variable

- void dsr_step (size_t d_index, size_t dr_index, int increment, const RealSet &values, Variables &vars)

  helper function for performing a discrete step in a real set variable

Private Attributes

- short pStudyType

  internal code for parameter study type: LIST, VECTOR_SV, VECTOR_FP, CENTERED, or MULTIDIM

- size_t numEvals

  total number of parameter study evaluations computed from specification

- RealVectorArray listCVPoints

  array of continuous evaluation points for the list_parameter_study

- IntVectorArray listDIVPoints

  array of discrete int evaluation points for the list_parameter_study

- RealVectorArray listDRVPoints

  array of discrete real evaluation points for the list_parameter_study

- RealVector initialCVPoint

  the continuous starting point for vector and centered parameter studies

- IntVector initialDIVPoint

  the continuous starting point for vector and centered parameter studies

- RealVector initialDRVPoint

  the continuous starting point for vector and centered parameter studies

- RealVector finalPoint

  the ending point for vector_parameter_study (a specification option)

- RealVector contStepVector

  the n-dimensional continuous increment in vector_parameter_study

- IntVector discStepVector

  the n-dimensional discrete increment in vector_parameter_study

- int numSteps

  the number of times stepVector is applied in vector_parameter_study

- IntVector stepsPerVariable

  number of offsets in the plus and the minus direction for each variable in a centered_parameter_study

- UShortArray variablePartitions

  number of partitions for each variable in a multidim_parameter_study

43.108.1 Detailed Description

Class for vector, list, centered, and multidimensional parameter studies. The ParamStudy class contains several algorithms for performing parameter studies of different types. The vector parameter study steps along an n-dimensional vector from an arbitrary initial point to an arbitrary final point in a specified number of steps. The centered parameter study performs a number of plus and minus offsets in each coordinate direction around a center point. A multidimensional parameter study fills an n-dimensional hypercube based on bounds and a specified number of partitions for each dimension. And the list parameter study provides for a user specification of a list of points to evaluate, which allows general parameter investigations not fitting the structure of vector, centered, or multidim parameter studies.

43.108.2 Member Function Documentation

43.108.2.1 void pre_run () `[virtual]`

pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori pre-run phase, which a derived iterator may optionally reimplement; when not present, pre-run is likely integrated into the derived run function. This is a virtual function; when re-implementing, a derived class must call its nearest parent's pre_run(), if implemented, typically _before_ performing its own implementation steps.

Reimplemented from Iterator.

References Dakota::abort_handler(), Analyzer::allHeaders, Analyzer::allVariables, ParamStudy::centered_-loop(), Model::continuous_variables(), ParamStudy::contStepVector, Dakota::copy_data(), Model::current_-variables(), Model::discrete_int_variables(), Model::discrete_real_variables(), ParamStudy::discStepVector, ParamStudy::distribute_partitions(), ParamStudy::final_point_to_step_vector(), ParamStudy::finalPoint, ParamStudy::initialCVPoint, ParamStudy::initialDIVPoint, ParamStudy::initialDRVPoint, Iterator::iteratedModel, ParamStudy::multidim_loop(), ParamStudy::numEvals, ParamStudy::numSteps, Iterator::outputLevel, ParamStudy::pStudyType, ParamStudy::sample(), Variables::shared_data(), ParamStudy::stepsPerVariable, ParamStudy::variablePartitions, ParamStudy::vector_loop(), Dakota::write_data(), and ParamStudy::write_ordered().

43.108.2.2 void post_run (std::ostream & *s*) `[virtual]`

post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way Post-run phase, which a derived iterator may optionally reimplement; when not present, post-run is likely integrated into run. This is a virtual function; when re-implementing, a derived class must call its nearest parent's post_run(), typically _after_ performing its own implementation steps.

Reimplemented from Iterator.

References Analyzer::allResponses, Analyzer::allVariables, SensAnalysisGlobal::compute_correlations(), PStudyDACE::pStudyDACESensGlobal, ParamStudy::pStudyType, and Iterator::subIteratorFlag.

The documentation for this class was generated from the following files:

- ParamStudy.H
- ParamStudy.C

43.109 partial_prp_equality Struct Reference

predicate for comparing ONLY the interfaceId and Vars attributes of PRPair

Public Member Functions

- bool operator() (const ParamResponsePair &database_pr, const ParamResponsePair &search_pr) const
  access operator

43.109.1 Detailed Description

predicate for comparing ONLY the interfaceId and Vars attributes of PRPair

The documentation for this struct was generated from the following file:

- PRPMultiIndex.H

43.110 partial_prp_hash Struct Reference

wrapper to delegate to the ParamResponsePair hash_value function

Public Member Functions

- std::size_t operator() (const ParamResponsePair &prp) const
  access operator

43.110.1 Detailed Description

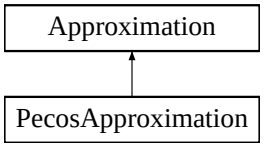
wrapper to delegate to the ParamResponsePair hash_value function

The documentation for this struct was generated from the following file:

- PRPMultiIndex.H

43.111 PecosApproximation Class Reference

Derived approximation class for global basis polynomials. Inheritance diagram for PecosApproximation::



Public Member Functions

- PecosApproximation ()

  default constructor

- PecosApproximation (const String &approx_type, const UShortArray &approx_order, size_t num_vars, short data_order)

  alternate constructor

- PecosApproximation (ProblemDescDB &problem_db, size_t num_vars)

  standard ProblemDescDB-driven constructor

- ~PecosApproximation ()

  destructor

- void increment_order ()

  increment OrthogPolyApproximation::approxOrder uniformly

- void solution_approach (short soln_approach)

  set pecosBasisApprox.configOptions.expCoeffsSolnApproach

- short solution_approach () const

  get pecosBasisApprox.configOptions.expCoeffsSolnApproach

- void expansion_coefficient_flag (bool coeff_flag)

  set pecosBasisApprox.configOptions.expansionCoeffFlag

- bool expansion_coefficient_flag () const

  get pecosBasisApprox.configOptions.expansionCoeffFlag

- void expansion_gradient_flag (bool grad_flag)

  set pecosBasisApprox.configOptions.expansionGradFlag

- bool expansion_gradient_flag () const

  get pecosBasisApprox.configOptions.expansionGradFlag

- void refinement_control (short refine_cntl)

  set pecosBasisApprox.configOptions.refinementControl

- short refinement_control () const

  get pecosBasisApprox.configOptions.refinementControl

- void vbd_control (short vbd_cntl)

  set pecosBasisApprox.configOptions.vbdControl

- short vbd_control () const

  get pecosBasisApprox.configOptions.vbdControl

- void compute_component_effects ()

  Performs global sensitivity analysis using Sobol' Indices by computing component (main and interaction) effects.

- void compute_total_effects ()

  Performs global sensitivity analysis using Sobol' Indices by computing total effects.

- const Pecos::IntIntMap & sobol_index_map () const

  return polyApproxRep->sobolIndexMap

- const Pecos::RealVector & sobol_indices () const

  return polyApproxRep->sobolIndices

- const Pecos::RealVector & total_sobol_indices () const

  return polyApproxRep->totalSobolIndices

- const Pecos::RealVector & dimension_decay_rates () const

  return OrthogPolyApproximation::decayRates

- void random_variables_key (const Pecos::BoolDeque &random_vars_key)

  set pecosBasisApprox.randomVarsKey

- void integration_iterator (const Iterator &iterator)

  set pecosBasisApprox.driverRep

- void construct_basis (const Pecos::ShortArray &u_types, const Pecos::DistributionParams &dp, const Pecos::BasisConfigOptions &bc_options)

  invoke Pecos::OrthogPolyApproximation::construct_basis()

- void basis_types (const Pecos::ShortArray &basis_types)

  set Pecos::OrthogPolyApproximation::basisTypes

- const Pecos::ShortArray & basis_types () const

  get Pecos::OrthogPolyApproximation::basisTypes

- void polynomial_basis (const std::vector< Pecos::BasisPolynomial > &poly_basis)

  set Pecos::OrthogPolyApproximation::polynomialBasis

- const std::vector< Pecos::BasisPolynomial > & polynomial_basis () const

  get Pecos::OrthogPolyApproximation::polynomialBasis

- void coefficients_norms_flag (bool flag)

  invoke Pecos::OrthogPolyApproximation::coefficients_norms_flag()

- void expansion_terms (size_t terms)

  invoke Pecos::OrthogPolyApproximation::expansion_terms()

- size_t expansion_terms () const

  return Pecos::OrthogPolyApproximation::expansion_terms()

- void allocate_arrays ()

  invoke Pecos::PolynomialApproximation::allocate_arrays()

- Real mean ()

  return the mean of the expansion, treating all variables as random

- Real mean (const Pecos::RealVector &x)

  return the mean of the expansion for a given parameter vector, treating a subset of the variables as random

- const Pecos::RealVector & mean_gradient ()

  return the gradient of the expansion mean for a given parameter vector, treating all variables as random

- const Pecos::RealVector & mean_gradient (const Pecos::RealVector &x, const Pecos::SizetArray &dvv)

  return the gradient of the expansion mean for a given parameter vector and given DVV, treating a subset of the variables as random

- Real variance ()

  return the variance of the expansion, treating all variables as random

- Real variance (const Pecos::RealVector &x)

  return the variance of the expansion for a given parameter vector, treating a subset of the variables as random

- const Pecos::RealVector & variance_gradient ()

  return the gradient of the expansion variance for a given parameter vector, treating all variables as random

- const Pecos::RealVector & variance_gradient (const Pecos::RealVector &x, const Pecos::SizetArray &dvv)

  return the gradient of the expansion variance for a given parameter vector and given DVV, treating a subset of the variables as random

- Real covariance (PecosApproximation *pecos_approx_2)

  return the variance of the expansion, treating all variables as random

- Real covariance (const Pecos::RealVector &x, PecosApproximation *pecos_approx_2)

  return the variance of the expansion, treating a subset of the variables as random

- void compute_moments ()

  compute moments up to the order supported by the Pecos polynomial approximation

- void compute_moments (const Pecos::RealVector &x)

  compute moments in all-variables mode up to the order supported by the Pecos polynomial approximation

- const RealVector & moments () const

  return virtual Pecos::PolynomialApproximation::moments()

- const RealVector & expansion_moments () const

  return Pecos::PolynomialApproximation::expansionMoments

- const RealVector & numerical_moments () const

  return Pecos::PolynomialApproximation::numericalMoments

- Pecos::BasisApproximation & pecos_basis_approximation ()

  return pecosBasisApprox

Protected Member Functions

- Real get_value (const Pecos::RealVector &x)

  retrieve the approximate function value for a given parameter vector

- const Pecos::RealVector & get_gradient (const Pecos::RealVector &x)

  retrieve the approximate function gradient for a given parameter vector

- const Pecos::RealSymMatrix & get_hessian (const Pecos::RealVector &x)

  retrieve the approximate function Hessian for a given parameter vector

- int min_coefficients () const

  return the minimum number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- void build ()

  builds the approximation from scratch

- void rebuild ()

  rebuilds the approximation incrementally

- void pop (bool save_data)

  removes entries from end of SurrogateData::{vars,resp}Data (last points appended)

- void restore ()

  restores state prior to previous append()

- bool restore_available ()

  queries availability of restoration for trial set

- size_t restoration_index ()

  return index of trial set within restorable bookkeeping sets

- void finalize ()

  finalize approximation by applying all remaining trial sets

- size_t finalization_index (size_t i)

  return index of i-th trailing trial set within restorable bookkeeping sets

- void store ()

  store current approximation for later combination

- void combine (short corr_type)

  combine current approximation with previously stored approximation

- void print_coefficients (std::ostream &s) const

  print the coefficient array computed in build()/rebuild()

- const RealVector & approximation_coefficients () const

  return the coefficient array computed by build()/rebuild()

- void approximation_coefficients (const RealVector &approx_coeffs)

  set the coefficient array from external sources, rather than computing with build()/rebuild()

Private Member Functions

- void approx_type_to_basis_type (const String &approx_type, short &basis_type)

  utility to convert Dakota type string to Pecos type enumeration

Private Attributes

- Pecos::BasisApproximation pecosBasisApprox

  the Pecos basis approximation, encompassing OrthogPolyApproximation and InterpPolyApproximation

- Pecos::PolynomialApproximation * polyApproxRep

  convenience pointer to representation

43.111.1 Detailed Description

Derived approximation class for global basis polynomials. The PecosApproximation class provides a global approximation based on basis polynomials. This includes orthogonal polynomials used for polynomial chaos expansions and interpolation polynomials used for stochastic collocation.

43.111.2 Member Function Documentation

43.111.2.1 void build () `[inline, protected, virtual]`

builds the approximation from scratch This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

References PecosApproximation::pecosBasisApprox.

43.111.2.2 void rebuild () `[inline, protected, virtual]`

rebuilds the approximation incrementally This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

References PecosApproximation::pecosBasisApprox.

43.111.2.3 void pop (bool *save_data*) `[inline, protected, virtual]`

removes entries from end of SurrogateData::{vars,resp}Data (last points appended) This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

References PecosApproximation::pecosBasisApprox.

43.111.2.4 void restore () `[inline, protected, virtual]`

restores state prior to previous append() This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

References PecosApproximation::pecosBasisApprox.

43.111.2.5 void finalize () [inline, protected, virtual]

finalize approximation by applying all remaining trial sets This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

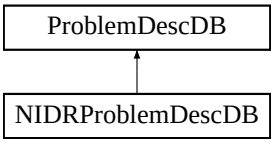
References PecosApproximation::pecosBasisApprox.

The documentation for this class was generated from the following files:

- PecosApproximation.H
- PecosApproximation.C

43.112 ProblemDescDB Class Reference

The database containing information parsed from the DAKOTA input file. Inheritance diagram for ProblemDescDB::



Public Member Functions

- ProblemDescDB ()

  default constructor

- ProblemDescDB (ParallelLibrary &parallel_lib)

  standard constructor

- ProblemDescDB (const ProblemDescDB &db)

  copy constructor

- ~ProblemDescDB ()

  destructor

- ProblemDescDB operator= (const ProblemDescDB &db)

  assignment operator

- void manage_inputs (CommandLineHandler &cmd_line_handler)

  invokes manage_inputs(const char, ...) using the dakota input filename passed with the "-input" option on the DAKOTA command line. This is the normal API employed in main.C.*

- void manage_inputs (const char *dakota_input_file, const char *parser_options=NULL, void(*callback)(void *)=NULL, void *callback_data=NULL)

  invokes parse_inputs() to populate the problem description database and execute any callback function, broadcast() to propagate DB data to all processors, and post_process() to construct default variables/response vectors. This is an alternate API used by the file parsing mode in library_mode.C.

- void parse_inputs (const char *dakota_input_file, const char *parser_options=NULL, void(*callback)(void *)=NULL, void *callback_data=NULL)

  parses the input file and populates the problem description database. This function reads from the dakota input filename passed in and allows subsequent modifications to be done by a callback function. This API is used by the mixed mode option in library_mode.C since it allows broadcast() and post_process() to be deferred until all inputs have been provided.

- void check_input ()

verifies that there is at least one of each of the required keywords in the dakota input file. Used by parse_inputs().

- void broadcast ()

  invokes send_db_buffer() and receive_db_buffer() to broadcast DB data across the processor allocation. Used by manage_inputs().

- void post_process ()

  post-processes the (minimal) input specification to assign default variables/responses specification arrays. Used by manage_inputs().

- void lock ()

  Locks the database in order to prevent data access when the list nodes may not be set properly. Unlocked by a set nodes operation.

- void unlock ()

  Explicitly unlocks the database. Use with care.

- void set_db_list_nodes (const String &method_tag)

  set dataMethodIter based on a method identifier string to activate a particular method specification in dataMethodList and use pointers from this method specification to set all other list iterators.

- void set_db_list_nodes (const size_t &method_index)

  set dataMethodIter based on an index within dataMethodList to activate a particular method specification and use pointers from this method specification to set all other list iterators.

- void resolve_top_method ()

  For a (default) strategy lacking a method pointer, this function is used to determine which of several potential method specifications corresponds to the top method and then sets the list nodes accordingly.

- void set_db_method_node (const String &method_tag)

  set dataMethodIter based on a method identifier string to activate a particular method specification (only).

- void set_db_method_node (const size_t &method_index)

  set dataMethodIter based on an index within dataMethodList to activate a particular method specification (only).

- size_t get_db_method_node ()

  return the index of the active node in dataMethodList

- void set_db_model_nodes (const String &model_tag)

  set the model list iterators (dataModelIter, dataVariablesIter, dataInterfaceIter, and dataResponsesIter) based on the model identifier string

- void set_db_model_nodes (const size_t &model_index)

  set the model list iterators (dataModelIter, dataVariablesIter, dataInterfaceIter, and dataResponsesIter) based on an index within dataModelList

- size_t get_db_model_node ()

return the index of the active node in dataModelList

- void set_db_variables_node (const String &variables_tag)

  set dataVariablesIter based on the variables identifier string

- void set_db_interface_node (const String &interface_tag)

  set dataInterfaceIter based on the interface identifier string

- void set_db_responses_node (const String &responses_tag)

  set dataResponsesIter based on the responses identifier string

- ParallelLibrary & parallel_library () const

  return the parallelLib reference

- IteratorList & iterator_list ()

  return a list of all Iterator objects that have been instantiated

- ModelList & model_list ()

  return a list of all Model objects that have been instantiated

- VariablesList & variables_list ()

  return a list of all Variables objects that have been instantiated

- InterfaceList & interface_list ()

  return a list of all Interface objects that have been instantiated

- ResponseList & response_list ()

  return a list of all Response objects that have been instantiated

- const RealVector & get_rdv (const String &entry_name) const

  get a RealVector out of the database based on an identifier string

- const IntVector & get_idv (const String &entry_name) const

  get an IntVector out of the database based on an identifier string

- const UShortArray & get_dusa (const String &entry_name) const

  get an UShortArray out of the database based on an identifier string

- const RealSymMatrix & get_rsdm (const String &entry_name) const

  get a RealSymMatrix out of the database based on an identifier string

- const RealVectorArray & get_rdva (const String &entry_name) const

  get a RealVectorArray out of the database based on an identifier string

- const IntList & get_dil (const String &entry_name) const

  get an IntList out of the database based on an identifier string

- const IntSet & get_dis (const String &entry_name) const
  get an IntSet out of the database based on an identifier string
- const IntSetArray & get_disa (const String &entry_name) const
  get an IntSetArray out of the database based on an identifier string
- const RealSetArray & get_drsa (const String &entry_name) const
  get a RealSetArray out of the database based on an identifier string
- const StringArray & get_dsa (const String &entry_name) const
  get a StringArray out of the database based on an identifier string
- const String2DArray & get_ds2a (const String &entry_name) const
  get a String2DArray out of the database based on an identifier string
- const String & get_string (const String &entry_name) const
  get a String out of the database based on an identifier string
- const Real & get_real (const String &entry_name) const
  get a Real out of the database based on an identifier string
- int get_int (const String &entry_name) const
  get an int out of the database based on an identifier string
- short get_short (const String &entry_name) const
  get a short out of the database based on an identifier string
- unsigned short get_ushort (const String &entry_name) const
  get an unsigned short out of the database based on an identifier string
- size_t get_sizet (const String &entry_name) const
  get a size_t out of the database based on an identifier string
- bool get_bool (const String &entry_name) const
  get a bool out of the database based on an identifier string
- void ** get_voidss (const String &entry_name) const
  *for getting a void**, e.g., &dlLib*
- void insert_node (const DataStrategy &data_strategy)
  set the DataStrategy object
- void insert_node (const DataMethod &data_method)
  add a DataMethod object to the dataMethodList

- void insert_node (const DataModel &data_model)

  add a DataModel object to the dataModelList

- void insert_node (DataVariables &data_variables)

  add a DataVariables object to the dataVariablesList

- void insert_node (const DataInterface &data_interface)

  add a DataInterface object to the dataInterfaceList

- void insert_node (const DataResponses &data_responses)

  add a DataResponses object to the dataResponsesList

- void set (const String &entry_name, const RealVector &rdv)

  set a RealVector within the database based on an identifier string

- void set (const String &entry_name, const IntVector &idv)

  set an IntVector within the database based on an identifier string

- void set (const String &entry_name, const RealSymMatrix &rsdm)

  set a RealMatrix within the database based on an identifier string

- void set (const String &entry_name, const RealVectorArray &rdva)

  set a RealVectorArray within the database based on an identifier string

- void set (const String &entry_name, const StringArray &dsa)

  set a StringArray within the database based on an identifier string

- bool is_null () const

  function to check dbRep (does this envelope contain a letter)

Protected Member Functions

- ProblemDescDB (BaseConstructor, ParallelLibrary &parallel_lib)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- virtual void derived_parse_inputs (const char *dakota_input_file, const char *parser_options)

  derived class specifics within parse_inputs()

- virtual void derived_broadcast ()

  derived class specifics within broadcast()

- virtual void derived_post_process ()

  derived class specifics within post_process()

Protected Attributes

- DataStrategy strategySpec

  the strategy specification (only one allowed) resulting from a call to strategy_kwhandler() or insert_node()

- std::list< DataMethod > dataMethodList

  list of method specifications, one for each call to method_kwhandler() or insert_node()

- std::list< DataModel > dataModelList

  list of model specifications, one for each call to model_kwhandler() or insert_node()

- std::list< DataVariables > dataVariablesList

  list of variables specifications, one for each call to variables_kwhandler() or insert_node()

- std::list< DataInterface > dataInterfaceList

  list of interface specifications, one for each call to interface_kwhandler() or insert_node()

- std::list< DataResponses > dataResponsesList

  list of responses specifications, one for each call to responses_kwhandler() or insert_node()

- size_t strategyCntr

  counter for strategy specifications used in check_input

Private Member Functions

- const Iterator & get_iterator (Model &model)

  retrieve an existing Iterator, if it exists, or instantiate a new one

- const Model & get_model ()

  retrieve an existing Model, if it exists, or instantiate a new one

- const Variables & get_variables ()

  retrieve an existing Variables, if it exists, or instantiate a new one

- const Interface & get_interface ()

  retrieve an existing Interface, if it exists, or instantiate a new one

- const Response & get_response (const Variables &vars)

  retrieve an existing Response, if it exists, or instantiate a new one

- ProblemDescDB * get_db (ParallelLibrary &parallel_lib)

  Used by the envelope constructor to instantiate the correct letter class.

- void send_db_buffer ()

MPI send of a large buffer containing strategySpec and all objects in dataMethodList, dataModelList, dataVariablesList, dataInterfaceList, and dataResponsesList. Used by manage_inputs().

- void receive_db_buffer ()

  MPI receive of a large buffer containing strategySpec and all objects in dataMethodList, dataModelList, dataVariablesList, dataInterfaceList, and dataResponsesList. Used by manage_inputs().

Private Attributes

- ParallelLibrary & parallelLib

  reference to the parallel_lib object passed from main

- std::list< DataMethod >::iterator dataMethodIter

  iterator identifying the active list node in dataMethodList

- std::list< DataModel >::iterator dataModelIter

  iterator identifying the active list node in dataModelList

- std::list< DataVariables >::iterator dataVariablesIter

  iterator identifying the active list node in dataVariablesList

- std::list< DataInterface >::iterator dataInterfaceIter

  iterator identifying the active list node in dataInterfaceList

- std::list< DataResponses >::iterator dataResponsesIter

  iterator identifying the active list node in dataResponsesList

- IteratorList iteratorList

  list of iterator objects, one for each method specification

- ModelList modelList

  list of model objects, one for each model specification

- VariablesList variablesList

  list of variables objects, one for each variables specification

- InterfaceList interfaceList

  list of interface objects, one for each interface specification

- ResponseList responseList

  list of response objects, one for each responses specification

- bool methodDBLocked

  prevents use of get_<type> retrieval and set_<type> update functions prior to setting the list node for the active method specification

- bool modelDBLocked

  prevents use of get_<type> retrieval and set_<type> update functions prior to setting the list node for the active model specification

- bool variablesDBLocked

  prevents use of get_<type> retrieval and set_<type> update functions prior to setting the list node for the active variables specification

- bool interfaceDBLocked

  prevents use of get_<type> retrieval and set_<type> update functions prior to setting the list node for the active interface specification

- bool responsesDBLocked

  prevents use of get_<type> retrieval and set_<type> update functions prior to setting the list node for the active responses specification

- ProblemDescDB * dbRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing dbRep

Friends

- class Model

  Model requires access to get_variables() and get_response().

- class SingleModel

  SingleModel requires access to get_interface().

- class HierarchSurrModel

  HierarchSurrModel requires access to get_model().

- class DataFitSurrModel

  DataFitSurrModel requires access to get_iterator() and get_model().

- class NestedModel

  NestedModel requires access to get_interface(), get_response(), get_iterator(), and get_model().

- class Strategy

  Strategy requires access to get_iterator().

- class SingleMethodStrategy

  SingleMethodStrategy requires access to get_model().

- class HybridStrategy

  HybridStrategy requires access to get_model().

- class SequentialHybridStrategy

  SequentialStrategy requires access to get_iterator().

- class ConcurrentStrategy

  ConcurrentStrategy requires access to get_model().

- class SurrBasedLocalMinimizer

  SurrBasedLocalMinimizer requires access to get_iterator().

- class SurrBasedGlobalMinimizer

  SurrBasedGlobalMinimizer requires access to get_iterator().

43.112.1 Detailed Description

The database containing information parsed from the DAKOTA input file. The ProblemDescDB class is a database for DAKOTA input file data that is populated by a parser defined in a derived class. When the parser reads a complete keyword, it populates a data class object (DataStrategy, DataMethod, DataVariables, DataInterface, or DataResponses) and, for all cases except strategy, appends the object to a linked list (dataMethodList, dataVariablesList, dataInterfaceList, or dataResponsesList). No strategy linked list is used since only one strategy specification is allowed.

43.112.2 Constructor & Destructor Documentation

43.112.2.1 ProblemDescDB ()

default constructor The default constructor: dbRep is NULL in this case. This makes it necessary to check for NULL in the copy constructor, assignment operator, and destructor.

43.112.2.2 ProblemDescDB (ParallelLibrary & *parallel_lib*)

standard constructor This is the envelope constructor which uses problem_db to build a fully populated db object. It only needs to extract enough data to properly execute get_db(problem_db), since the constructor overloaded with BaseConstructor builds the actual base class data inherited by the derived classes.

References Dakota::abort_handler(), ProblemDescDB::dbRep, and ProblemDescDB::get_db().

43.112.2.3 ProblemDescDB (const ProblemDescDB & *db*)

copy constructor Copy constructor manages sharing of dbRep and incrementing of referenceCount.

References ProblemDescDB::dbRep, and ProblemDescDB::referenceCount.

43.112.2.4 ~ProblemDescDB ()

destructor Destructor decrements referenceCount and only deletes dbRep when referenceCount reaches zero.

References Dakota::Dak_pddb, ProblemDescDB::dbRep, and ProblemDescDB::referenceCount.

43.112.2.5 ProblemDescDB (BaseConstructor, ParallelLibrary & *parallel_lib*) `[protected]`

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_db() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_db() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~ProblemDescDB).

43.112.3 Member Function Documentation

43.112.3.1 ProblemDescDB operator= (const ProblemDescDB & *db*)

assignment operator Assignment operator decrements referenceCount for old dbRep, assigns new dbRep, and increments referenceCount for new dbRep.

References ProblemDescDB::dbRep, and ProblemDescDB::referenceCount.

43.112.3.2 void manage_inputs (CommandLineHandler & *cmd_line_handler*)

invokes manage_inputs(const char*, ...) using the dakota input filename passed with the "-input" option on the DAKOTA command line. This is the normal API employed in main.C. Manage command line inputs using the CommandLineHandler class and parse the input file.

References ProblemDescDB::dbRep, ProblemDescDB::manage_inputs(), ProblemDescDB::parallelLib, GetLongOpt::retrieve(), and ParallelLibrary::world_rank().

Referenced by main(), ProblemDescDB::manage_inputs(), run_dakota(), and run_dakota_parse().

43.112.3.3 void manage_inputs (const char * *dakota_input_file*, const char * *parser_options* = `NULL`, void(*)(void *) *callback* = `NULL`, void * *callback_data* = `NULL`)

invokes parse_inputs() to populate the problem description database and execute any callback function, broadcast() to propagate DB data to all processors, and post_process() to construct default variables/response vectors. This is an alternate API used by the file parsing mode in library_mode.C. Parse the input file, broadcast it to all processors, and post-process the data on all processors.

References ProblemDescDB::broadcast(), ProblemDescDB::dbRep, ProblemDescDB::manage_inputs(), ProblemDescDB::parse_inputs(), and ProblemDescDB::post_process().

43.112.3.4 void parse_inputs (const char * *dakota_input_file*, const char * *parser_options* = NULL, void(*)(void *) *callback* = NULL, void * *callback_data* = NULL)

parses the input file and populates the problem description database. This function reads from the dakota input filename passed in and allows subsequent modifications to be done by a callback function. This API is used by the mixed mode option in library_mode.C since it allows broadcast() and post_process() to be deferred until all inputs have been provided. Parse the input file, execute the callback function (if present), and perform basic checks on keyword counts.

References ProblemDescDB::check_input(), ProblemDescDB::dbRep, ProblemDescDB::derived_parse_inputs(), ProblemDescDB::parallelLib, ProblemDescDB::parse_inputs(), and ParallelLibrary::world_rank().

Referenced by ProblemDescDB::manage_inputs(), ProblemDescDB::parse_inputs(), and run_dakota_mixed().

43.112.3.5 void post_process ()

post-processes the (minimal) input specification to assign default variables/responses specification arrays. Used by manage_inputs(). When using library mode in a parallel application, post_process() should be called on all processors following broadcast() of a minimal problem specification.

References ProblemDescDB::dbRep, and ProblemDescDB::derived_post_process().

Referenced by ProblemDescDB::manage_inputs(), Dakota::run_dakota_data(), and run_dakota_mixed().

43.112.3.6 ProblemDescDB * get_db (ParallelLibrary & *parallel_lib*) [private]

Used by the envelope constructor to instantiate the correct letter class. Initializes dbRep to the appropriate derived type. The standard derived class constructors are invoked.

References Dakota::Dak_pddb.

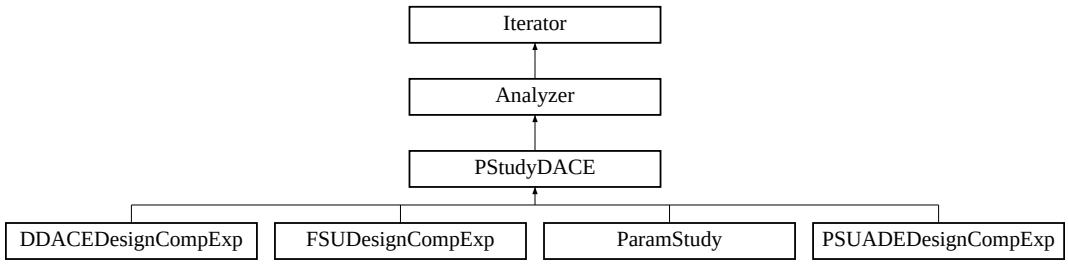
Referenced by ProblemDescDB::ProblemDescDB().

The documentation for this class was generated from the following files:

- ProblemDescDB.H
- ProblemDescDB.C

43.113 PStudyDACE Class Reference

Base class for managing common aspects of parameter studies and design of experiments methods. Inheritance diagram for PStudyDACE::



Protected Member Functions

- PStudyDACE (Model &model)

  constructor

- PStudyDACE (NoDBBaseConstructor, Model &model)

  alternate constructor for instantiations "on the fly"

- ~PStudyDACE ()

  destructor

- void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- void print_results (std::ostream &s)

  print the final iterator results

- virtual void extract_trends ()=0

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

- void volumetric_quality (int ndim, int num_samples, double *sample_points)

  Calculation of volumetric quality measures.

Protected Attributes

- SensAnalysisGlobal pStudyDACESensGlobal

  initialize statistical post processing

- bool volQualityFlag

flag which specifies evaluation of volumetric quality measures

- bool varBasedDecompFlag

  flag which specifies calculating variance based decomposition sensitivity analysis metrics

Private Attributes

- double chiMeas

  quality measure

- double dMeas

  quality measure

- double hMeas

  quality measure

- double tauMeas

  quality measure

43.113.1 Detailed Description

Base class for managing common aspects of parameter studies and design of experiments methods. The PStudyDACE base class manages common data and functions, such as those involving the best solutions located during the parameter set evaluations or the printing of final results.

43.113.2 Member Function Documentation

43.113.2.1 void run () `[inline, protected, virtual]`

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented from Iterator.

References Analyzer::bestVarsRespMap, and PStudyDACE::extract_trends().

43.113.2.2 void print_results (std::ostream & *s*) `[protected, virtual]`

print the final iterator results This virtual function provides additional iterator-specific final results outputs beyond the function evaluation summary printed in finalize_run().

Reimplemented from Analyzer.

References PStudyDACE::chiMeas, Analyzer::compactMode, Model::continuous_variable_labels(), SensAnalysisGlobal::correlations_computed(), Model::discrete_int_variable_labels(), Model::discrete_real_variable_labels(), PStudyDACE::dMeas, PStudyDACE::hMeas, Iterator::iteratedModel, Analyzer::numLSqTerms, Analyzer::numObjFns, SensAnalysisGlobal::print_correlations(), Analyzer::print_sobol_indices(), PStudyDACE::pStudyDACESensGlobal, Model::response_labels(), PStudyDACE::tauMeas, PStudyDACE::varBasedDecompFlag, and PStudyDACE::volQualityFlag.

43.113.2.3 void volumetric_quality (int *ndim*, int *num_samples*, double * *sample_points*) [protected]

Calculation of volumetric quality measures. Calculation of volumetric quality measures developed by FSU.

References PStudyDACE::chiMeas, PStudyDACE::dMeas, PStudyDACE::hMeas, and PStudyDACE::tauMeas.

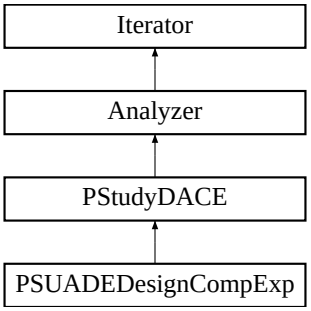
Referenced by FSUDesignCompExp::get_parameter_sets(), and DDACEDesignCompExp::get_parameter_sets().

The documentation for this class was generated from the following files:

- DakotaPStudyDACE.H
- DakotaPStudyDACE.C

43.114 PSUADEDesignCompExp Class Reference

Wrapper class for the PSUADE library. Inheritance diagram for PSUADEDesignCompExp::



Public Member Functions

- PSUADEDesignCompExp (Model &model)

  primary constructor for building a standard DACE iterator

- ~PSUADEDesignCompExp ()

  destructor

- void pre_run ()

  pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori

- void post_input ()

  read tabular data for post-run mode

- void extract_trends ()

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

- void post_run (std::ostream &s)

  post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way

- int num_samples () const

  get the current number of samples

- void sampling_reset (int min_samples, bool all_data_flag, bool stats_flag)

  reset sampling iterator to use at least min_samples

- const String & sampling_scheme () const

  return sampling name

- void vary_pattern (bool pattern_flag)

  sets varyPattern in derived classes that support it

- void get_parameter_sets (Model &model)

  Returns one block of samples (ndim ∗ num_samples).

Private Member Functions

- void enforce_input_rules ()

  enforce sanity checks/modifications for the user input specification

Private Attributes

- int samplesSpec

  initial specification of number of samples

- int numSamples

  current number of samples to be evaluated

- const UShortArray & varPartitionsSpec

  number of partitions in each variable direction

- int numPartitions

  number of partitions to pass to PSUADE (levels = partitions + 1)

- bool allDataFlag

  flag which triggers the update of allVars/allResponses for use by Iterator::all_variables() and Iterator::all_responses()

- size_t numDACERuns

  counter for number of run() executions for this object

- bool varyPattern

  flag for generating a sequence of seed values within multiple get_parameter_sets() calls so that the sample sets are not repeated, but are still repeatable

- const int seedSpec

  the user seed specification for the random number generator (allows repeatable results)

- int randomSeed

  current seed for the random number generator

43.114.1 Detailed Description

Wrapper class for the PSUADE library. The PSUADEDesignCompExp class provides a wrapper for PSUADE, a C++ design of experiments library from Lawrence Livermore National Laboratory. Currently this class only includes the PSUADE Morris One-at-a-time (MOAT) method to uniformly sample the parameter space spanned by the active bounds of the current Model. It returns all generated samples and their corresponding responses as well as the best sample found.

43.114.2 Constructor & Destructor Documentation

43.114.2.1 PSUADEDesignCompExp (Model & *model*)

primary constructor for building a standard DACE iterator This constructor is called for a standard iterator built with data from probDescDB.

References Dakota::abort_handler(), Iterator::maxConcurrency, Iterator::methodName, and PSUADEDesignCompExp::numSamples.

43.114.3 Member Function Documentation

43.114.3.1 void pre_run () `[virtual]`

pre-run portion of run_iterator (optional); re-implemented by Iterators which can generate all Variables (parameter sets) a priori pre-run phase, which a derived iterator may optionally reimplement; when not present, pre-run is likely integrated into the derived run function. This is a virtual function; when re-implementing, a derived class must call its nearest parent's pre_run(), if implemented, typically _before_ performing its own implementation steps.

Reimplemented from Iterator.

References PSUADEDesignCompExp::get_parameter_sets(), and Iterator::iteratedModel.

43.114.3.2 void post_run (std::ostream & *s*) `[virtual]`

post-run portion of run_iterator (optional); verbose to print results; re-implemented by Iterators that can read all Variables/Responses and perform final analysis phase in a standalone way Post-run phase, which a derived iterator may optionally reimplement; when not present, post-run is likely integrated into run. This is a virtual function; when re-implementing, a derived class must call its nearest parent's post_run(), typically _after_ performing its own implementation steps.

Reimplemented from Iterator.

References Dakota::abort_handler(), Analyzer::allResponses, Analyzer::allSamples, Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Iterator::iteratedModel, Iterator::numContinuousVars, Iterator::numFunctions, and PSUADEDesignCompExp::numSamples.

43.114.3.3 int num_samples () const [inline, virtual]

get the current number of samples Return current number of evaluation points. Since the calculation of samples, collocation points, etc. might be costly, provide a default implementation here that backs out from the maxConcurrency. May be (is) overridden by derived classes.

Reimplemented from Iterator.

References PSUADEDesignCompExp::numSamples.

43.114.3.4 void enforce_input_rules () [private]

enforce sanity checks/modifications for the user input specification Users may input a variety of quantities, but this function must enforce any restrictions imposed by the sampling algorithms.

References Dakota::abort_handler(), Iterator::methodName, Iterator::numContinuousVars, PSUADEDesignCompExp::numPartitions, PSUADEDesignCompExp::numSamples, and PSUADEDesignCompExp::varPartitionsSpec.

Referenced by PSUADEDesignCompExp::get_parameter_sets().

The documentation for this class was generated from the following files:

- PSUADEDesignCompExp.H
- PSUADEDesignCompExp.C

43.115 RecastBaseConstructor Struct Reference

Dummy struct for overloading constructors used in on-the-fly Model instantiations.

Public Member Functions

- RecastBaseConstructor (int=0)

  C++ structs can have constructors.

43.115.1 Detailed Description

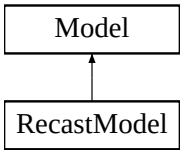
Dummy struct for overloading constructors used in on-the-fly Model instantiations. RecastBaseConstructor is used to overload the constructor used for on-the-fly Model instantiations. Putting this struct here avoids circular dependencies.

The documentation for this struct was generated from the following file:

- global_defs.h

43.116 RecastModel Class Reference

Derived model class which provides a thin wrapper around a sub-model in order to recast the form of its inputs and/or outputs. Inheritance diagram for RecastModel::



Public Member Functions

- RecastModel (const Model &sub_model, const Sizet2DArray &vars_map_indices, const SizetArray &vars_comps_total, bool nonlinear_vars_mapping, void(∗variables_map)(const Variables &recast_vars, Variables &sub_model_vars), void(∗set_map)(const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set), const Sizet2DArray &primary_resp_map_indices, const Sizet2DArray &secondary_resp_map_indices, size_t recast_secondary_offset, const BoolDequeArray &nonlinear_resp_mapping, void(∗primary_resp_map)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response), void(∗secondary_resp_map)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response))

  standard constructor

- RecastModel (const Model &sub_model, const SizetArray &vars_comps_totals, size_t num_recast_primary_fns, size_t num_recast_secondary_fns, size_t recast_secondary_offset)

  alternate constructor

- ∼RecastModel ()

  destructor

- void initialize (const Sizet2DArray &vars_map_indices, bool nonlinear_vars_mapping, void(∗variables_map)(const Variables &recast_vars, Variables &sub_model_vars), void(∗set_map)(const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set), const Sizet2DArray &primary_resp_map_indices, const Sizet2DArray &secondary_resp_map_indices, const BoolDequeArray &nonlinear_resp_mapping, void(∗primary_resp_map)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response), void(∗secondary_resp_map)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response))

  completes initialization of the RecastModel after alternate construction

- void submodel_supports_derivative_estimation (bool sed_flag)

  override the submodel's derivative estimation behavior

Protected Member Functions

- void derived_compute_response (const ActiveSet &set)

  portion of compute_response() specific to RecastModel (forward to subModel.compute_response())

- void derived_asynch_compute_response (const ActiveSet &set)

  portion of asynch_compute_response() specific to RecastModel (forward to subModel.asynch_compute_response())

- const IntResponseMap & derived_synchronize ()

  portion of synchronize() specific to RecastModel (forward to subModel.synchronize())

- const IntResponseMap & derived_synchronize_nowait ()

  portion of synchronize_nowait() specific to RecastModel (forward to subModel.synchronize_nowait())

- Iterator & subordinate_iterator ()

  return sub-iterator, if present, within subModel

- Model & subordinate_model ()

  return subModel

- Model & surrogate_model ()

  return surrogate model, if present, within subModel

- Model & truth_model ()

  return truth model, if present, within subModel

- void derived_subordinate_models (ModelList &ml, bool recurse_flag)

  add subModel to list and recurse into subModel

- void update_from_subordinate_model (bool recurse_flag=true)

  pass request to subModel if recursing and then update from it

- Interface & interface ()

  return subModel interface

- void primary_response_fn_weights (const RealVector &wts, bool recurse_flag=true)

  set the relative weightings for multiple objective functions or least squares terms and optionally recurses into subModel

- void surrogate_function_indices (const IntSet &surr_fn_indices)

  update the subModel's surrogate response function indices (DataFitSurrModel::surrogateFnIndices)

- void surrogate_response_mode (bool mode)

  update the subModel's surrogate response mode (SurrogateModel::responseMode)

- void build_approximation ()

builds the subModel approximation

- bool build_approximation (const Variables &vars, const IntResponsePair &response_pr)

  builds the subModel approximation

- void update_approximation (bool rebuild_flag)

  replaces data in the subModel approximation

- void update_approximation (const Variables &vars, const IntResponsePair &response_pr, bool rebuild_-flag)

  replaces data in the subModel approximation

- void update_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map, bool rebuild_flag)

  replaces data in the subModel approximation

- void append_approximation (bool rebuild_flag)

  appends data to the subModel approximation

- void append_approximation (const Variables &vars, const IntResponsePair &response_pr, bool rebuild_-flag)

  appends data to the subModel approximation

- void append_approximation (const VariablesArray &vars_array, const IntResponseMap &resp_map, bool rebuild_flag)

  appends data to the subModel approximation

- void pop_approximation (bool save_surr_data)

  remove the previous data set addition to a surrogate (e.g., due to a previous append_approximation() call); flag manages storing of surrogate data for use in a subsequent restore_approximation()

- void restore_approximation ()

  restore a previous approximation data state within a surrogate

- bool restore_available ()

  query for whether a trial increment is restorable within a surrogate

- void finalize_approximation ()

  finalize an approximation by applying all previous trial increments

- void store_approximation ()

  move the current approximation into storage for later combination

- void combine_approximation (short corr_type)

  combine the current approximation with one previously stored

- std::vector< Approximation > & approximations ()

retrieve the set of Approximations from the subModel

- const RealVectorArray & approximation_coefficients ()

  retrieve the approximation coefficients from the subModel

- void approximation_coefficients (const RealVectorArray &approx_coeffs)

  set the approximation coefficients within the subModel

- const RealVector & approximation_variances (const RealVector &c_vars)

  retrieve the approximation variances from the subModel

- const Pecos::SurrogateData & approximation_data (size_t index)

  retrieve the approximation data from the subModel

- void component_parallel_mode (short mode)

  RecastModel only supports parallelism in subModel, so this virtual function redefinition is simply a sanity check.

- String local_eval_synchronization ()

  return subModel local synchronization setting

- int local_eval_concurrency ()

  return subModel local evaluation concurrency

- bool derived_master_overload () const

  flag which prevents overloading the master with a multiprocessor evaluation (request forwarded to subModel)

- void derived_init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set up RecastModel for parallel operations (request forwarded to subModel)

- void derived_init_serial ()

  set up RecastModel for serial operations (request forwarded to subModel).

- void derived_set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set active parallel configuration within subModel

- void derived_free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  deallocate communicator partitions for the RecastModel (request forwarded to subModel)

- void serve ()

  Service subModel job requests received from the master. Completes when a termination message is received from stop_servers().

- void stop_servers ()

  executed by the master to terminate subModel server operations when RecastModel iteration is complete.

- void inactive_view (short view, bool recurse_flag=true)

update the Model's inactive view based on higher level (nested) context and optionally recurse into subModel

- const String & interface_id () const

  return the subModel interface identifier

- int evaluation_id () const

  return the current evaluation id for the RecastModel (request forwarded to subModel)

- void set_evaluation_reference ()

  set the evaluation counter reference points for the RecastModel (request forwarded to subModel)

- void fine_grained_evaluation_counters ()

  request fine-grained evaluation reporting within subModel

- void print_evaluation_summary (std::ostream &s, bool minimal_header=false, bool relative_count=true) const

  print the evaluation summary for the RecastModel (request forwarded to subModel)

Private Member Functions

- void initialize_data_from_submodel ()

  code shared among constructors to initialize base class data from submodel

- void set_mapping (const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set)

  Uses recastFnMap to convert incoming recast_set from iterator into sub_model_set for use with subModel.

- void update_from_sub_model ()

  update current variables/labels/bounds/targets from subModel

Private Attributes

- Model subModel

  the sub-model underlying the function pointers

- Sizet2DArray varsMapIndices

  For each subModel variable, identifies the indices of the recast variables used to define it (maps RecastModel variables to subModel variables; data is packed with only the variable indices employed rather than a sparsely filled N_sm x N_r matrix).

- bool nonlinearVarsMapping

  boolean set to true if the variables mapping involves a nonlinear transformation. Used in set_mapping() to manage the requirement for gradients within the Hessian transformations. This does not require a BoolDeque for each individual variable, since response gradients and Hessians are managed per function, not per variable.

- bool respMapping

  set to true if non-NULL primaryRespMapping or secondaryRespMapping are supplied

- Sizet2DArray primaryRespMapIndices

  For each recast primary function, identifies the indices of the subModel functions used to define it (maps subModel response to RecastModel Response).

- Sizet2DArray secondaryRespMapIndices

  For each recast secondary function, identifies the indices of the subModel functions used to define it (maps subModel response to RecastModel response).

- BoolDequeArray nonlinearRespMapping

  array of BoolDeques, one for each recast response function. Each BoolDeque defines which subModel response functions contribute to the recast function using a nonlinear mapping. Used in set_mapping() to augment the subModel function value/gradient requirements.

- IntActiveSetMap recastSetMap

  map of recast active set passed to derived_asynch_compute_response(). Needed for currentResponse update in synchronization routines.

- IntVariablesMap recastVarsMap

  map of recast variables used by derived_asynch_compute_response(). Needed for primaryRespMapping() and secondaryRespMapping() in synchronization routines.

- IntVariablesMap subModelVarsMap

  map of subModel variables used by derived_asynch_compute_response(). Needed for primaryRespMapping() and secondaryRespMapping() in synchronization routines.

- IntResponseMap recastResponseMap

  map of recast responses used by RecastModel::derived_synchronize() and RecastModel::derived_synchronize_-nowait()

- void(∗ variablesMapping)(const Variables &recast_vars, Variables &sub_model_vars)

  holds pointer for variables mapping function passed in ctor/initialize

- void(∗ setMapping)(const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_-set)

  holds pointer for set mapping function passed in ctor/initialize

- void(∗ primaryRespMapping)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  holds pointer for primary response mapping function passed in ctor/initialize

- void(∗ secondaryRespMapping)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response)

  holds pointer for secondary response mapping function passed in ctor/initialize

43.116.1 Detailed Description

Derived model class which provides a thin wrapper around a sub-model in order to recast the form of its inputs and/or outputs. The RecastModel class uses function pointers to allow recasting of the subModel input/output into new problem forms. This is currently used to recast SBO approximate subproblems, but can be used for multiobjective, input/output scaling, and other problem modifications in the future.

43.116.2 Constructor & Destructor Documentation

43.116.2.1 RecastModel (const Model & *sub_model*, const Sizet2DArray & *vars_map_indices*, const SizetArray & *vars_comps_totals*, bool *nonlinear_vars_mapping*, void(∗)(const Variables &recast_vars, Variables &sub_model_vars) *variables_map*, void(∗)(const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set) *set_map*, const Sizet2DArray & *primary_resp_map_indices*, const Sizet2DArray & *secondary_resp_map_indices*, size_t *recast_secondary_offset*, const BoolDequeArray & *nonlinear_resp_mapping*, void(∗)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response) *primary_resp_map*, void(∗)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response) *secondary_resp_map*)

standard constructor Default recast model constructor. Requires full definition of the transformation. Parameter vars_comps_totals indicates the number of each type of variable {4 types} x {3 domains} in the recast variable space

References Dakota::abort_handler(), Constraints::copy(), Response::copy(), Variables::copy(), Model::current_response(), Model::current_variables(), Model::currentResponse, Model::currentVariables, Variables::cv(), Response::function_gradients(), Response::function_hessians(), RecastModel::initialize_data_from_submodel(), RecastModel::nonlinearRespMapping, Response::num_functions(), Model::num_functions(), Constraints::num_linear_eq_constraints(), Constraints::num_linear_ineq_constraints(), Constraints::num_nonlinear_eq_constraints(), Constraints::num_nonlinear_ineq_constraints(), Model::numDerivVars, Model::numFns, RecastModel::primaryRespMapIndices, RecastModel::primaryRespMapping, Constraints::reshape(), Response::reshape(), RecastModel::respMapping, RecastModel::secondaryRespMapIndices, RecastModel::secondaryRespMapping, RecastModel::subModel, Model::user_defined_constraints(), Model::userDefinedConstraints, Variables::variables_components_totals(), RecastModel::variablesMapping, and Variables::view().

43.116.2.2 RecastModel (const Model & *sub_model*, const SizetArray & *vars_comps_totals*, size_t *num_recast_primary_fns*, size_t *num_recast_secondary_fns*, size_t *recast_secondary_offset*)

alternate constructor This alternate constructor defers initialization of the function pointers until a separate call to initialize(), and accepts the minimum information needed to construct currentVariables, currentResponse, and userDefinedConstraints. The resulting model is sufficiently complete for passing to an Iterator. Parameter vars_comps_totals indicates the number of each type of variable {4 types} x {3 domains} in the recast variable space

References Constraints::copy(), Response::copy(), Variables::copy(), Model::current_response(), Model::current_variables(), Model::currentResponse, Model::currentVariables, Variables::cv(), Response::function_gradients(), Response::function_hessians(), RecastModel::initialize_data_from_submodel(), Model::num_functions(), Constraints::num_linear_eq_constraints(), Constraints::num_linear_ineq_constraints(), Constraints::num_nonlinear_eq_constraints(), Constraints::num_nonlinear_ineq_constraints(),

Model::numDerivVars, Model::numFns, Constraints::reshape(), Response::reshape(), RecastModel::subModel, Model::user_defined_constraints(), Model::userDefinedConstraints, Variables::variables_components_totals(), and Variables::view().

43.116.3 Member Function Documentation

43.116.3.1 void initialize (const Sizet2DArray & *vars_map_indices*, bool *nonlinear_vars_mapping*, void(∗)(const Variables &recast_vars, Variables &sub_model_vars) *variables_map*, void(∗)(const Variables &recast_vars, const ActiveSet &recast_set, ActiveSet &sub_model_set) *set_map*, const Sizet2DArray & *primary_resp_map_indices*, const Sizet2DArray & *secondary_resp_map_indices*, const BoolDequeArray & *nonlinear_resp_mapping*, void(∗)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response) *primary_resp_map*, void(∗)(const Variables &sub_model_vars, const Variables &recast_vars, const Response &sub_model_response, Response &recast_response) *secondary_resp_map*)

completes initialization of the RecastModel after alternate construction This function is used for late initialization of the recasting functions. It is used in concert with the alternate constructor.

References Dakota::abort_handler(), RecastModel::nonlinearRespMapping, RecastModel::nonlinearVarsMapping, RecastModel::primaryRespMapIndices, RecastModel::primaryRespMapping, RecastModel::respMapping, RecastModel::secondaryRespMapIndices, RecastModel::secondaryRespMapping, RecastModel::setMapping, RecastModel::variablesMapping, and RecastModel::varsMapIndices.

Referenced by LeastSq::LeastSq(), EffGlobalMinimizer::minimize_surrogates_on_model(), NonDLocalReliability::mpp_search(), NonDGlobalReliability::optimize_gaussian_process(), Optimizer::Optimizer(), NonDLocalInterval::quantify_uncertainty(), and NonDGlobalInterval::quantify_uncertainty().

43.116.3.2 void update_from_sub_model () [private]

update current variables/labels/bounds/targets from subModel Update inactive values and labels in currentVariables and inactive bound constraints in userDefinedConstraints from variables and constraints data within subModel.

References Model::continuous_lower_bounds(), Constraints::continuous_lower_bounds(), Model::continuous_upper_bounds(), Constraints::continuous_upper_bounds(), Model::continuous_variable_labels(), Variables::continuous_variable_labels(), Model::continuous_variables(), Variables::continuous_variables(), Model::currentResponse, Model::currentVariables, Model::discrete_design_set_int_values(), Model::discrete_design_set_real_values(), Model::discrete_int_lower_bounds(), Constraints::discrete_int_lower_bounds(), Model::discrete_int_upper_bounds(), Constraints::discrete_int_upper_bounds(), Model::discrete_int_variable_labels(), Variables::discrete_int_variable_labels(), Model::discrete_int_variables(), Variables::discrete_int_variables(), Model::discrete_real_lower_bounds(), Constraints::discrete_real_lower_bounds(), Model::discrete_real_upper_bounds(), Constraints::discrete_real_upper_bounds(), Model::discrete_real_variable_labels(), Variables::discrete_real_variable_labels(), Model::discrete_real_variables(), Variables::discrete_real_variables(), Model::discrete_state_set_int_values(), Model::discrete_state_set_real_values(), Model::discreteDesignSetIntValues, Model::discreteDesignSetRealValues, Model::discreteStateSetIntValues, Model::discreteStateSetRealValues, Model::distParams, Model::distribution_parameters(), Response::function_label(), Model::inactive_continuous_lower_bounds(), Constraints::inactive_continuous_lower_-

bounds(), Model::inactive_continuous_upper_bounds(), Constraints::inactive_continuous_upper_-bounds(), Model::inactive_continuous_variable_labels(), Variables::inactive_continuous_variable_labels(), Model::inactive_continuous_variables(), Variables::inactive_continuous_variables(), Model::inactive_discrete_-int_lower_bounds(), Constraints::inactive_discrete_int_lower_bounds(), Model::inactive_discrete_int_upper_-bounds(), Constraints::inactive_discrete_int_upper_bounds(), Model::inactive_discrete_int_variable_labels(), Variables::inactive_discrete_int_variable_labels(), Model::inactive_discrete_int_variables(), Variables::inactive_-discrete_int_variables(), Model::inactive_discrete_real_lower_bounds(), Constraints::inactive_discrete_real_-lower_bounds(), Model::inactive_discrete_real_upper_bounds(), Constraints::inactive_discrete_real_upper_-bounds(), Model::inactive_discrete_real_variable_labels(), Variables::inactive_discrete_real_variable_labels(), Model::inactive_discrete_real_variables(), Variables::inactive_discrete_real_variables(), Model::linear_-eq_constraint_coeffs(), Constraints::linear_eq_constraint_coeffs(), Model::linear_eq_constraint_targets(), Constraints::linear_eq_constraint_targets(), Model::linear_ineq_constraint_coeffs(), Constraints::linear_ineq_-constraint_coeffs(), Model::linear_ineq_constraint_lower_bounds(), Constraints::linear_ineq_constraint_lower_-bounds(), Model::linear_ineq_constraint_upper_bounds(), Constraints::linear_ineq_constraint_upper_bounds(), Model::nonlinear_eq_constraint_targets(), Constraints::nonlinear_eq_constraint_targets(), Model::nonlinear_-ineq_constraint_lower_bounds(), Constraints::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_-ineq_constraint_upper_bounds(), Constraints::nonlinear_ineq_constraint_upper_bounds(), Model::num_-functions(), Model::num_linear_eq_constraints(), Model::num_linear_ineq_constraints(), Model::num_-nonlinear_eq_constraints(), Constraints::num_nonlinear_eq_constraints(), Model::num_nonlinear_ineq_-constraints(), Constraints::num_nonlinear_ineq_constraints(), Model::numFns, Model::primary_response_-fn_weights(), Model::primaryRespFnWts, RecastModel::primaryRespMapping, Model::response_labels(), RecastModel::secondaryRespMapping, RecastModel::subModel, Model::userDefinedConstraints, and Recast-Model::variablesMapping.

Referenced by RecastModel::update_from_subordinate_model().

The documentation for this class was generated from the following files:

- RecastModel.H
- RecastModel.C

43.117 Response Class Reference

Container class for response functions and their derivatives. Response provides the handle class.

Public Member Functions

- Response ()

  default constructor

- Response (const Variables &vars, const ProblemDescDB &problem_db)

  standard constructor built from problem description database

- Response (const ActiveSet &set)

  alternate constructor using limited data

- Response (const Response &response)

  copy constructor

- ~Response ()

  destructor

- Response operator= (const Response &response)

  assignment operator

- size_t num_functions () const

  return the number of response functions

- const ActiveSet & active_set () const

  return the active set

- void active_set (const ActiveSet &set)

  set the active set

- const ShortArray & active_set_request_vector () const

  return the active set request vector

- void active_set_request_vector (const ShortArray &asrv)

  set the active set request vector

- const SizetArray & active_set_derivative_vector () const

  return the active set derivative vector

- void active_set_derivative_vector (const SizetArray &asdv)

  set the active set derivative vector

- const String & responses_id () const

  return the response identifier

- const String & function_label (const size_t &i) const

  return a response function identifier string

- const StringArray & function_labels () const

  return the response function identifier strings

- void function_label (const String &label, const size_t &i)

  set a response function identifier string

- void function_labels (const StringArray &labels)

  set the response function identifier strings

- const Real & function_value (const size_t &i) const

  return a function value

- Real & function_value_view (const size_t &i)

  return a "view" of a function value for updating in place

- const RealVector & function_values () const

  return all function values

- RealVector function_values_view ()

  return all function values as a view for updating in place

- void function_value (const Real &function_val, const size_t &i)

  set a function value

- void function_values (const RealVector &function_vals)

  set all function values

- const Real ∗ function_gradient (const int &i) const

  return the i-th function gradient as a const Real∗

- RealVector function_gradient_view (const int &i) const

  return the i-th function gradient as a SerialDenseVector Teuchos::View (shallow copy) for updating in place

- RealVector function_gradient_copy (const int &i) const

  return the i-th function gradient as a SerialDenseVector Teuchos::Copy (deep copy)

- const RealMatrix & function_gradients () const

  return all function gradients

- RealMatrix function_gradients_view ()

return all function gradients as a view for updating in place

- void function_gradient (const RealVector &function_grad, const int &i)

  set a function gradient

- void function_gradients (const RealMatrix &function_grads)

  set all function gradients

- const RealSymMatrix & function_hessian (const size_t &i) const

  return the i-th function Hessian

- RealSymMatrix function_hessian_view (const size_t &i)

  return the i-th function Hessian as a Teuchos::View (shallow copy) for updating in place

- const RealSymMatrixArray & function_hessians () const

  return all function Hessians

- RealSymMatrixArray function_hessians_view ()

  return all function Hessians as Teuchos::Views (shallow copies) for updating in place

- void function_hessian (const RealSymMatrix &function_hessian, const size_t &i)

  set a function Hessian

- void function_hessians (const RealSymMatrixArray &function_hessians)

  set all function Hessians

- void read (std::istream &s)

  read a response object from an std::istream

- void write (std::ostream &s) const

  write a response object to an std::ostream

- void read_annotated (std::istream &s)

  read a response object in annotated format from an std::istream

- void write_annotated (std::ostream &s) const

  write a response object in annotated format to an std::ostream

- void read_tabular (std::istream &s)

  read responseRep::functionValues in tabular format from an std::istream

- void write_tabular (std::ostream &s) const

  write responseRep::functionValues in tabular format to an std::ostream

- void read (BiStream &s)

  read a response object from the binary restart stream

- void write (BoStream &s) const

  write a response object to the binary restart stream

- void read (MPIUnpackBuffer &s)

  read a response object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a response object to a packed MPI buffer

- Response copy () const

  a deep copy for use in history mechanisms

- int data_size ()

  handle class forward to corresponding body class member function

- void read_data (double *response_data)

  handle class forward to corresponding body class member function

- void write_data (double *response_data)

  handle class forward to corresponding body class member function

- void overlay (const Response &response)

  handle class forward to corresponding body class member function

- void update (const Response &response)

  Used in place of operator= when only results data updates are desired (functionValues/functionGradients/functionHessians are updated, ASV/labels/id's/etc. are not). Care is taken to allow different derivative array sizing between the two response objects.

- void update (const RealVector &source_fn_vals, const RealMatrix &source_fn_grads, const RealSymMatrixArray &source_fn_hessians, const ActiveSet &source_set)

  Overloaded form which allows update from components of a response object. Care is taken to allow different derivative array sizing.

- void update_partial (size_t start_index_target, size_t num_items, const Response &response, size_t start_index_source)

  partial update of this response object from another response object. The response objects may have different numbers of response functions.

- void update_partial (size_t start_index_target, size_t num_items, const RealVector &source_fn_vals, const RealMatrix &source_fn_grads, const RealSymMatrixArray &source_fn_hessians, const ActiveSet &source_set, size_t start_index_source)

  Overloaded form which allows partial update from components of a response object. The response objects may have different numbers of response functions.

- void reshape (const size_t &num_fns, const size_t &num_params, bool grad_flag, bool hess_flag)

rehapes response data arrays

- void reset ()

  handle class forward to corresponding body class member function

- void reset_inactive ()

  handle class forward to corresponding body class member function

- bool is_null () const

  function to check responseRep (does this handle contain a body)

Private Attributes

- ResponseRep * responseRep

  pointer to the body (handle-body idiom)

Friends

- bool operator== (const Response &resp1, const Response &resp2)

  equality operator

- bool operator!= (const Response &resp1, const Response &resp2)

  inequality operator

43.117.1 Detailed Description

Container class for response functions and their derivatives. Response provides the handle class. The Response class is a container class for an abstract set of functions (functionValues) and their first (functionGradients) and second (functionHessians) derivatives. The functions may involve objective and constraint functions (optimization data set), least squares terms (parameter estimation data set), or generic response functions (uncertainty quantification data set). It is not currently part of a class hierarchy, since the abstraction has been sufficiently general and has not required specialization. For memory efficiency, it employs the "handle-body idiom" approach to reference counting and representation sharing (see Coplien "Advanced C++", p. 58), for which Response serves as the handle and ResponseRep serves as the body.

43.117.2 Constructor & Destructor Documentation

43.117.2.1 Response ()

default constructor Need a populated problem description database to build a meaningful Response object, so set the responseRep=NULL in default constructor for efficiency. This then requires a check on NULL in the copy constructor, assignment operator, and destructor.

The documentation for this class was generated from the following files:

- DakotaResponse.H
- DakotaResponse.C

43.118 ResponseRep Class Reference

Container class for response functions and their derivatives. ResponseRep provides the body class.

Private Member Functions

- ResponseRep ()

  default constructor

- ResponseRep (const Variables &vars, const ProblemDescDB &problem_db)

  standard constructor built from problem description database

- ResponseRep (const ActiveSet &set)

  alternate constructor using limited data

- ~ResponseRep ()

  destructor

- void read (std::istream &s)

  read a responseRep object from an std::istream

- void write (std::ostream &s) const

  write a responseRep object to an std::ostream

- void read_annotated (std::istream &s)

  read a responseRep object from an std::istream (annotated format)

- void write_annotated (std::ostream &s) const

  write a responseRep object to an std::ostream (annotated format)

- void read_tabular (std::istream &s)

  read functionValues from an std::istream (tabular format)

- void write_tabular (std::ostream &s) const

  write functionValues to an std::ostream (tabular format)

- void read (BiStream &s)

  read a responseRep object from a binary stream

- void write (BoStream &s) const

  write a responseRep object to a binary stream

- void read (MPIUnpackBuffer &s)

  read a responseRep object from a packed MPI buffer

- void write (MPIPackBuffer &s) const

  write a responseRep object to a packed MPI buffer

- int data_size ()

  return the number of doubles active in response. Used for sizing double∗ response_data arrays passed into read_data and write_data.

- void read_data (double ∗response_data)

  read from an incoming double∗ array

- void write_data (double ∗response_data)

  write to an incoming double∗ array

- void overlay (const Response &response)

  add incoming response to functionValues/Gradients/Hessians

- void update (const RealVector &source_fn_vals, const RealMatrix &source_fn_grads, const RealSymMatrixArray &source_fn_hessians, const ActiveSet &source_set)

  update this response object from components of another response object

- void update_partial (size_t start_index_target, size_t num_items, const RealVector &source_fn_vals, const RealMatrix &source_fn_grads, const RealSymMatrixArray &source_fn_hessians, const ActiveSet &source_set, size_t start_index_source)

  partially update this response object partial components of another response object

- void reshape (const size_t &num_fns, const size_t &num_params, bool grad_flag, bool hess_flag)

  rehapes response data arrays

- void reset ()

  resets all response data to zero

- void reset_inactive ()

  resets all inactive response data to zero

- void active_set_request_vector (const ShortArray &asrv)

  set the active set request vector and verify consistent number of response functions

- void active_set_derivative_vector (const SizetArray &asdv)

  set the active set derivative vector and reshape functionGradients/functionHessians if needed

Private Attributes

- int referenceCount

  number of handle objects sharing responseRep

- RealVector functionValues

  abstract set of response functions

- RealMatrix functionGradients

  first derivatives of the response functions

- RealSymMatrixArray functionHessians

  second derivatives of the response functions

- ActiveSet responseActiveSet

  copy of the ActiveSet used by the Model to generate a Response instance

- StringArray functionLabels

  response function identifiers used to improve output readability

- String responsesId

  response identifier string from the input file

Friends

- class Response

  the handle class can access attributes of the body class directly

- bool operator== (const ResponseRep &rep1, const ResponseRep &rep2)

  equality operator

43.118.1 Detailed Description

Container class for response functions and their derivatives. ResponseRep provides the body class. The ResponseRep class is the "representation" of the response container class. It is the "body" portion of the "handle-body idiom" (see Coplien "Advanced C++", p. 58). The handle class (Response) provides for memory efficiency in management of multiple response objects through reference counting and representation sharing. The body class (ResponseRep) actually contains the response data (functionValues, functionGradients, functionHessians, etc.). The representation is hidden in that an instance of ResponseRep may only be created by Response. Therefore, programmers create instances of the Response handle class, and only need to be aware of the handle/body mechanisms when it comes to managing shallow copies (shared representation) versus deep copies (separate representation used for history mechanisms).

43.118.2 Constructor & Destructor Documentation

43.118.2.1 ResponseRep (const Variables & *vars*, const ProblemDescDB & *problem_db*) `[private]`

standard constructor built from problem description database The standard constructor used by Dakota::ModelRep.

References Dakota::abort_handler(), Variables::continuous_variable_ids(), Variables::cv(), ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, ProblemDescDB::get_sizet(), ProblemDescDB::get_string(), ActiveSet::request_vector(), and ResponseRep::responseActiveSet.

43.118.2.2 ResponseRep (const ActiveSet & *set*) [private]

alternate constructor using limited data Used for building a response object of the correct size on the fly (e.g., by slave analysis servers performing execute() on a local_response). functionLabels is not needed for this purpose since it's not passed in the MPI send/recv buffers. However, NPSOLOptimizer's user-defined functions option uses this constructor to build bestResponseArray.front() and bestResponseArray.front() needs functionLabels for I/O, so construction of functionLabels has been added.

References Dakota::build_labels(), ResponseRep::functionGradients, ResponseRep::functionHessians, and ResponseRep::functionLabels.

43.118.3 Member Function Documentation

43.118.3.1 void read (std::istream & *s*) [private]

read a responseRep object from an std::istream ASCII version of read needs capabilities for capturing data omissions or formatting errors (resulting from user error or asynch race condition) and analysis failures (resulting from nonconvergence, instability, etc.).

References ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, Dakota::re_match(), Dakota::read_col_vector_trans(), ResponseRep::read_data(), ActiveSet::request_vector(), ResponseRep::reset(), and ResponseRep::responseActiveSet.

Referenced by Response::read().

43.118.3.2 void write (std::ostream & *s*) const [private]

write a responseRep object to an std::ostream ASCII version of write.

References Dakota::abort_handler(), Dakota::array_write_annotated(), ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionLabels, ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::responseActiveSet, Dakota::write_col_vector_trans(), ResponseRep::write_data(), and Dakota::write_precision.

Referenced by Response::write().

43.118.3.3 void read_annotated (std::istream & *s*) [private]

read a responseRep object from an std::istream (annotated format) read_annotated() is used for neutral file translation of restart files. Since objects are built solely from this data, annotations are used. This version closely mirrors the BiStream version.

References ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionLabels, ResponseRep::functionValues, Dakota::read_col_vector_trans(), Dakota::read_lower_triangle(),

ActiveSet::request_vector(), ResponseRep::reset(), ResponseRep::reshape(), ActiveSet::reshape(), and ResponseRep::responseActiveSet.

Referenced by Response::read_annotated().

43.118.3.4 void write_annotated (std::ostream & *s*) const [private]

write a responseRep object to an std::ostream (annotated format) write_annotated() is used for neutral file translation of restart files. Since objects need to be build solely from this data, annotations are used. This version closely mirrors the BoStream version, with the exception of the use of white space between fields.

References Dakota::array_write_annotated(), ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionLabels, ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::responseActiveSet, ActiveSet::write_annotated(), Dakota::write_col_vector_trans(), and Dakota::write_lower_triangle().

Referenced by Response::write_annotated().

43.118.3.5 void read_tabular (std::istream & *s*) [private]

read functionValues from an std::istream (tabular format) read_tabular is used to read functionValues in tabular format. It is currently only used by ApproximationInterfaces in reading samples from a file. There is insufficient data in a tabular file to build complete response objects; rather, the response object must be constructed a priori and then its functionValues can be set.

References ResponseRep::functionValues.

Referenced by Response::read_tabular().

43.118.3.6 void write_tabular (std::ostream & *s*) const [private]

write functionValues to an std::ostream (tabular format) write_tabular is used for output of functionValues in a tabular format for convenience in post-processing/plotting of DAKOTA results.

References ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::responseActiveSet, and Dakota::write_precision.

Referenced by Response::write_tabular().

43.118.3.7 void read (BiStream & *s*) [private]

read a responseRep object from a binary stream Binary version differs from ASCII version in 2 primary ways: (1) it lacks formatting. (2) the Response has not been sized a priori. In reading data from the binary restart file, a ParamResponsePair was constructed with its default constructor which called the Response default constructor. Therefore, we must first read sizing data and resize all of the arrays.

References ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionLabels, ResponseRep::functionValues, Dakota::read_col_vector_trans(), Dakota::read_lower_triangle(), ActiveSet::request_vector(), ResponseRep::reset(), ResponseRep::reshape(), and ResponseRep::responseActiveSet.

43.118.3.8 void write (BoStream & *s*) const [private]

write a responseRep object to a binary stream Binary version differs from ASCII version in 2 primary ways: (1) It lacks formatting. (2) In reading data from the binary restart file, ParamResponsePairs are constructed with their default constructor which calls the Response default constructor. Therefore, we must first write sizing data so that ResponseRep::read(BoStream& s) can resize the arrays.

References ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionLabels, ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::responseActiveSet, Dakota::write_col_vector_trans(), and Dakota::write_lower_triangle().

43.118.3.9 void read (MPIUnpackBuffer & *s*) [private]

read a responseRep object from a packed MPI buffer UnpackBuffer version differs from BiStream version in the omission of functionLabels. Master processor retains labels and interface ids and communicates asv and response data only with slaves.

References ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, Dakota::read_col_vector_trans(), Dakota::read_lower_triangle(), ResponseRep::reset(), ResponseRep::reshape(), and ResponseRep::responseActiveSet.

43.118.3.10 void write (MPIPackBuffer & *s*) const [private]

write a responseRep object to a packed MPI buffer MPIPackBuffer version differs from BoStream version only in the omission of functionLabels. The master processor retains labels and ids and communicates asv and response data only with slaves.

References ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::responseActiveSet, Dakota::write_col_vector_trans(), and Dakota::write_lower_triangle().

43.118.3.11 void update (const RealVector & *source_fn_vals*, const RealMatrix & *source_fn_grads*, const RealSymMatrixArray & *source_fn_hessians*, const ActiveSet & *source_set*) [private]

update this response object from components of another response object Copy function values/gradients/Hessians data _only_. Prevents unwanted overwriting of responseActiveSet, functionLabels, etc. Also, care is taken to account for differences in derivative variable matrix sizing.

References Dakota::abort_handler(), ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::reset_inactive(), and ResponseRep::responseActiveSet.

Referenced by Response::update().

43.118.3.12 void update_partial (size_t *start_index_target*, size_t *num_items*, const RealVector & *source_fn_vals*, const RealMatrix & *source_fn_grads*, const RealSymMatrixArray & *source_fn_hessians*, const ActiveSet & *source_set*, size_t *start_index_source*) [private]

partially update this response object partial components of another response object Copy function values/gradients/Hessians data _only_. Prevents unwanted overwriting of responseActiveSet, functionLabels, etc. Also, care is taken to account for differences in derivative variable matrix sizing.

References Dakota::abort_handler(), ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, ActiveSet::request_vector(), ResponseRep::reset_inactive(), and ResponseRep::responseActiveSet.

Referenced by Response::update_partial().

43.118.3.13 void reshape (const size_t & *num_fns*, const size_t & *num_params*, bool *grad_flag*, bool *hess_flag*) [private]

rehapes response data arrays Reshape functionValues, functionGradients, and functionHessians according to num_fns, num_params, grad_flag, and hess_flag.

References Dakota::build_labels(), ActiveSet::derivative_vector(), ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionLabels, ResponseRep::functionValues, ActiveSet::request_vector(), ActiveSet::reshape(), and ResponseRep::responseActiveSet.

Referenced by ResponseRep::active_set_derivative_vector(), ResponseRep::read(), ResponseRep::read_annotated(), and Response::reshape().

43.118.3.14 void reset () [private]

resets all response data to zero Reset all numerical response data (not labels, ids, or active set) to zero.

References ResponseRep::functionGradients, ResponseRep::functionHessians, and ResponseRep::functionValues.

Referenced by ResponseRep::read(), ResponseRep::read_annotated(), and Response::reset().

43.118.3.15 void reset_inactive () [private]

resets all inactive response data to zero Used to clear out any inactive data left over from previous evaluations.

References ResponseRep::functionGradients, ResponseRep::functionHessians, ResponseRep::functionValues, ActiveSet::request_vector(), and ResponseRep::responseActiveSet.

Referenced by Response::reset_inactive(), ResponseRep::update(), and ResponseRep::update_partial().

43.118.4 Member Data Documentation

43.118.4.1 RealMatrix functionGradients [private]

first derivatives of the response functions the gradient vectors (plural) are column vectors in the matrix (singular) with (row, col) = (variable index, response fn index).

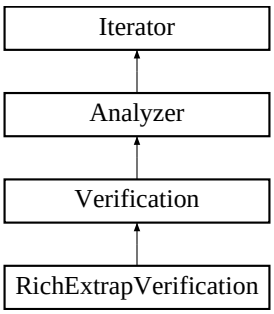
Referenced by ResponseRep::active_set_derivative_vector(), Response::copy(), Response::function_gradient(), Response::function_gradient_copy(), Response::function_gradient_view(), Response::function_gradients(), Response::function_gradients_view(), Dakota::operator==(), ResponseRep::overlay(), ResponseRep::read(), ResponseRep::read_annotated(), ResponseRep::read_data(), ResponseRep::reset(), ResponseRep::reset_inactive(), ResponseRep::reshape(), ResponseRep::ResponseRep(), ResponseRep::update(), ResponseRep::update_partial(), ResponseRep::write(), ResponseRep::write_annotated(), and ResponseRep::write_data().

The documentation for this class was generated from the following files:

- DakotaResponse.H
- DakotaResponse.C

43.119 RichExtrapVerification Class Reference

Class for Richardson extrapolation for code and solution verification. Inheritance diagram for RichExtrapVerification::



Public Member Functions

- RichExtrapVerification (Model &model)

  constructor

- ~RichExtrapVerification ()

  destructor

- void perform_verification ()

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

- void print_results (std::ostream &s)

  print the final iterator results

Private Member Functions

- void estimate_order ()

  perform a single estimation of convOrder using extrapolation()

- void converge_order ()

  iterate using extrapolation() until convOrder stabilizes

- void converge_qoi ()

  iterate using extrapolation() until QOIs stabilize

- void extrapolation (const RealVector &refine_triple, RealMatrix &qoi_triples)

  estimate convOrder from refinement and quantity of interest (QOI) triples

- void extrapolate_result (const RealVector &refine_triple, const RealMatrix &qoi_triples)

predict the converged value based on the convergence rate and the value of Phi

Private Attributes

- short studyType

  internal code for extrapolation study type: ESTIMATE_ORDER, CONVERGE_ORDER, or CONVERGE_QOI

- size_t numFactors

  number of refinement factors defined from active state variables

- RealVector initialCVars

  initial reference values for refinement factors

- size_t factorIndex

  the index of the active factor

- Real refinementRate

  rate of mesh refinement (default = 2.)

- RealMatrix convOrder

  the orders of convergence of the QOIs (numFunctions by numFactors)

- RealMatrix extrapQOI

  the extrapolated value of the QOI (numFunctions by numFactors)

- RealMatrix numErrorQOI

  the numerical uncertainty associated with level of refinement (numFunctions by numFactors)

- RealVector refinementRefPt

  This is a reference point reported for the converged extrapQOI and numErrorQOI. It currently corresponds to the coarsest mesh in the final refinement triple.

43.119.1 Detailed Description

Class for Richardson extrapolation for code and solution verification. The RichExtrapVerification class contains several algorithms for performing Richardson extrapolation.

43.119.2 Member Function Documentation

43.119.2.1 void print_results (std::ostream & *s*) `[virtual]`

print the final iterator results This virtual function provides additional iterator-specific final results outputs beyond the function evaluation summary printed in finalize_run().

Reimplemented from Verification.

References Model::continuous_variable_labels(), RichExtrapVerification::convOrder, Dakota::copy_data(), RichExtrapVerification::extrapQOI, Iterator::iteratedModel, RichExtrapVerification::numErrorQOI, RichExtrapVerification::refinementRate, RichExtrapVerification::refinementRefPt, Model::response_labels(), and Dakota::write_data().

43.119.2.2 void estimate_order () [private]

perform a single estimation of convOrder using extrapolation() This algorithm executes a single refinement triple and returns convergence order estimates.

References RichExtrapVerification::extrapolate_result(), RichExtrapVerification::extrapolation(), RichExtrapVerification::extrapQOI, RichExtrapVerification::factorIndex, RichExtrapVerification::initialCVars, RichExtrapVerification::numErrorQOI, RichExtrapVerification::numFactors, Iterator::numFunctions, RichExtrapVerification::refinementRate, and RichExtrapVerification::refinementRefPt.

Referenced by RichExtrapVerification::perform_verification().

43.119.2.3 void converge_order () [private]

iterate using extrapolation() until convOrder stabilizes This algorithm continues to refine until the convergence order estimate converges.

References Iterator::convergenceTol, RichExtrapVerification::convOrder, Dakota::copy_data(), RichExtrapVerification::extrapolate_result(), RichExtrapVerification::extrapolation(), RichExtrapVerification::extrapQOI, RichExtrapVerification::factorIndex, RichExtrapVerification::initialCVars, Iterator::maxIterations, RichExtrapVerification::numErrorQOI, RichExtrapVerification::numFactors, Iterator::numFunctions, Iterator::outputLevel, RichExtrapVerification::refinementRate, RichExtrapVerification::refinementRefPt, and Dakota::write_data().

Referenced by RichExtrapVerification::perform_verification().

43.119.2.4 void converge_qoi () [private]

iterate using extrapolation() until QOIs stabilize This algorithm continues to refine until the discretization error lies within a prescribed tolerance.

References Iterator::convergenceTol, RichExtrapVerification::extrapolate_result(), RichExtrapVerification::extrapolation(), RichExtrapVerification::extrapQOI, RichExtrapVerification::factorIndex, RichExtrapVerification::initialCVars, Iterator::maxIterations, RichExtrapVerification::numErrorQOI, RichExtrapVerification::numFactors, Iterator::numFunctions, Iterator::outputLevel, RichExtrapVerification::refinementRate, RichExtrapVerification::refinementRefPt, and Dakota::write_data().

Referenced by RichExtrapVerification::perform_verification().

The documentation for this class was generated from the following files:

- RichExtrapVerification.H
- RichExtrapVerification.C

43.120 SensAnalysisGlobal Class Reference

Class for a utility class containing correlation calculations and variance-based decomposition.

Public Member Functions

- SensAnalysisGlobal ()

  constructor

- ~SensAnalysisGlobal ()

  destructor

- void compute_correlations (const VariablesArray &vars_samples, const IntResponseMap &resp_samples)

  computes four correlation matrices for input and output data simple, partial, simple rank, and partial rank

- void compute_correlations (const RealMatrix &vars_samples, const IntResponseMap &resp_samples)

  computes four correlation matrices for input and output data simple, partial, simple rank, and partial rank

- bool correlations_computed () const

  returns corrComputed to indicate whether compute_correlations() has been invoked

- void print_correlations (std::ostream &s, StringMultiArrayConstView cv_labels, StringMultiArrayConstView div_labels, StringMultiArrayConstView drv_labels, const StringArray &resp_labels) const

  prints the correlations computed in compute_correlations()

Private Member Functions

- void simple_corr (RealMatrix &total_data, bool rank_on, const int &num_in)

  computes simple correlations

- void partial_corr (RealMatrix &total_data, bool rank_on, const int &num_in)

  computes partial correlations

Static Private Member Functions

- static bool rank_sort (const int &x, const int &y)

  sort algorithm to compute ranks for rank correlations

Private Attributes

- RealMatrix simpleCorr
  matrix to hold simple raw correlations
- RealMatrix simpleRankCorr
  matrix to hold simple rank correlations
- RealMatrix partialCorr
  matrix to hold partial raw correlations
- RealMatrix partialRankCorr
  matrix to hold partial rank correlations
- size_t numFns
  number of responses
- size_t numVars
  number of inputs
- bool numericalIssuesRaw
  flag indicating numerical issues in partial raw correlation calculations
- bool numericalIssuesRank
  flag indicating numerical issues in partial rank correlation calculations
- bool corrComputed
  flag indictaing whether correlations have been computed

Static Private Attributes

- static RealArray rawData = RealArray()
  array to hold temporary data before sort

43.120.1 Detailed Description

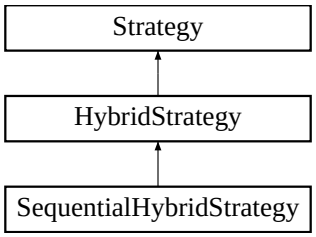
Class for a utility class containing correlation calculations and variance-based decomposition. This class provides code for several of the sampling methods both in the NonD branch and in the PStudyDACE branch. Currently, the utility functions provide global sensitivity analysis through correlation calculations (e.g. simple, partial, rank, raw) as well as variance-based decomposition.

The documentation for this class was generated from the following files:

- SensAnalysisGlobal.H
- SensAnalysisGlobal.C

43.121 SequentialHybridStrategy Class Reference

Strategy for sequential hybrid minimization using multiple optimization and nonlinear least squares methods on multiple models of varying fidelity. Inheritance diagram for SequentialHybridStrategy::



Public Member Functions

- SequentialHybridStrategy (ProblemDescDB &problem_db)

  constructor

- ~SequentialHybridStrategy ()

  destructor

Protected Member Functions

- void run_strategy ()

  Performs the hybrid minimization strategy by executing multiple iterators on different models of varying fidelity.

- const Variables & variables_results () const

  return the final solution from selectedIterators (variables)

- const Response & response_results () const

  return the final solution from selectedIterators (response)

- void initialize_iterator (int job_index)

  initialize the iterator about to be executed within a parallel iterator scheduling function (serve_iterators() or static_-schedule_iterators())

- void pack_parameters_buffer (MPIPackBuffer &send_buffer, int job_index)

  pack a send_buffer for assigning an iterator job to a server

- void unpack_parameters_buffer (MPIUnpackBuffer &recv_buffer)

  unpack a recv_buffer for accepting an iterator job from the scheduler

- void pack_results_buffer (MPIPackBuffer &send_buffer, int job_index)

  pack a send_buffer for returning iterator results from a server

- void unpack_results_buffer (MPIUnpackBuffer &recv_buffer, int job_index)

  unpack a recv_buffer for accepting iterator results from a server

- void update_local_results (int job_index)

  update local PRP results arrays with current iteration results

Private Member Functions

- void run_sequential ()

  run a sequential hybrid

- void run_sequential_adaptive ()

  run a sequential adaptive hybrid

- void partition_sets (size_t num_sets, int job_index, size_t &start_index, size_t &job_size)

  convert num_sets and job_index into a start_index and job_size for extraction from parameterSets

- void extract_parameter_sets (int job_index, VariablesArray &partial_param_sets)

  extract partial_param_sets from parameterSets based on job_index

- void update_local_results (PRPArray &prp_results, int job_id)

  update the partial set of final results from the local iterator execution

- void initialize_iterator (const VariablesArray &param_sets)

  called by unpack_parameters_buffer(MPIUnpackBuffer) and initialize_iterator(int) to update the active Model and Iterator

Private Attributes

- String hybridType

  sequential or sequential_adaptive

- size_t seqCount

  hybrid sequence counter: 0 to numIterators-1

- Real progressMetric

  the amount of progress made in a single iterator++ cycle within a sequential adaptive hybrid

- Real progressThreshold

  when the progress metric falls below this threshold, the sequential adaptive hybrid switches to the next method

- PRP2DArray prpResults

2-D array of results corresponding to numIteratorJobs, one set of results per job (iterators may return multiple final solutions)

- VariablesArray parameterSets

  1-D array of variable starting points for the iterator jobs

43.121.1 Detailed Description

Strategy for sequential hybrid minimization using multiple optimization and nonlinear least squares methods on multiple models of varying fidelity. The sequential hybrid minimization strategy has two approaches: (1) the non-adaptive sequential hybrid runs one method to completion, passes its best results as the starting point for a subsequent method, and continues this succession until all methods have been executed (the stopping rules are controlled internally by each minimizer), and (2) the adaptive sequential hybrid uses adaptive stopping rules for the minimizers that are controlled externally by the strategy. Note that while the strategy is targeted at minimizers, any iterator may be used so long as it defines the notion of a final solution which can be passed as the starting point for subsequent iterators.

43.121.2 Member Function Documentation

43.121.2.1 void pack_parameters_buffer (MPIPackBuffer & *send_buffer*, int *job_index*) [inline, protected, virtual]

pack a send_buffer for assigning an iterator job to a server This virtual function redefinition is executed on the dedicated master processor for self scheduling. It is not used for peer partitions.

Reimplemented from Strategy.

References SequentialHybridStrategy::extract_parameter_sets(), and SequentialHybridStrategy::seqCount.

Referenced by SequentialHybridStrategy::run_sequential().

43.121.2.2 void unpack_parameters_buffer (MPIUnpackBuffer & *recv_buffer*) [inline, protected, virtual]

unpack a recv_buffer for accepting an iterator job from the scheduler This virtual function redefinition is executed on an iterator server for dedicated master self scheduling. It is not used for peer partitions.

Reimplemented from Strategy.

References SequentialHybridStrategy::initialize_iterator(), and SequentialHybridStrategy::seqCount.

43.121.2.3 void pack_results_buffer (MPIPackBuffer & *send_buffer*, int *job_index*) [inline, protected, virtual]

pack a send_buffer for returning iterator results from a server This virtual function redefinition is executed either on an iterator server for dedicated master self scheduling or on peers 2 through n for static scheduling.

Reimplemented from Strategy.

References SequentialHybridStrategy::prpResults.

43.121.2.4 void unpack_results_buffer (MPIUnpackBuffer & *recv_buffer*, int *job_index*) [inline, protected, virtual]

unpack a recv_buffer for accepting iterator results from a server This virtual function redefinition is executed on an strategy master (either the dedicated master processor for self scheduling or peer 1 for static scheduling).

Reimplemented from Strategy.

References SequentialHybridStrategy::prpResults.

43.121.2.5 void run_sequential () [private]

run a sequential hybrid In the sequential nonadaptive case, there is no interference with the iterators. Each runs until its own convergence criteria is satisfied. Status: fully operational.

References Iterator::accepts_multiple_points(), ParallelLibrary::bcast_i(), ParallelLibrary::bcast_si(), Response::function_values(), Strategy::graph2DFlag, Iterator::initialize_graphics(), Model::interface_id(), Response::is_null(), Variables::is_null(), Strategy::iteratorCommRank, Strategy::iteratorCommSize, Strategy::iteratorServerId, HybridStrategy::methodList, Iterator::num_final_solutions(), Strategy::numIteratorJobs, HybridStrategy::numIterators, Strategy::numIteratorServers, SequentialHybridStrategy::pack_parameters_buffer(), Strategy::parallelLib, SequentialHybridStrategy::parameterSets, Strategy::paramsMsgLen, SequentialHybridStrategy::prpResults, ParallelLibrary::recv_si(), Iterator::response_results(), Strategy::resultsMsgLen, Iterator::returns_multiple_points(), Strategy::schedule_iterators(), HybridStrategy::selectedIterators, ParallelLibrary::send_si(), SequentialHybridStrategy::seqCount, MPIPackBuffer::size(), Strategy::stratIterDedMaster, Strategy::stratIterMessagePass, Strategy::tabularDataFile, Strategy::tabularDataFlag, HybridStrategy::userDefinedModels, Iterator::variables_results(), Strategy::worldRank, and Dakota::write_data().

Referenced by SequentialHybridStrategy::run_strategy().

43.121.2.6 void run_sequential_adaptive () [private]

run a sequential adaptive hybrid In the sequential adaptive case, there is interference with the iterators through the use of the ++ overloaded operator. iterator++ runs the iterator for one cycle, after which a progress_metric is computed. This progress metric is used to dictate method switching instead of each iterator's internal convergence criteria. Status: incomplete.

References Strategy::graph2DFlag, HybridStrategy::methodList, HybridStrategy::numIterators, SequentialHybridStrategy::progressMetric, SequentialHybridStrategy::progressThreshold, Strategy::run_iterator(), HybridStrategy::selectedIterators, SequentialHybridStrategy::seqCount, Strategy::tabularDataFile, Strategy::tabularDataFlag, HybridStrategy::userDefinedModels, and Strategy::worldRank.

Referenced by SequentialHybridStrategy::run_strategy().

43.121.2.7 void extract_parameter_sets (int *job_index*, VariablesArray & *partial_param_sets*) [inline, private]

extract partial_param_sets from parameterSets based on job_index This convenience function is executed on an iterator master (static scheduling) or a strategy master (self scheduling) at run initialization time and has access to the full parameterSets array (this is All-Reduced for all peers at the completion of each cycle in run_sequential()).

References SequentialHybridStrategy::parameterSets, and SequentialHybridStrategy::partition_sets().

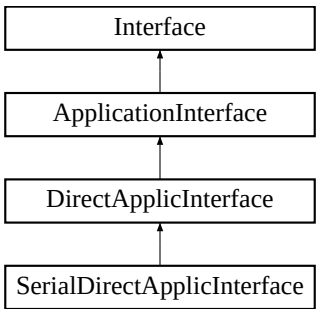
Referenced by SequentialHybridStrategy::initialize_iterator(), and SequentialHybridStrategy::pack_parameters_-buffer().

The documentation for this class was generated from the following files:

- SequentialHybridStrategy.H
- SequentialHybridStrategy.C

43.122 SerialDirectApplicInterface Class Reference

Sample derived interface class for testing serial simulator plug-ins using assign_rep(). Inheritance diagram for SerialDirectApplicInterface::



Public Member Functions

- SerialDirectApplicInterface (const Dakota::ProblemDescDB &problem_db)

  constructor

- ~SerialDirectApplicInterface ()

  destructor

Protected Member Functions

- int derived_map_ac (const Dakota::String &ac_name)

  execute an analysis code portion of a direct evaluation invocation

- void derived_map_asynch (const Dakota::ParamResponsePair &pair)

  no-op hides base error; job batching occurs within derived_synch()

- void derived_synch (Dakota::PRPQueue &prp_queue)

  evaluate the batch of jobs contained in prp_queue

- void derived_synch_nowait (Dakota::PRPQueue &prp_queue)

  invokes derived_synch() (no special nowait support)

- void check_configuration (int max_iterator_concurrency)

  no-op hides base error checks

Private Member Functions

- void rosenbrock (const Dakota::RealVector &c_vars, short asv, Dakota::Real &fn_val, Dakota::RealVector &fn_grad, Dakota::RealSymMatrix &fn_hess)

  Rosenbrock plug-in test function.

43.122.1 Detailed Description

Sample derived interface class for testing serial simulator plug-ins using assign_rep(). The plug-in SerialDirectApplicInterface resides in namespace SIM and uses a copy of rosenbrock() to perform serial parameter to response mappings. It may be activated by specifying the --with-plugin configure option, which activates the DAKOTA_PLUGIN macro in dakota_config.h used by main.C (which activates the plug-in code block within that file) and activates the PLUGIN_S declaration defined in Makefile.include and used in Makefile.source (which add this class to the build). Test input files should then use an analysis_driver of "plugin_rosenbrock".

43.122.2 Member Function Documentation

43.122.2.1 void derived_synch_nowait (Dakota::PRPQueue & *prp_queue*) `[protected, virtual]`

invokes derived_synch() (no special nowait support) For use by ApplicationInterface::serve_evaluations_asynch(), which can provide a batch processing capability within message passing schedulers (called using chain Strategy::run_iterator() --> Model::serve() --> ApplicationInterface::serve_evaluations() --> ApplicationInterface::serve_evaluations_asynch()).

Reimplemented from DirectApplicInterface.

References SerialDirectApplicInterface::derived_synch().

The documentation for this class was generated from the following files:

- PluginSerialDirectApplicInterface.H
- PluginSerialDirectApplicInterface.C

43.123 SharedVariablesData Class Reference

Container class encapsulating variables data that can be shared among a set of Variables instances.

Public Member Functions

- SharedVariablesData ()

  default constructor

- SharedVariablesData (const ProblemDescDB &problem_db, const std::pair< short, short > &view)

  standard constructor

- SharedVariablesData (const std::pair< short, short > &view, const SizetArray &vars_comps_totals)

  lightweight constructor

- SharedVariablesData (const SharedVariablesData &svd)

  copy constructor

- ~SharedVariablesData ()

  destructor

- SharedVariablesData & operator= (const SharedVariablesData &svd)

  assignment operator

- void size_all_continuous_labels (bool relax)

  size labels for all of the continuous variables, with or without discrete relaxation

- void initialize_all_continuous_types (bool relax)

  initialize types for all of the continuous variables, with or without discrete relaxation

- void initialize_all_continuous_ids (bool relax)

  initialize ids for all of the continuous variables, with or without discrete relaxation

- void size_all_discrete_int_labels ()

  size labels for all of the discrete integer variables

- void initialize_all_discrete_int_types ()

  initialize types for all of the discrete integer variables

- void size_all_discrete_real_labels ()

  size labels for all of the discrete real variables

- void initialize_all_discrete_real_types ()

  initialize types for all of the discrete real variables

- StringMultiArrayView all_continuous_labels (size_t start, size_t num_items) const

  get num_items continuous labels beginning at index start

- void all_continuous_labels (StringMultiArrayConstView cv_labels, size_t start, size_t num_items)

  set num_items continuous labels beginning at index start

- void all_continuous_label (const String &cv_label, size_t index)

  set continuous label at index start

- StringMultiArrayView all_discrete_int_labels (size_t start, size_t num_items) const

  get num_items discrete integer labels beginning at index start

- void all_discrete_int_labels (StringMultiArrayConstView div_labels, size_t start, size_t num_items)

  set num_items discrete integer labels beginning at index start

- void all_discrete_int_label (const String &div_label, size_t index)

  set discrete integer label at index start

- StringMultiArrayView all_discrete_real_labels (size_t start, size_t num_items) const

  get num_items discrete real labels beginning at index start

- void all_discrete_real_labels (StringMultiArrayConstView drv_labels, size_t start, size_t num_items)

  set num_items discrete real labels beginning at index start

- void all_discrete_real_label (const String &drv_label, size_t index)

  set discrete real label at index start

- UShortMultiArrayConstView all_continuous_types (size_t start, size_t num_items) const

  get num_items continuous types beginning at index start

- UShortMultiArrayConstView all_discrete_int_types (size_t start, size_t num_items) const

  get num_items discrete integer types beginning at index start

- UShortMultiArrayConstView all_discrete_real_types (size_t start, size_t num_items) const

  get num_items discrete real types beginning at index start

- SizetMultiArrayConstView all_continuous_ids (size_t start, size_t num_items) const

  get num_items continuous ids beginning at index start

- const SizetArray & merged_discrete_ids () const

  get ids of discrete variables that have been merged into continuous arrays

- const std::pair< short, short > & view () const

  retreive the Variables view

- void inactive_view (short view2)

set the inactive Variables view

- const String & id () const

  return the user-provided or default Variables identifier

- const SizetArray & components_totals () const

  return variable type counts for {continuous,discrete integer,discrete real} {design,aleatory uncertain,epistemic uncertain,state}

- size_t vc_lookup (unsigned short key) const

  retrieve the variables type count within svdRep->variablesComponents corresponding to (a fine-grain variables type) key

Private Attributes

- SharedVariablesDataRep * svdRep

  pointer to the body (handle-body idiom)

43.123.1 Detailed Description

Container class encapsulating variables data that can be shared among a set of Variables instances. An array of Variables objects (e.g., Analyzer::allVariables) contains repeated configuration data (id's, labels, counts). SharedVariablesData employs a handle-body idiom to allow this shared data to be managed in a single object with many references to it, one per Variables object in the array. This allows scaling to larger sample sets.

The documentation for this class was generated from the following file:

- SharedVariablesData.H

43.124 SharedVariablesDataRep Class Reference

The representation of a SharedVariablesData instance. This representation, or body, may be shared by multiple SharedVariablesData handle instances.

Private Member Functions

- SharedVariablesDataRep (const ProblemDescDB &problem_db, const std::pair< short, short > &view)
  standard constructor
- SharedVariablesDataRep (const std::pair< short, short > &view, const SizetArray &vars_comps_totals)
  lightweight constructor
- ~SharedVariablesDataRep ()
  destructor
- void size_all_continuous_labels (bool relax)
  size allContinuousLabels, with or without discrete relaxation
- void initialize_all_continuous_types (bool relax)
  initialize allContinuousTypes, with or without discrete relaxation
- void initialize_all_continuous_ids (bool relax)
  initialize allContinuousIds, with or without discrete relaxation
- void size_all_discrete_int_labels ()
  size allDiscreteIntLabels
- void initialize_all_discrete_int_types ()
  initialize allDiscreteIntTypes
- void size_all_discrete_real_labels ()
  size allDiscreteRealLabels
- void initialize_all_discrete_real_types ()
  initialize allDiscreteRealTypes
- size_t vc_lookup (unsigned short key) const
  retrieve the count within variablesComponents corresponding to key

Private Attributes

- String variablesId
  variables identifier string from the input file

- std::pair< short, short > variablesView

  the variables view pair containing active (first) and inactive (second) view enumerations

- std::map< unsigned short, size_t > variablesComponents

  map linking variable types to counts

- SizetArray variablesCompsTotals

  totals for variable type counts for {continuous,discrete integer,discrete real} {design,aleatory uncertain,epistemic uncertain,state}

- StringMultiArray allContinuousLabels

  array of variable labels for all of the continuous variables

- StringMultiArray allDiscreteIntLabels

  array of variable labels for all of the discrete integer variables

- StringMultiArray allDiscreteRealLabels

  array of variable labels for all of the discrete real variables

- UShortMultiArray allContinuousTypes

  array of variable types for all of the continuous variables

- UShortMultiArray allDiscreteIntTypes

  array of variable types for all of the discrete integer variables

- UShortMultiArray allDiscreteRealTypes

  array of variable types for all of the discrete real variables

- SizetMultiArray allContinuousIds

  array of 1-based position identifiers for the all continuous variables array

- SizetArray mergedDiscreteIds

  array of discrete variable identifiers for which the discrete requirement is relaxed by merging them into a continuous array

- int referenceCount

  number of handle objects sharing svdRep

Friends

- class **SharedVariablesData**

43.124.1 Detailed Description

The representation of a SharedVariablesData instance. This representation, or body, may be shared by multiple SharedVariablesData handle instances. The SharedVariablesData/SharedVariablesDataRep pairs utilize a handle-body idiom (Coplien, Advanced C++).

43.124.2 Constructor & Destructor Documentation

43.124.2.1 SharedVariablesDataRep (const ProblemDescDB & *problem_db*, const std::pair< short, short > & *view*) [private]

standard constructor This constructor is the one which must build the base class data for all derived classes. get_-variables() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_variables() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~Variables).

References SharedVariablesDataRep::allContinuousLabels, SharedVariablesDataRep::allDiscreteIntLabels, SharedVariablesDataRep::allDiscreteRealLabels, Dakota::copy_data_partial(), ProblemDescDB::get_-dsa(), ProblemDescDB::get_sizet(), SharedVariablesDataRep::initialize_all_continuous_ids(), SharedVariablesDataRep::initialize_all_continuous_types(), SharedVariablesDataRep::initialize_all_-discrete_int_types(), SharedVariablesDataRep::initialize_all_discrete_real_types(), SharedVariables-DataRep::variablesComponents, SharedVariablesDataRep::variablesCompsTotals, and SharedVariables-DataRep::variablesView.

43.124.3 Member Data Documentation

43.124.3.1 SizetMultiArray allContinuousIds [private]

array of 1-based position identifiers for the all continuous variables array These identifiers define positions of the all continuous variables array within the total variable sequence.

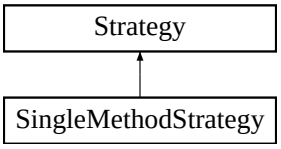
Referenced by SharedVariablesDataRep::initialize_all_continuous_ids().

The documentation for this class was generated from the following files:

- SharedVariablesData.H
- SharedVariablesData.C

43.125 SingleMethodStrategy Class Reference

Simple fall-through strategy for running a single iterator on a single model. Inheritance diagram for SingleMethodStrategy::



Public Member Functions

- SingleMethodStrategy (ProblemDescDB &problem_db)

  constructor

- ~SingleMethodStrategy ()

  destructor

- void run_strategy ()

  Perform the strategy by executing selectedIterator on userDefinedModel.

- const Variables & variables_results () const

  return the final solution from selectedIterator (variables)

- const Response & response_results () const

  return the final solution from selectedIterator (response)

Private Attributes

- Model userDefinedModel

  the model to be iterated

- Iterator selectedIterator

  the iterator

43.125.1 Detailed Description

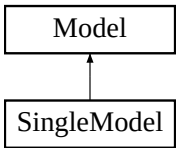
Simple fall-through strategy for running a single iterator on a single model. This strategy executes a single iterator on a single model. Since it does not provide coordination for multiple iterators and models, it can considered to be a "fall-through" strategy in that it allows control to fall through immediately to the iterator.

The documentation for this class was generated from the following files:

- SingleMethodStrategy.H
- SingleMethodStrategy.C

43.126 SingleModel Class Reference

Derived model class which utilizes a single interface to map variables into responses. Inheritance diagram for SingleModel::



Public Member Functions

- SingleModel (ProblemDescDB &problem_db)

  constructor

- ~SingleModel ()

  destructor

Protected Member Functions

- Interface & interface ()

  return userDefinedInterface

- void derived_compute_response (const ActiveSet &set)

  portion of compute_response() specific to SingleModel (invokes a synchronous map() on userDefinedInterface)

- void derived_asynch_compute_response (const ActiveSet &set)

  portion of asynch_compute_response() specific to SingleModel (invokes an asynchronous map() on userDefinedInterface)

- const IntResponseMap & derived_synchronize ()

  portion of synchronize() specific to SingleModel (invokes synch() on userDefinedInterface)

- const IntResponseMap & derived_synchronize_nowait ()

  portion of synchronize_nowait() specific to SingleModel (invokes synch_nowait() on userDefinedInterface)

- void component_parallel_mode (short mode)

  SingleModel only supports parallelism in userDefinedInterface, so this virtual function redefinition is simply a sanity check.

- String local_eval_synchronization ()

  return userDefinedInterface synchronization setting

- int local_eval_concurrency ()

  return userDefinedInterface asynchronous evaluation concurrency

- bool derived_master_overload () const

  flag which prevents overloading the master with a multiprocessor evaluation (request forwarded to userDefinedInterface)

- void derived_init_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set up SingleModel for parallel operations (request forwarded to userDefinedInterface)

- void derived_init_serial ()

  set up SingleModel for serial operations (request forwarded to userDefinedInterface).

- void derived_set_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  set active parallel configuration for the SingleModel (request forwarded to userDefinedInterface)

- void derived_free_communicators (const int &max_iterator_concurrency, bool recurse_flag=true)

  deallocate communicator partitions for the SingleModel (request forwarded to userDefinedInterface)

- void serve ()

  Service userDefinedInterface job requests received from the master. Completes when a termination message is received from stop_servers().

- void stop_servers ()

  executed by the master to terminate userDefinedInterface server operations when SingleModel iteration is complete.

- const String & interface_id () const

  return the userDefinedInterface identifier

- int evaluation_id () const

  return the current evaluation id for the SingleModel (request forwarded to userDefinedInterface)

- bool evaluation_cache () const

  return flag indicated usage of an evaluation cache by the SingleModel (request forwarded to userDefinedInterface)

- void set_evaluation_reference ()

  set the evaluation counter reference points for the SingleModel (request forwarded to userDefinedInterface)

- void fine_grained_evaluation_counters ()

  request fine-grained evaluation reporting within the userDefinedInterface

- void print_evaluation_summary (std::ostream &s, bool minimal_header=false, bool relative_count=true) const

  print the evaluation summary for the SingleModel (request forwarded to userDefinedInterface)

Private Attributes

- Interface userDefinedInterface

  the interface used for mapping variables to responses

43.126.1 Detailed Description

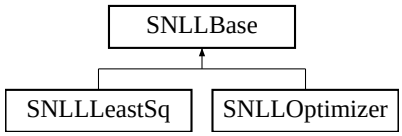
Derived model class which utilizes a single interface to map variables into responses. The SingleModel class is the simplest of the derived model classes. It provides the capabilities of the original Model class, prior to the development of surrogate and nested model extensions. The derived response computation and synchronization functions utilize a single interface to perform the function evaluations.

The documentation for this class was generated from the following files:

- SingleModel.H
- SingleModel.C

43.127 SNLLBase Class Reference

Base class for OPT++ optimization and least squares methods. Inheritance diagram for SNLLBase::



Public Member Functions

- SNLLBase ()

  default constructor

- SNLLBase (Model &model)

  standard constructor

- ~SNLLBase ()

  destructor

Protected Member Functions

- void copy_con_vals_dak_to_optpp (const RealVector &local_fn_vals, RealVector &g, const size_t &offset)

  convenience function for copying local_fn_vals to g; used by constraint evaluator functions

- void copy_con_vals_optpp_to_dak (const RealVector &g, RealVector &local_fn_vals, const size_t &offset)

  convenience function for copying g to local_fn_vals; used in final solution logging

- void copy_con_grad (const RealMatrix &local_fn_grads, RealMatrix &grad_g, const size_t &offset)

  convenience function for copying local_fn_grads to grad_g; used by constraint evaluator functions

- void copy_con_hess (const RealSymMatrixArray &local_fn_hessians, OPTPP::OptppArray< RealSymMatrix > &hess_g, const size_t &offset)

  convenience function for copying local_fn_hessians to hess_g; used by constraint evaluator functions

- void snll_pre_instantiate (const String &merit_fn, bool bound_constr_flag, const int &num_constr)

  convenience function for setting OPT++ options prior to the method instantiation

- void snll_post_instantiate (const int &num_cv, bool vendor_num_grad_flag, const String &finite_diff_type, const Real &fdss, const int &max_iter, const int &max_fn_evals, const Real &conv_tol, const

Real &grad_tol, const Real &max_step, bool bound_constr_flag, const int &num_constr, short output_-lev, OPTPP::OptimizeClass *the_optimizer, OPTPP::NLP0 *nlf_objective, OPTPP::FDNLF1 *fd_nlf1, OPTPP::FDNLF1 *fd_nlf1_con)

convenience function for setting OPT++ options after the method instantiation

- void snll_initialize_run (OPTPP::NLP0 *nlf_objective, OPTPP::NLP *nlp_constraint, const RealVector &init_pt, bool bound_constr_flag, const RealVector &lower_bnds, const RealVector &upper_bnds, const RealMatrix &lin_ineq_coeffs, const RealVector &lin_ineq_l_bnds, const RealVector &lin_ineq_u_bnds, const RealMatrix &lin_eq_coeffs, const RealVector &lin_eq_targets, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_targets)

  convenience function for OPT++ configuration prior to the method invocation

- void snll_post_run (OPTPP::NLP0 *nlf_objective)

  convenience function for setting OPT++ options after the method instantiations

Static Protected Member Functions

- static void init_fn (int n, RealVector &x)

  An initialization mechanism provided by OPT++ (not currently used).

Protected Attributes

- String searchMethod

  value_based_line_search, gradient_based_line_search, trust_region, or tr_pds

- OPTPP::SearchStrategy searchStrat

  enum: LineSearch, TrustRegion, or TrustPDS

- OPTPP::MeritFcn meritFn

  enum: NormFmu, ArgaezTapia, or VanShanno

- bool constantASVFlag

  flags a user selection of active_set_vector == constant. By mapping this into mode override, reliance on duplicate detection can be avoided.

Static Protected Attributes

- static Minimizer * optLSqInstance

  pointer to the active base class object instance used within the static evaluator functions in order to avoid the need for static data

- static bool modeOverrideFlag

flags OPT++ mode override (for combining value, gradient, and Hessian requests)

- static EvalType lastFnEvalLocn

  an enum used to track whether an nlf evaluator or a constraint evaluator was the last location of a function evaluation

- static int lastEvalMode

  copy of mode from constraint evaluators

- static RealVector lastEvalVars

  copy of variables from constraint evaluators

43.127.1 Detailed Description

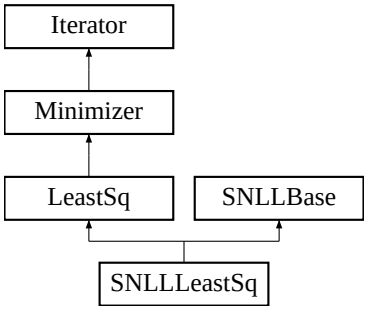
Base class for OPT++ optimization and least squares methods. The SNLLBase class provides a common base class for SNLLOptimizer and SNLLLeastSq, both of which are wrappers for OPT++, a C++ optimization library from the Computational Sciences and Mathematics Research (CSMR) department at Sandia's Livermore CA site.

The documentation for this class was generated from the following files:

- SNLLBase.H
- SNLLBase.C

43.128 SNLLLeastSq Class Reference

Wrapper class for the OPT++ optimization library. Inheritance diagram for SNLLLeastSq::



Public Member Functions

- SNLLLeastSq (Model &model)
  standard constructor
- SNLLLeastSq (const String &method_name, Model &model)
  alternate constructor for instantiations without ProblemDescDB support
- ~SNLLLeastSq ()
  destructor
- void minimize_residuals ()
  Performs the iterations to determine the least squares solution.

Protected Member Functions

- void initialize_run ()
  invokes LeastSq::initialize_run(), SNLLBase::snll_initialize_run(), and performs other set-up
- void post_run (std::ostream &s)
  invokes snll_post_run and re-implements post_run (does not call parent) and performs other solution processing
- void finalize_run ()
  restores instances

Static Private Member Functions

- static void nlf2_evaluator_gn (int mode, int n, const RealVector &x, double &f, RealVector &grad_f, RealSymMatrix &hess_f, int &result_mode)

objective function evaluator function which obtains values and gradients for least square terms and computes objective function value, gradient, and Hessian using the Gauss-Newton approximation.

- static void constraint1_evaluator_gn (int mode, int n, const RealVector &x, RealVector &g, RealMatrix &grad_g, int &result_mode)

  constraint evaluator function which provides constraint values and gradients to OPT++ Gauss-Newton methods.

- static void constraint2_evaluator_gn (int mode, int n, const RealVector &x, RealVector &g, RealMatrix &grad_g, OPTPP::OptppArray< RealSymMatrix > &hess_g, int &result_mode)

  constraint evaluator function which provides constraint values, gradients, and Hessians to OPT++ Gauss-Newton methods.

Private Attributes

- SNLLLeastSq * prevSnllLSqInstance

  pointer to the previously active object instance used for restoration in the case of iterator/model recursion

- OPTPP::NLP0 * nlfObjective

  objective NLF base class pointer

- OPTPP::NLP0 * nlfConstraint

  constraint NLF base class pointer

- OPTPP::NLP * nlpConstraint

  constraint NLP pointer

- OPTPP::NLF2 * nlf2

  pointer to objective NLF for full Newton optimizers

- OPTPP::NLF2 * nlf2Con

  pointer to constraint NLF for full Newton optimizers

- OPTPP::NLF1 * nlf1Con

  pointer to constraint NLF for Quasi Newton optimizers

- OPTPP::OptimizeClass * theOptimizer

  optimizer base class pointer

- OPTPP::OptNewton * optnewton

  Newton optimizer pointer.

- OPTPP::OptBCNewton * optbcnewton

  Bound constrained Newton optimizer ptr.

- OPTPP::OptDHNIPS * optdhnips

  Disaggregated Hessian NIPS optimizer ptr.

Static Private Attributes

- static SNLLLeastSq * snllLSqInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.128.1 Detailed Description

Wrapper class for the OPT++ optimization library. The SNLLLeastSq class provides a wrapper for OPT++, a C++ optimization library of nonlinear programming and pattern search techniques from the Computational Sciences and Mathematics Research (CSMR) department at Sandia's Livermore CA site. It uses a function pointer approach for which passed functions must be either global functions or static member functions. Any attribute used within static member functions must be either local to that function, a static member, or accessed by static pointer.

The user input mappings are as follows: `max_iterations`, `max_function_evaluations`, `convergence_tolerance`, `max_step`, `gradient_tolerance`, `search_method`, and `search_scheme_size` are set using OPT++'s setMaxIter(), setMaxFeval(), setFcnTol(), setMaxStep(), setGradTol(), setSearchStrategy(), and setSSS() member functions, respectively; `output` verbosity is used to toggle OPT++'s debug mode using the setDebug() member function. Internal to OPT++, there are 3 search strategies, while the DAKOTA `search_method` specification supports 4 (`value_based_line_search`, `gradient_based_line_search`, `trust_region`, or `tr_pds`). The difference stems from the "is_expensive" flag in OPT++. If the search strategy is LineSearch and "is_expensive" is turned on, then the `value_based_line_search` is used. Otherwise (the "is_expensive" default is off), the algorithm will use the `gradient_based_line_search`. Refer to [Meza, J.C., 1994] and to the OPT++ source in the Dakota/packages/OPTPP directory for information on OPT++ class member functions.

43.128.2 Member Function Documentation

43.128.2.1 void post_run (std::ostream & *s*) `[protected, virtual]`

invokes snll_post_run and re-implements post_run (does not call parent) and performs other solution processing SNLLLeastSq requires fn DB lookup, so overrides LeastSq::post_run and directly invokes Iterator::post_run when complete.

Reimplemented from LeastSq.

References Iterator::activeSet, Iterator::bestResponseArray, Iterator::bestVariablesArray, SNLLBase::copy_con_vals_optpp_to_dak(), Dakota::copy_data_partial(), Minimizer::cvScaleMultipliers, Minimizer::cvScaleOffsets, Minimizer::cvScaleTypes, Dakota::data_pairs, Response::function_values(), LeastSq::get_confidence_intervals(), Model::interface_id(), Iterator::iteratedModel, Dakota::lookup_by_val(), Minimizer::modify_s2n(), SNLLLeastSq::nlfObjective, Iterator::numFunctions, LeastSq::numLeastSqTerms, Minimizer::numNonlinearConstraints, ActiveSet::request_values(), ActiveSet::request_vector(), Minimizer::responseScaleMultipliers, Minimizer::responseScaleOffsets, Minimizer::responseScaleTypes, Minimizer::secondaryRespScaleFlag, SNLLBase::snll_post_run(), SNLLLeastSq::theOptimizer, and Minimizer::varsScaleFlag.

43.128.2.2 void nlf2_evaluator_gn (int *mode*, int *n*, const RealVector & *x*, double & *f*, RealVector & *grad_f*, RealSymMatrix & *hess_f*, int & *result_mode*) [static, private]

objective function evaluator function which obtains values and gradients for least square terms and computes objective function value, gradient, and Hessian using the Gauss-Newton approximation. This nlf2 evaluator function is used for the Gauss-Newton method in order to exploit the special structure of the nonlinear least squares problem. Here, fx = sum (T_i - Tbar_i)^2 and Response is made up of residual functions and their gradients along with any nonlinear constraints. The objective function and its gradient vector and Hessian matrix are computed directly from the residual functions and their derivatives (which are returned from the Response object).

References Dakota::abort_handler(), Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), Model::current_response(), Response::function_gradients(), Response::function_values(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Iterator::numFunctions, LeastSq::numLeastSqTerms, Minimizer::numNonlinearConstraints, Iterator::outputLevel, ActiveSet::request_vector(), SNLLLeastSq::snlllLSqInstance, Dakota::write_data(), and Dakota::write_precision.

Referenced by SNLLLeastSq::SNLLLeastSq().

43.128.2.3 void constraint1_evaluator_gn (int *mode*, int *n*, const RealVector & *x*, RealVector & *g*, RealMatrix & *grad_g*, int & *result_mode*) [static, private]

constraint evaluator function which provides constraint values and gradients to OPT++ Gauss-Newton methods. While it does not employ the Gauss-Newton approximation, it is distinct from constraint1_evaluator() due to its need to anticipate the required modes for the least squares terms. This constraint evaluator function is used with diaggregated Hessian NIPS and is currently active.

References Dakota::abort_handler(), Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), SNLLBase::copy_con_grad(), SNLLBase::copy_con_vals_dak_to_optpp(), Model::current_response(), Response::function_gradients(), Response::function_values(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Iterator::numFunctions, LeastSq::numLeastSqTerms, Iterator::outputLevel, ActiveSet::request_vector(), and SNLLLeastSq::snlllLSqInstance.

Referenced by SNLLLeastSq::SNLLLeastSq().

43.128.2.4 void constraint2_evaluator_gn (int *mode*, int *n*, const RealVector & *x*, RealVector & *g*, RealMatrix & *grad_g*, OPTPP::OptppArray< RealSymMatrix > & *hess_g*, int & *result_mode*) [static, private]

constraint evaluator function which provides constraint values, gradients, and Hessians to OPT++ Gauss-Newton methods. While it does not employ the Gauss-Newton approximation, it is distinct from constraint2_evaluator() due to its need to anticipate the required modes for the least squares terms. This constraint evaluator function is used with full Newton NIPS and is currently inactive.

References Dakota::abort_handler(), Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), SNLLBase::copy_con_grad(), SNLLBase::copy_con_hess(), SNLLBase::copy_con_vals_dak_to_optpp(), Model::current_response(), Response::function_gradients(), Response::function_hessians(), Response::function_values(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, SNLLBase::modeOverrideFlag, Iterator::numFunctions,

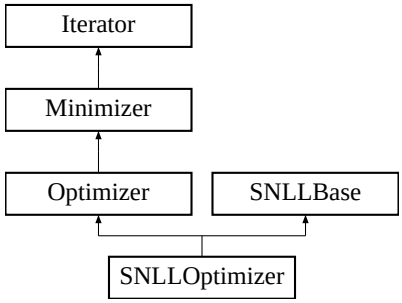
LeastSq::numLeastSqTerms, Iterator::outputLevel, ActiveSet::request_vector(), and SNLL-LeastSq::snllLSqInstance.

The documentation for this class was generated from the following files:

- SNLLLeastSq.H
- SNLLLeastSq.C

43.129 SNLLOptimizer Class Reference

Wrapper class for the OPT++ optimization library. Inheritance diagram for SNLLOptimizer::



Public Member Functions

- SNLLOptimizer (Model &model)

  standard constructor

- SNLLOptimizer (const String &method_name, Model &model)

  alternate constructor for instantiations "on the fly"

- SNLLOptimizer (const RealVector &initial_pt, const RealVector &var_l_bnds, const RealVector &var_u_bnds, const RealMatrix &lin_ineq_coeffs, const RealVector &lin_ineq_l_bnds, const RealVector &lin_ineq_u_bnds, const RealMatrix &lin_eq_coeffs, const RealVector &lin_eq_tgts, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_tgts, void(∗user_obj_eval)(int mode, int n, const RealVector &x, double &f, RealVector &grad_f, int &result_mode), void(∗user_con_eval)(int mode, int n, const RealVector &x, RealVector &g, RealMatrix &grad_g, int &result_mode))

  alternate constructor for instantiations "on the fly"

- ∼SNLLOptimizer ()

  destructor

- void find_optimum ()

  Performs the iterations to determine the optimal solution.

Protected Member Functions

- void initialize_run ()

  invokes Optimizer::initialize_run(), SNLLBase::snll_initialize_run(), and performs other set-up

- void post_run (std::ostream &s)

  performs data recovery and calls Optimizer::post_run()

- void finalize_run ()

  performs cleanup, restores instances and calls parent finalize

Static Private Member Functions

- static void nlf0_evaluator (int n, const RealVector &x, double &f, int &result_mode)

  objective function evaluator function for OPT++ methods which require only function values.

- static void nlf1_evaluator (int mode, int n, const RealVector &x, double &f, RealVector &grad_f, int &result_mode)

  objective function evaluator function which provides function values and gradients to OPT++ methods.

- static void nlf2_evaluator (int mode, int n, const RealVector &x, double &f, RealVector &grad_f, RealSymMatrix &hess_f, int &result_mode)

  objective function evaluator function which provides function values, gradients, and Hessians to OPT++ methods.

- static void constraint0_evaluator (int n, const RealVector &x, RealVector &g, int &result_mode)

  constraint evaluator function for OPT++ methods which require only constraint values.

- static void constraint1_evaluator (int mode, int n, const RealVector &x, RealVector &g, RealMatrix &grad_g, int &result_mode)

  constraint evaluator function which provides constraint values and gradients to OPT++ methods.

- static void constraint2_evaluator (int mode, int n, const RealVector &x, RealVector &g, RealMatrix &grad_g, OPTPP::OptppArray< RealSymMatrix > &hess_g, int &result_mode)

  constraint evaluator function which provides constraint values, gradients, and Hessians to OPT++ methods.

Private Attributes

- SNLLOptimizer * prevSnllOptInstance

  pointer to the previously active object instance used for restoration in the case of iterator/model recursion

- OPTPP::NLP0 * nlfObjective

  objective NLF base class pointer

- OPTPP::NLP0 * nlfConstraint

  constraint NLF base class pointer

- OPTPP::NLP * nlpConstraint

  constraint NLP pointer

- OPTPP::NLF0 * nlf0

pointer to objective NLF for nongradient optimizers

- OPTPP::NLF1 * nlf1

  pointer to objective NLF for (analytic) gradient-based optimizers

- OPTPP::NLF1 * nlf1Con

  pointer to constraint NLF for (analytic) gradient-based optimizers

- OPTPP::FDNLF1 * fdnlf1

  pointer to objective NLF for (finite diff) gradient-based optimizers

- OPTPP::FDNLF1 * fdnlf1Con

  pointer to constraint NLF for (finite diff) gradient-based optimizers

- OPTPP::NLF2 * nlf2

  pointer to objective NLF for full Newton optimizers

- OPTPP::NLF2 * nlf2Con

  pointer to constraint NLF for full Newton optimizers

- OPTPP::OptimizeClass * theOptimizer

  optimizer base class pointer

- OPTPP::OptPDS * optpds

  PDS optimizer pointer.

- OPTPP::OptCG * optcg

  CG optimizer pointer.

- OPTPP::OptLBFGS * optlbfgs

  L-BFGS optimizer pointer.

- OPTPP::OptNewton * optnewton

  Newton optimizer pointer.

- OPTPP::OptQNewton * optqnewton

  Quasi-Newton optimizer pointer.

- OPTPP::OptFDNewton * optfdnewton

  Finite Difference Newton opt pointer.

- OPTPP::OptBCNewton * optbcnewton

  Bound constrained Newton opt pointer.

- OPTPP::OptBCQNewton * optbcqnewton

  Bnd constrained Quasi-Newton opt ptr.

- OPTPP::OptBCFDNewton * optbcfdnewton

  Bnd constrained FD-Newton opt ptr.

- OPTPP::OptNIPS * optnips

  NIPS optimizer pointer.

- OPTPP::OptQNIPS * optqnips

  Quasi-Newton NIPS optimizer pointer.

- OPTPP::OptFDNIPS * optfdnips

  Finite Difference NIPS opt pointer.

- String setUpType

  flag for iteration mode: "model" (normal usage) or "user_functions" (user-supplied functions mode for "on the fly" instantiations). NonDReliability currently uses the user_functions mode.

- RealVector initialPoint

  holds initial point passed in for "user_functions" mode.

- RealVector lowerBounds

  holds variable lower bounds passed in for "user_functions" mode.

- RealVector upperBounds

  holds variable upper bounds passed in for "user_functions" mode.

Static Private Attributes

- static SNLLOptimizer * snllOptInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

43.129.1 Detailed Description

Wrapper class for the OPT++ optimization library. The SNLLOptimizer class provides a wrapper for OPT++, a C++ optimization library of nonlinear programming and pattern search techniques from the Computational Sciences and Mathematics Research (CSMR) department at Sandia's Livermore CA site. It uses a function pointer approach for which passed functions must be either global functions or static member functions. Any attribute used within static member functions must be either local to that function, a static member, or accessed by static pointer.

The user input mappings are as follows: `max_iterations`, `max_function_evaluations`, `convergence_tolerance`, `max_step`, `gradient_tolerance`, `search_method`, and `search_scheme_size` are set using OPT++'s setMaxIter(), setMaxFeval(), setFcnTol(), setMaxStep(), setGradTol(), setSearchStrategy(), and setSSS() member functions, respectively; `output` verbosity is used to toggle OPT++'s

debug mode using the setDebug() member function. Internal to OPT++, there are 3 search strategies, while the DAKOTA `search_method` specification supports 4 (`value_based_line_search`, `gradient_based_line_search`, `trust_region`, or `tr_pds`). The difference stems from the "is_expensive" flag in OPT++. If the search strategy is LineSearch and "is_expensive" is turned on, then the `value_based_line_search` is used. Otherwise (the "is_expensive" default is off), the algorithm will use the `gradient_based_line_search`. Refer to [Meza, J.C., 1994] and to the OPT++ source in the Dakota/packages/OPTPP directory for information on OPT++ class member functions.

43.129.2 Constructor & Destructor Documentation

43.129.2.1 SNLLOptimizer (Model & *model*)

standard constructor This constructor is used for normal instantiations using data from the ProblemDescDB.

References Dakota::abort_handler(), Minimizer::boundConstraintFlag, SNLLOptimizer::constraint0_evaluator(), SNLLOptimizer::constraint1_evaluator(), SNLLOptimizer::constraint2_evaluator(), Iterator::convergenceTol, Iterator::fdGradStepSize, SNLLOptimizer::fdnlf1, SNLLOptimizer::fdnlf1Con, ProblemDescDB::get_int(), ProblemDescDB::get_real(), ProblemDescDB::get_string(), Model::init_communicators(), SNLLBase::init_fn(), Iterator::intervalType, Iterator::iteratedModel, Dakota::LARGE_SCALE, Optimizer::localObjectiveRecast, Iterator::maxConcurrency, Iterator::maxFunctionEvals, Iterator::maxIterations, SNLLBase::meritFn, Iterator::methodName, SNLLOptimizer::nlf0, SNLLOptimizer::nlf0_evaluator(), SNLLOptimizer::nlf1, SNLLOptimizer::nlf1_evaluator(), SNLLOptimizer::nlf1Con, SNLLOptimizer::nlf2, SNLLOptimizer::nlf2_evaluator(), SNLLOptimizer::nlf2Con, SNLLOptimizer::nlfConstraint, SNLLOptimizer::nlfObjective, SNLLOptimizer::nlpConstraint, Minimizer::numConstraints, Iterator::numContinuousVars, Minimizer::numNonlinearConstraints, SNLLOptimizer::optbcfdnewton, SNLLOptimizer::optbcnewton, SNLLOptimizer::optbcqnewton, SNLLOptimizer::optcg, SNLLOptimizer::optfdnewton, SNLLOptimizer::optfdnips, SNLLOptimizer::optlbfgs, SNLLOptimizer::optnewton, SNLLOptimizer::optnips, SNLLOptimizer::optpds, SNLLOptimizer::optqnewton, SNLLOptimizer::optqnips, Iterator::outputLevel, Iterator::probDescDB, Minimizer::scaleFlag, SNLLBase::searchStrat, SNLLBase::snll_post_instantiate(), SNLLBase::snll_pre_instantiate(), SNLLOptimizer::theOptimizer, and Minimizer::vendorNumericalGradFlag.

43.129.2.2 SNLLOptimizer (const String & *method_name*, Model & *model*)

alternate constructor for instantiations "on the fly" This is an alternate constructor for instantiations on the fly using a Model but no ProblemDescDB.

References Minimizer::boundConstraintFlag, SNLLOptimizer::constraint1_evaluator(), Iterator::convergenceTol, Iterator::fdGradStepSize, SNLLBase::init_fn(), Iterator::intervalType, Dakota::LARGE_SCALE, Iterator::maxFunctionEvals, Iterator::maxIterations, SNLLBase::meritFn, Iterator::methodName, SNLLOptimizer::nlf1, SNLLOptimizer::nlf1_evaluator(), SNLLOptimizer::nlf1Con, SNLLOptimizer::nlfConstraint, SNLLOptimizer::nlfObjective, SNLLOptimizer::nlpConstraint, Minimizer::numConstraints, Iterator::numContinuousVars, Minimizer::numNonlinearConstraints, SNLLOptimizer::optbcqnewton, SNLLOptimizer::optlbfgs, SNLLOptimizer::optqnewton, SNLLOptimizer::optqnips, Iterator::outputLevel, SNLLBase::searchStrat, SNLLBase::snll_post_instantiate(), SNLLBase::snll_pre_instantiate(), SNLLOptimizer::theOptimizer, and Minimizer::vendorNumericalGradFlag.

43.129.2.3 SNLLOptimizer (const RealVector & *initial_pt*, const RealVector & *var_l_bnds*, const RealVector & *var_u_bnds*, const RealMatrix & *lin_ineq_coeffs*, const RealVector & *lin_ineq_l_bnds*, const RealVector & *lin_ineq_u_bnds*, const RealMatrix & *lin_eq_coeffs*, const RealVector & *lin_eq_tgts*, const RealVector & *nln_ineq_l_bnds*, const RealVector & *nln_ineq_u_bnds*, const RealVector & *nln_eq_tgts*, void(∗)(int mode, int n, const RealVector &x, double &f, RealVector &grad_f, int &result_mode) *user_obj_eval*, void(∗)(int mode, int n, const RealVector &x, RealVector &g, RealMatrix &grad_g, int &result_mode) *user_con_eval*)

alternate constructor for instantiations "on the fly" This is an alternate constructor for performing an optimization using the passed in objective function and constraint function pointers.

References Minimizer::bigRealBoundSize, Minimizer::boundConstraintFlag, SNLLBase::init_fn(), SNLLOptimizer::initialPoint, Dakota::LARGE_SCALE, SNLLOptimizer::lowerBounds, SNLLBase::meritFn, SNLLOptimizer::nlf1, SNLLOptimizer::nlf1Con, SNLLOptimizer::nlfConstraint, SNLLOptimizer::nlfObjective, SNLLOptimizer::nlpConstraint, Minimizer::numConstraints, Iterator::numContinuousVars, Minimizer::numNonlinearConstraints, SNLLOptimizer::optbcqnewton, SNLLOptimizer::optlbfgs, SNLLOptimizer::optqnewton, SNLLOptimizer::optqnips, Iterator::outputLevel, SNLLBase::searchStrat, SNLLBase::snll_initialize_run(), SNLLBase::snll_post_instantiate(), SNLLBase::snll_pre_instantiate(), SNLLOptimizer::theOptimizer, and SNLLOptimizer::upperBounds.

43.129.3 Member Function Documentation

43.129.3.1 void nlf0_evaluator (int *n*, const RealVector & *x*, double & *f*, int & *result_mode*) `[static, private]`

objective function evaluator function for OPT++ methods which require only function values. For use when DAKOTA computes f and gradients are not directly available. This is used by nongradient-based optimizers such as PDS and by gradient-based optimizers in vendor numerical gradient mode (opt++'s internal finite difference routine is used).

References Model::compute_response(), Model::continuous_variables(), Model::current_response(), Response::function_value(), Iterator::iteratedModel, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Minimizer::numNonlinearConstraints, Iterator::outputLevel, and SNLLOptimizer::snllOptInstance.

Referenced by SNLLOptimizer::SNLLOptimizer().

43.129.3.2 void nlf1_evaluator (int *mode*, int *n*, const RealVector & *x*, double & *f*, RealVector & *grad_f*, int & *result_mode*) `[static, private]`

objective function evaluator function which provides function values and gradients to OPT++ methods. For use when DAKOTA computes f and df/dX (regardless of gradientType). Vendor numerical gradient case is handled by nlf0_evaluator.

References Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), Model::current_response(), Response::function_gradient_copy(), Response::function_value(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Minimizer::numNonlinearConstraints, Iterator::outputLevel, ActiveSet::request_values(), and SNLLOptimizer::snllOptInstance.

Referenced by SNLLOptimizer::SNLLOptimizer().

43.129.3.3 void nlf2_evaluator (int *mode*, int *n*, const RealVector & *x*, double & *f*, RealVector & *grad_f*, RealSymMatrix & *hess_f*, int & *result_mode*) [static, private]

objective function evaluator function which provides function values, gradients, and Hessians to OPT++ methods. For use when DAKOTA receives f, df/dX, & d^2f/dx^2 from the ApplicationInterface (analytic only). Finite differencing does not make sense for a full Newton approach, since lack of analytic gradients & Hessian should dictate the use of quasi-newton or fd-newton. Thus, there is no fdnlf2_evaluator for use with full Newton approaches, since it is preferable to use quasi-newton or fd-newton with nlf1. Gauss-Newton does not fit this model; it uses nlf2_evaluator_gn instead of nlf2_evaluator.

References Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), Model::current_response(), Response::function_gradient_copy(), Response::function_hessian(), Response::function_value(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Minimizer::numNonlinearConstraints, Iterator::outputLevel, ActiveSet::request_values(), and SNLLOptimizer::snllOptInstance.

Referenced by SNLLOptimizer::SNLLOptimizer().

43.129.3.4 void constraint0_evaluator (int *n*, const RealVector & *x*, RealVector & *g*, int & *result_mode*) [static, private]

constraint evaluator function for OPT++ methods which require only constraint values. For use when DAKOTA computes g and gradients are not directly available. This is used by nongradient-based optimizers and by gradient-based optimizers in vendor numerical gradient mode (opt++'s internal finite difference routine is used).

References Model::compute_response(), Model::continuous_variables(), SNLLBase::copy_con_vals_dak_to_optpp(), Model::current_response(), Response::function_values(), Iterator::iteratedModel, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Optimizer::numObjectiveFns, Iterator::outputLevel, and SNLLOptimizer::snllOptInstance.

Referenced by SNLLOptimizer::SNLLOptimizer().

43.129.3.5 void constraint1_evaluator (int *mode*, int *n*, const RealVector & *x*, RealVector & *g*, RealMatrix & *grad_g*, int & *result_mode*) [static, private]

constraint evaluator function which provides constraint values and gradients to OPT++ methods. For use when DAKOTA computes g and dg/dX (regardless of gradientType). Vendor numerical gradient case is handled by constraint0_evaluator.

References Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), SNLLBase::copy_con_grad(), SNLLBase::copy_con_vals_dak_to_optpp(), Model::current_response(), Response::function_gradients(), Response::function_values(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Optimizer::numObjectiveFns, Iterator::outputLevel, ActiveSet::request_values(), and SNLLOptimizer::snllOptInstance.

Referenced by SNLLOptimizer::SNLLOptimizer().

43.129.3.6 void constraint2_evaluator (int *mode*, int *n*, const RealVector & *x*, RealVector & *g*, RealMatrix & *grad_g*, OPTPP::OptppArray< RealSymMatrix > & *hess_g*, int & *result_mode*) [static, private]

constraint evaluator function which provides constraint values, gradients, and Hessians to OPT++ methods. For use when DAKOTA computes g, dg/dX, & d^2g/dx^2 (analytic only).

References Iterator::activeSet, Model::compute_response(), Model::continuous_variables(), SNLLBase::copy_con_grad(), SNLLBase::copy_con_hess(), SNLLBase::copy_con_vals_dak_to_optpp(), Model::current_response(), Response::function_gradients(), Response::function_hessians(), Response::function_values(), Iterator::iteratedModel, SNLLBase::lastEvalMode, SNLLBase::lastEvalVars, SNLLBase::lastFnEvalLocn, Optimizer::numObjectiveFns, Iterator::outputLevel, ActiveSet::request_values(), and SNLLOptimizer::snllOptInstance.

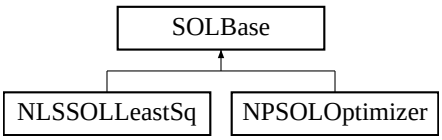
Referenced by SNLLOptimizer::SNLLOptimizer().

The documentation for this class was generated from the following files:

- SNLLOptimizer.H
- SNLLOptimizer.C

43.130 SOLBase Class Reference

Base class for Stanford SOL software. Inheritance diagram for SOLBase::



Public Member Functions

- SOLBase ()

  default constructor

- SOLBase (Model &model)

  standard constructor

- ~SOLBase ()

  destructor

Protected Member Functions

- void allocate_arrays (const int &num_cv, const size_t &num_nln_con, const RealMatrix &lin_ineq_coeffs, const RealMatrix &lin_eq_coeffs)

  Allocates miscellaneous arrays for the SOL algorithms.

- void deallocate_arrays ()

  Deallocates memory previously allocated by allocate_arrays().

- void allocate_workspace (const int &num_cv, const int &num_nln_con, const int &num_lin_con, const int &num_lsq)

  Allocates real and integer workspaces for the SOL algorithms.

- void set_options (bool speculative_flag, bool vendor_num_grad_flag, short output_lev, const int &verify_-lev, const Real &fn_prec, const Real &linesrch_tol, const int &max_iter, const Real &constr_tol, const Real &conv_tol, const std::string &grad_type, const Real &fdss)

  Sets SOL method options using calls to npoptn2.

- void augment_bounds (RealVector &augmented_l_bnds, RealVector &augmented_u_bnds, const RealVector &lin_ineq_l_bnds, const RealVector &lin_ineq_u_bnds, const RealVector &lin_eq_targets, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_targets)

  augments variable bounds with linear and nonlinear constraint bounds.

Static Protected Member Functions

- static void constraint_eval (int &mode, int &ncnln, int &n, int &nrowj, int *needc, double *x, double *c, double *cjac, int &nstate)

  CONFUN in NPSOL manual: computes the values and first derivatives of the nonlinear constraint functions.

Protected Attributes

- int realWorkSpaceSize

  size of realWorkSpace

- int intWorkSpaceSize

  size of intWorkSpace

- RealArray realWorkSpace

  real work space for NPSOL/NLSSOL

- IntArray intWorkSpace

  int work space for NPSOL/NLSSOL

- int nlnConstraintArraySize

  used for non-zero array sizing (nonlinear constraints)

- int linConstraintArraySize

  used for non-zero array sizing (linear constraints)

- RealArray cLambda

  CLAMBDA from NPSOL manual: Langrange multipliers.

- IntArray constraintState

  ISTATE from NPSOL manual: constraint status.

- int informResult

  INFORM from NPSOL manual: optimization status on exit.

- int numberIterations

  ITER from NPSOL manual: number of (major) iterations performed.

- int boundsArraySize

  length of augmented bounds arrays (variable bounds plus linear and nonlinear constraint bounds)

- double * linConstraintMatrixF77

  [A] matrix from NPSOL manual: linear constraint coefficients

- double * upperFactorHessianF77

[R] matrix from NPSOL manual: upper Cholesky factor of the Hessian of the Lagrangian.

- double * constraintJacMatrixF77

  [CJAC] matrix from NPSOL manual: nonlinear constraint Jacobian

- int fnEvalCntr

  counter for testing against maxFunctionEvals

- size_t constrOffset

  used in constraint_eval() to bridge NLSSOLLeastSq::numLeastSqTerms and NPSOLOptimizer::numObjectiveFns

Static Protected Attributes

- static SOLBase * solInstance

  pointer to the active object instance used within the static evaluator functions in order to avoid the need for static data

- static Minimizer * optLSqInstance

  pointer to the active base class object instance used within the static evaluator functions in order to avoid the need for static data

43.130.1 Detailed Description

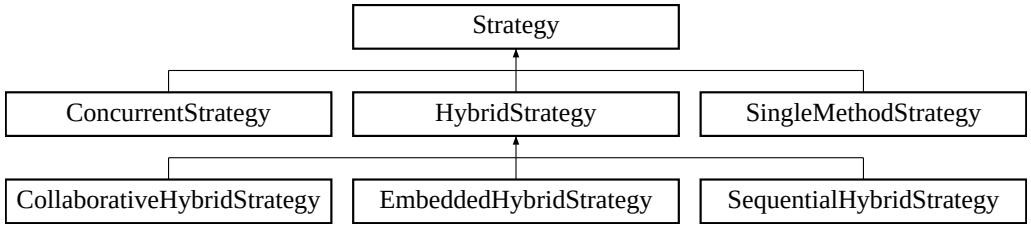
Base class for Stanford SOL software. The SOLBase class provides a common base class for NPSOLOptimizer and NLSSOLLeastSq, both of which are Fortran 77 sequential quadratic programming algorithms from Stanford University marketed by Stanford Business Associates.

The documentation for this class was generated from the following files:

- SOLBase.H
- SOLBase.C

43.131 Strategy Class Reference

Base class for the strategy class hierarchy. Inheritance diagram for Strategy::



Public Member Functions

- Strategy ()

  default constructor

- Strategy (ProblemDescDB &problem_db)

  envelope constructor

- Strategy (const Strategy &strat)

  copy constructor

- virtual ~Strategy ()

  destructor

- Strategy operator= (const Strategy &strat)

  assignment operator

- virtual void run_strategy ()

  the run function for the strategy: invoke the iterator(s) on the model(s). Called from main.C.

- virtual const Variables & variables_results () const

  return the final strategy solution (variables)

- virtual const Response & response_results () const

  return the final strategy solution (response)

- ProblemDescDB & problem_description_db () const

  returns the problem description database (probDescDB)

Protected Member Functions

- Strategy (BaseConstructor, ProblemDescDB &problem_db)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- virtual void initialize_iterator (int index)

  initialize the iterator about to be executed within a parallel iterator scheduling function (serve_iterators() or static_schedule_iterators())

- virtual void pack_parameters_buffer (MPIPackBuffer &send_buffer, int job_index)

  pack a send_buffer for assigning an iterator job to a server

- virtual void unpack_parameters_buffer (MPIUnpackBuffer &recv_buffer)

  unpack a recv_buffer for accepting an iterator job from the scheduler

- virtual void pack_results_buffer (MPIPackBuffer &send_buffer, int job_index)

  pack a send_buffer for returning iterator results from a server

- virtual void unpack_results_buffer (MPIUnpackBuffer &recv_buffer, int job_index)

  unpack a recv_buffer for accepting iterator results from a server

- virtual void update_local_results (int job_index)

  update local PRP results arrays with current iteration results

- void init_iterator_parallelism ()

  convenience function for initializing iterator communicators, setting parallel configuration attributes, and managing outputs and restart.

- void init_iterator (Iterator &the_iterator, Model &the_model)

  convenience function for allocating comms prior to running an iterator

- void run_iterator (Iterator &the_iterator, Model &the_model)

  Convenience function for invoking an iterator and managing parallelism. This version omits communicator repartitioning. Function must be public due to use by MINLPNode.

- void free_iterator (Iterator &the_iterator, Model &the_model)

  convenience function for deallocating comms after running an iterator

- void schedule_iterators (Iterator &the_iterator, Model &the_model)

  short convenience function for distributing control among self_schedule_iterators(), serve_iterators(), and static_schedule_iterators()

- void self_schedule_iterators (Model &the_model)

  executed by the strategy master to self-schedule iterator jobs among slave iterator servers (called by derived run_strategy())

- void serve_iterators (Iterator &the_iterator, Model &the_model)

  executed on the slave iterator servers to perform iterator jobs assigned by the strategy master (called by derived run_strategy())

- void static_schedule_iterators (Iterator &the_iterator, Model &the_model)

  executed on iterator peers to statically schedule iterator jobs (called by derived run_strategy())

Protected Attributes

- ProblemDescDB & probDescDB

  class member reference to the problem description database

- ParallelLibrary & parallelLib

  class member reference to the parallel library

- String strategyName

  type of strategy: single_method, hybrid, multi_start, or pareto_set.

- bool stratIterMessagePass

  flag for message passing at si level

- bool stratIterDedMaster

  flag for dedicated master part. at si level

- int worldRank

  processor rank in MPI_COMM_WORLD

- int worldSize

  size of MPI_COMM_WORLD

- int iteratorCommRank

  processor rank in iteratorComm

- int iteratorCommSize

  number of processors in iteratorComm

- int numIteratorServers

  number of concurrent iterator partitions

- int iteratorServerId

  identifier for an iterator server

- bool graph2DFlag

  flag for using 2D graphics plots

- bool tabularDataFlag

  flag for file tabulation of graphics data

- String tabularDataFile

  filename for tabulation of graphics data

- int maxConcurrency

  maximum iterator concurrency possible in Strategy

- int numIteratorJobs

  number of iterator executions to schedule

- int paramsMsgLen

  length of MPI buffer for parameter input instance(s)

- int resultsMsgLen

  length of MPI buffer for results output instance(s)

Private Member Functions

- Strategy * get_strategy ()

  Used by the envelope to instantiate the correct letter class.

Private Attributes

- Strategy * strategyRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing strategyRep

43.131.1 Detailed Description

Base class for the strategy class hierarchy. The Strategy class is the base class for the class hierarchy providing the top level control in DAKOTA. The strategy is responsible for creating and managing iterators and models. For memory efficiency and enhanced polymorphism, the strategy hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Strategy) serves as the envelope and one of the derived classes (selected in Strategy::get_strategy()) serves as the letter.

43.131.2 Constructor & Destructor Documentation

43.131.2.1 Strategy ()

default constructor Default constructor. strategyRep is NULL in this case (a populated problem_db is needed to build a meaningful Strategy object). This makes it necessary to check for NULL in the copy constructor, assignment operator, and destructor.

43.131.2.2 Strategy (ProblemDescDB & *problem_db*)

envelope constructor Used in main.C instantiation to build the envelope. This constructor only needs to extract enough data to properly execute get_strategy, since Strategy::Strategy(BaseConstructor, problem_db) builds the actual base class data inherited by the derived strategies.

References Dakota::abort_handler(), Strategy::get_strategy(), and Strategy::strategyRep.

43.131.2.3 Strategy (const Strategy & *strat*)

copy constructor Copy constructor manages sharing of strategyRep and incrementing of referenceCount.

References Strategy::referenceCount, and Strategy::strategyRep.

43.131.2.4 ~Strategy () `[virtual]`

destructor Destructor decrements referenceCount and only deletes strategyRep when referenceCount reaches zero.

References ParallelLibrary::free_iterator_communicators(), ParallelLibrary::is_null(), Strategy::parallelLib, Strategy::referenceCount, and Strategy::strategyRep.

43.131.2.5 Strategy (BaseConstructor, ProblemDescDB & *problem_db*) `[protected]`

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all inherited strategies. get_strategy() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_strategy() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~Strategy).

References ProblemDescDB::get_int(), Strategy::probDescDB, and Dakota::write_precision.

43.131.3 Member Function Documentation

43.131.3.1 Strategy operator= (const Strategy & *strat*)

assignment operator Assignment operator decrements referenceCount for old strategyRep, assigns new strategyRep, and increments referenceCount for new strategyRep.

References Strategy::referenceCount, and Strategy::strategyRep.

43.131.3.2 void pack_parameters_buffer (MPIPackBuffer & *send_buffer*, int *job_index*) [protected, virtual]

pack a send_buffer for assigning an iterator job to a server This virtual function redefinition is executed on the dedicated master processor for self scheduling. It is not used for peer partitions.

Reimplemented in ConcurrentStrategy, and SequentialHybridStrategy.

References Strategy::pack_parameters_buffer(), and Strategy::strategyRep.

Referenced by Strategy::pack_parameters_buffer(), and Strategy::self_schedule_iterators().

43.131.3.3 void unpack_parameters_buffer (MPIUnpackBuffer & *recv_buffer*) [protected, virtual]

unpack a recv_buffer for accepting an iterator job from the scheduler This virtual function redefinition is executed on an iterator server for dedicated master self scheduling. It is not used for peer partitions.

Reimplemented in ConcurrentStrategy, and SequentialHybridStrategy.

References Strategy::strategyRep, and Strategy::unpack_parameters_buffer().

Referenced by Strategy::serve_iterators(), and Strategy::unpack_parameters_buffer().

43.131.3.4 void pack_results_buffer (MPIPackBuffer & *send_buffer*, int *job_index*) [protected, virtual]

pack a send_buffer for returning iterator results from a server This virtual function redefinition is executed either on an iterator server for dedicated master self scheduling or on peers 2 through n for static scheduling.

Reimplemented in ConcurrentStrategy, and SequentialHybridStrategy.

References Strategy::pack_results_buffer(), and Strategy::strategyRep.

Referenced by Strategy::pack_results_buffer(), Strategy::serve_iterators(), and Strategy::static_schedule_-iterators().

43.131.3.5 void unpack_results_buffer (MPIUnpackBuffer & *recv_buffer*, int *job_index*) [protected, virtual]

unpack a recv_buffer for accepting iterator results from a server This virtual function redefinition is executed on an strategy master (either the dedicated master processor for self scheduling or peer 1 for static scheduling).

Reimplemented in ConcurrentStrategy, and SequentialHybridStrategy.

References Strategy::strategyRep, and Strategy::unpack_results_buffer().

Referenced by Strategy::self_schedule_iterators(), Strategy::static_schedule_iterators(), and Strategy::unpack_-results_buffer().

43.131.3.6 void init_iterator_parallelism () [protected]

convenience function for initializing iterator communicators, setting parallel configuration attributes, and managing outputs and restart. This function is called from derived class constructors once maxConcurrency is defined but prior to instantiating Iterators and Models.

References ParallelLevel::dedicated_master_flag(), ProblemDescDB::get_int(), ProblemDescDB::get_string(), ParallelLibrary::init_iterator_communicators(), Strategy::iteratorCommRank, Strategy::iteratorCommSize, Strategy::iteratorServerId, ParallelLibrary::manage_outputs_restart(), Strategy::maxConcurrency, ParallelLevel::message_pass(), ParallelLevel::num_servers(), Strategy::numIteratorServers, Strategy::parallelLib, Strategy::probDescDB, ParallelLevel::server_communicator_rank(), ParallelLevel::server_communicator_size(), ParallelLevel::server_id(), Strategy::stratIterDedMaster, and Strategy::stratIterMessagePass.

Referenced by CollaborativeHybridStrategy::CollaborativeHybridStrategy(), ConcurrentStrategy::ConcurrentStrategy(), EmbeddedHybridStrategy::EmbeddedHybridStrategy(), SequentialHybridStrategy::SequentialHybridStrategy(), and SingleMethodStrategy::SingleMethodStrategy().

43.131.3.7 void init_iterator (Iterator & *the_iterator*, Model & *the_model*) [protected]

convenience function for allocating comms prior to running an iterator This is a convenience function for encapsulating the allocation of communicators prior to running an iterator. It does not require a strategyRep forward since it is only used by letter objects.

References ProblemDescDB::get_iterator(), Model::init_comms_bcast_flag(), Model::init_communicators(), Strategy::iteratorCommRank, Strategy::iteratorCommSize, Iterator::maximum_concurrency(), Strategy::probDescDB, Model::serve_configurations(), and Model::stop_configurations().

Referenced by HybridStrategy::allocate_methods(), ConcurrentStrategy::ConcurrentStrategy(), and SingleMethodStrategy::SingleMethodStrategy().

43.131.3.8 void run_iterator (Iterator & *the_iterator*, Model & *the_model*) [protected]

Convenience function for invoking an iterator and managing parallelism. This version omits communicator repartitioning. Function must be public due to use by MINLPNode. This is a convenience function for encapsulating the parallel features (run/serve) of running an iterator. This function omits allocation/deallocation of communicators to provide greater efficiency in those strategies which involve multiple iterator executions but only require communicator allocation/deallocation to be performed once.

It does not require a strategyRep forward since it is only used by letter objects. While it is currently a public function due to its use in MINLPNode, this usage still involves a strategy letter object.

References Strategy::iteratorCommRank, Iterator::maximum_concurrency(), Iterator::run_iterator(), Model::serve(), Model::set_communicators(), and Model::stop_servers().

Referenced by SequentialHybridStrategy::run_sequential_adaptive(), SingleMethodStrategy::run_strategy(), Strategy::serve_iterators(), and Strategy::static_schedule_iterators().

43.131.3.9 void free_iterator (Iterator & *the_iterator*, Model & *the_model*) [protected]

convenience function for deallocating comms after running an iterator This is a convenience function for encapsulating the deallocation of communicators after running an iterator. It does not require a strategyRep forward

since it is only used by letter objects.

References Model::free_communicators(), and Iterator::maximum_concurrency().

Referenced by HybridStrategy::deallocate_methods(), ConcurrentStrategy::∼ConcurrentStrategy(), and SingleMethodStrategy::∼SingleMethodStrategy().

43.131.3.10 void schedule_iterators (Iterator & *the_iterator*, Model & *the_model*) [protected]

short convenience function for distributing control among self_schedule_iterators(), serve_iterators(), and static_schedule_iterators() This implementation supports the scheduling of multiple jobs using a single iterator/model pair. Additional future (overloaded) implementations could involve independent iterator instances.

References Strategy::self_schedule_iterators(), Strategy::serve_iterators(), Strategy::static_schedule_iterators(), Strategy::stratIterDedMaster, and Strategy::worldRank.

Referenced by SequentialHybridStrategy::run_sequential(), EmbeddedHybridStrategy::run_strategy(), ConcurrentStrategy::run_strategy(), and CollaborativeHybridStrategy::run_strategy().

43.131.3.11 void self_schedule_iterators (Model & *the_model*) [protected]

executed by the strategy master to self-schedule iterator jobs among slave iterator servers (called by derived run_strategy()) This function is adapted from ApplicationInterface::self_schedule_evaluations().

References ParallelLibrary::free(), ParallelLibrary::irecv_si(), ParallelLibrary::isend_si(), Strategy::numIteratorJobs, Strategy::numIteratorServers, Strategy::pack_parameters_buffer(), Strategy::parallelLib, ParallelLibrary::print_configuration(), MPIPackBuffer::reset(), MPIUnpackBuffer::resize(), Strategy::resultsMsgLen, Strategy::unpack_results_buffer(), ParallelLibrary::waitall(), and ParallelLibrary::waitsome().

Referenced by Strategy::schedule_iterators().

43.131.3.12 void serve_iterators (Iterator & *the_iterator*, Model & *the_model*) [protected]

executed on the slave iterator servers to perform iterator jobs assigned by the strategy master (called by derived run_strategy()) This function is similar in structure to ApplicationInterface::serve_evaluations_synch().

References ParallelLibrary::bcast_i(), Strategy::iteratorCommRank, Strategy::iteratorCommSize, Strategy::pack_results_buffer(), ParallelLibrary::parallel_time(), Strategy::parallelLib, Strategy::paramsMsgLen, ParallelLibrary::recv_si(), Strategy::resultsMsgLen, Strategy::run_iterator(), ParallelLibrary::send_si(), Strategy::unpack_parameters_buffer(), and Strategy::update_local_results().

Referenced by Strategy::schedule_iterators().

43.131.3.13 Strategy ∗ get_strategy () [private]

Used by the envelope to instantiate the correct letter class. Used only by the envelope constructor to initialize strategyRep to the appropriate derived type, as given by the strategyName attribute.

References String::begins(), ProblemDescDB::get_string(), Strategy::probDescDB, and Strategy::strategyName.

Referenced by Strategy::Strategy().

The documentation for this class was generated from the following files:

- DakotaStrategy.H
- DakotaStrategy.C

43.132 String Class Reference

Dakota::String class, used as main string class for Dakota.

Public Member Functions

- String ()

  Default constructor.

- String (const String &a)

  Copy constructor for incoming String.

- String (const String &a, size_t start_index, size_t num_items)

  Copy constructor for portion of incoming String.

- String (const char *c_string)

  Copy constructor for incoming char array.*

- String (const std::string &a)

  Copy constructor for incoming base string.

- ~String ()

  Destructor.

- String & operator= (const String &)

  Assignment operator for incoming String.

- String & operator= (const std::string &)

  Assignment operator for incoming base string.

- String & operator= (const char *)

  Assignment operator for incoming char array.*

- operator const char * () const

  The operator() returns pointer to standard C char array.

- String & toUpper ()

  Convert to upper case string.

- void upper ()
- String & toLower ()

  Convert to lower case string.

- void lower ()
- bool contains (const char *sub_string) const

Returns true if String contains char∗ substring.

- bool begins (const char ∗sub_string) const

  Returns true if String starts with char∗ substring.

- bool ends (const char ∗sub_string) const

  Returns true if String ends with char∗ substring.

- char ∗ data () const

  Returns pointer to standard C char array.

43.132.1 Detailed Description

Dakota::String class, used as main string class for Dakota. The Dakota::String class is the common string class for Dakota. It provides a common interface for string operations whether using the std::string interface or the (legacy) RogueWave RWCString API

43.132.2 Member Function Documentation

43.132.2.1 operator const char ∗ () const `[inline]`

The operator() returns pointer to standard C char array. The operator () returns a pointer to a char string. Uses the STL c_str() method. This allows for the String to be used in method calls without having to call the data() or c_str() methods.

43.132.2.2 void upper ()

Private method which converts String to upper. Utilizes an STL iterator to step through the string and then calls the STL toupper() method. Needs to be done this way because STL only provides a single char toupper method.

Referenced by Dakota::toUpper(), and String::toUpper().

43.132.2.3 void lower ()

Private method which converts String to lower. Utilizes an STL iterator to step through the string and then calls the STL tolower() method. Needs to be done this way because STL only provides a single char tolower method.

Referenced by Dakota::toLower(), and String::toLower().

43.132.2.4 bool contains (const char ∗ *sub_string*) const `[inline]`

Returns true if String contains char∗ substring. Returns true if the String contains the char∗ sub_string. Uses the STL find() method.

Referenced by Interface::algebraic_function_type().

43.132.2.5 bool begins (const char ∗ *sub_string*) const [inline]

Returns true if String starts with char∗ substring. Returns true if the String begins with the char∗ sub_string. Uses the STL compare() method.

Referenced by PecosApproximation::approx_type_to_basis_type(), DataFitSurrModel::approximation_coefficients(), DataFitSurrModel::build_local_multipoint(), ProblemDescDB::check_input(), DataFitSurrModel::DataFitSurrModel(), SurrogateModel::force_rebuild(), ProblemDescDB::get_dis(), ProblemDescDB::get_ds2a(), Iterator::get_iterator(), ProblemDescDB::get_real(), ProblemDescDB::get_rsdm(), Strategy::get_strategy(), ProblemDescDB::get_string(), ProblemDescDB::get_ushort(), Variables::get_view(), NLPQLPOptimizer::initialize(), NCSUOptimizer::initialize(), DOTOptimizer::initialize(), CONMINOptimizer::initialize(), SurrBasedMinimizer::initialize_graphics(), Minimizer::Minimizer(), Optimizer::Optimizer(), ParamStudy::ParamStudy(), SurrBasedMinimizer::print_results(), ProblemDescDB::set(), and SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.132.2.6 bool ends (const char ∗ *sub_string*) const [inline]

Returns true if String ends with char∗ substring. Returns true if the String ends with the char∗ sub_string. Uses the STL compare() method.

Referenced by PecosApproximation::approx_type_to_basis_type(), ProblemDescDB::check_input(), DataFitSurrModel::DataFitSurrModel(), Approximation::get_approx(), Iterator::get_iterator(), ProblemDescDB::get_ushort(), Variables::get_view(), Interface::Interface(), Minimizer::Minimizer(), NonDLocalInterval::NonDLocalInterval(), NonDLocalReliability::NonDLocalReliability(), PStudyDACE::PStudyDACE(), SequentialHybridStrategy::run_strategy(), SequentialHybridStrategy::SequentialHybridStrategy(), and SOLBase::SOLBase().

43.132.2.7 char ∗ data () const [inline]

Returns pointer to standard C char array. Returns a pointer to C style char array. Needed to mimic the Rogue Wave string class. USE WITH CARE.

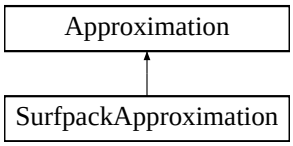
Referenced by GridApplicInterface::derived_map_asynch(), GridApplicInterface::grid_file_test(), Interface::Interface(), Dakota::print_restart_tabular(), and ConcurrentStrategy::print_results().

The documentation for this class was generated from the following files:

- DakotaString.H
- DakotaString.C

43.133 SurfpackApproximation Class Reference

Derived approximation class for Surfpack approximation classes. Interface between Surfpack and Dakota. Inheritance diagram for SurfpackApproximation::



Public Member Functions

- SurfpackApproximation ()

  default constructor

- SurfpackApproximation (const String &approx_type, const UShortArray &approx_order, size_t num_vars, short data_order)

  alternate constructor

- SurfpackApproximation (const ProblemDescDB &problem_db, const size_t &num_acv)

  standard constructor: Surfpack surface of appropriate type will be created

- ~SurfpackApproximation ()

  destructor

Protected Member Functions

- int min_coefficients () const

  return the minimum number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- int recommended_coefficients () const

  return the recommended number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- void build ()

  SurfData object will be created from Dakota's SurrogateData, and the appropriate Surfpack build method will be invoked.

- Real get_value (const RealVector &x)

  Return the value of the Surfpack surface for a given parameter vector x.

- Real get_prediction_variance (const RealVector &x)

retrieve the variance of the predicted value for a given parameter set x (KrigingModel only)

- const RealVector & get_gradient (const RealVector &x)

  retrieve the approximate function gradient for a given parameter vector x

- const RealSymMatrix & get_hessian (const RealVector &x)

  retrieve the approximate function Hessian for a given parameter vector x

- Real get_diagnostic (const String &metric_type)

  retrieve the diagnostic metric for the diagnostic type specified

- const bool diagnostics_available ()

  check if the diagnostics are available (true for the Surfpack types)

Private Member Functions

- SurfData ∗ surrogates_to_surf_data ()

  copy from SurrogateData to SurfPoint/SurfData

- void add_anchor_to_surfdata (SurfData &surf_data)

  set the anchor point (including gradient and hessian if present) into surf_data

- void add_sdp_to_surfdata (const Pecos::SurrogateDataVars &sdv, const Pecos::SurrogateDataResp &sdr, short fail_code, SurfData &surf_data)

  add Pecos::SurrogateData::SurrogateData{Vars,Resp} to SurfData, accounting for buildDataOrder available

- void copy_matrix (const RealSymMatrix &rsm, SurfpackMatrix< Real > &surfpack_matrix)

  copy RealSymMatrix to SurfpackMatrix (Real type only)

Private Attributes

- unsigned short approxOrder

  order of polynomial approximation

- SurfpackModel ∗ model

  The native Surfpack approximation.

- SurfpackModelFactory ∗ factory

  factory for the SurfpackModel instance

- SurfData ∗ surfData

  The data used to build the approximation, in Surfpack format.

43.133.1 Detailed Description

Derived approximation class for Surfpack approximation classes. Interface between Surfpack and Dakota. The SurfpackApproximation class is the interface between Dakota and Surfpack. Based on the information in the ProblemDescDB that is passed in through the constructor, SurfpackApproximation builds a Surfpack Surface object that corresponds to one of the following data-fitting techniques: polynomial regression, kriging, artificial neural networks, radial basis function network, or multivariate adaptaive regression splines (MARS).

43.133.2 Constructor & Destructor Documentation

43.133.2.1 SurfpackApproximation (const String & *approx_type*, const UShortArray & *approx_order*, size_t *num_vars*, short *data_order*)

alternate constructor On-the-fly constructor which uses mostly Surfpack model defaults.

References Dakota::abort_handler(), Approximation::approxLowerBounds, SurfpackApproximation::approxOrder, Approximation::approxType, Approximation::approxUpperBounds, Approximation::buildDataOrder, Dakota::copy_data(), and SurfpackApproximation::factory.

43.133.3 Member Function Documentation

43.133.3.1 void build () `[protected, virtual]`

SurfData object will be created from Dakota's SurrogateData, and the appropriate Surfpack build method will be invoked.

surfData will be deleted in dtor

Todo

Right now, we're completely deleting the old data and then recopying the current data into a SurfData object. This was just the easiest way to arrive at a solution that would build and run. This function is frequently called from addPoint rebuild, however, and it's not good to go through this whole process every time one more data point is added.

Reimplemented from Approximation.

References Dakota::abort_handler(), Approximation::approxLowerBounds, Approximation::approxUpperBounds, Dakota::copy_data(), SurfpackApproximation::factory, SurfpackApproximation::model, Approximation::outputLevel, SurfpackApproximation::surfData, and SurfpackApproximation::surrogates_to_surf_data().

43.133.3.2 const RealSymMatrix & get_hessian (const RealVector & *x*) `[protected, virtual]`

retrieve the approximate function Hessian for a given parameter vector x

Todo

Make this acceptably efficient

Reimplemented from Approximation.

References Dakota::abort_handler(), Approximation::approxHessian, Approximation::approxType, Dakota::copy_data(), and SurfpackApproximation::model.

43.133.3.3 SurfData * surrogates_to_surf_data () [private]

copy from SurrogateData to SurfPoint/SurfData Copy the data stored in Dakota-style SurrogateData into Surfpack-style SurfPoint and SurfData objects.

References SurfpackApproximation::add_anchor_to_surfdata(), SurfpackApproximation::add_sdp_to_-surfdata(), Approximation::approxData, Approximation::buildDataOrder, SurfpackApproximation::factory, and Approximation::outputLevel.

Referenced by SurfpackApproximation::build().

43.133.3.4 void add_anchor_to_surfdata (SurfData & *surf_data*) [private]

set the anchor point (including gradient and hessian if present) into surf_data If there is an anchor point, add an equality constraint for its response value. Also add constraints for gradient and hessian, if applicable.

References Dakota::abort_handler(), Approximation::approxData, Dakota::copy_data(), SurfpackApproximation::copy_matrix(), Approximation::outputLevel, and Dakota::write_data().

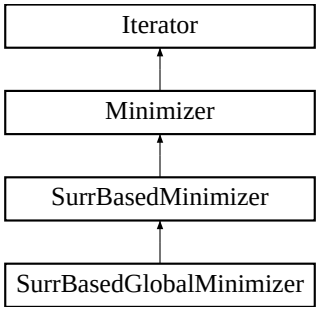
Referenced by SurfpackApproximation::surrogates_to_surf_data().

The documentation for this class was generated from the following files:

- SurfpackApproximation.H
- SurfpackApproximation.C

43.134 SurrBasedGlobalMinimizer Class Reference

The global surrogate-based minimizer which sequentially minimizes and updates a global surrogate model without trust region controls. Inheritance diagram for SurrBasedGlobalMinimizer::



Public Member Functions

- SurrBasedGlobalMinimizer (Model &model)

  constructor

- ~SurrBasedGlobalMinimizer ()

  destructor

Protected Member Functions

- bool returns_multiple_points () const

  Global surrogate-based methods can return multiple points.

Private Member Functions

- void minimize_surrogates ()

  Performs global surrogate-based optimization by repeatedly optimizing on and improving surrogates of the response functions.

Private Attributes

- bool replacePoints

  flag for replacing the previous iteration's point additions, rather than continuing to append, during construction of the next surrogate

43.134.1 Detailed Description

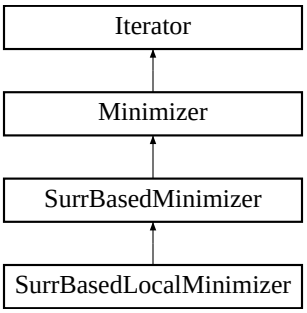
The global surrogate-based minimizer which sequentially minimizes and updates a global surrogate model without trust region controls. This method uses a SurrogateModel to perform minimization (optimization or nonlinear least squares) through a set of iterations. At each iteration, a surrogate is built, the surrogate is minimized, and the optimal points from the surrogate are then evaluated with the "true" function, to generate new points upon which the surrogate for the next iteration is built.

The documentation for this class was generated from the following files:

- SurrBasedGlobalMinimizer.H
- SurrBasedGlobalMinimizer.C

43.135 SurrBasedLocalMinimizer Class Reference

Class for provably-convergent local surrogate-based optimization and nonlinear least squares. Inheritance diagram for SurrBasedLocalMinimizer::



Public Member Functions

- SurrBasedLocalMinimizer (Model &model)

  constructor

- ~SurrBasedLocalMinimizer ()

  destructor

Protected Member Functions

- void reset ()

  reset convergence controls in case of multiple SBLM executions

Private Member Functions

- void minimize_surrogates ()

  Performs local surrogate-based minimization by minimizing local, global, or hierarchical surrogates over a series of trust regions.

- bool tr_bounds (const RealVector &global_lower_bnds, const RealVector &global_upper_bnds, RealVector &tr_lower_bnds, RealVector &tr_upper_bnds)

  compute current trust region bounds

- void find_center_truth (const Iterator &dace_iterator, Model &truth_model)

  retrieve responseCenterTruth if possible, evaluate it if not

- void find_center_approx ()

retrieve responseCenter_approx if possible, evaluate it if not

- void hard_convergence_check (const Response &response_truth, const RealVector &c_vars, const RealVector &lower_bnds, const RealVector &upper_bnds)

  check for hard convergence (norm of projected gradient of merit function near zero)

- void tr_ratio_check (const RealVector &c_vars_star, const RealVector &tr_lower_bounds, const RealVector &tr_upper_bounds)

  compute trust region ratio (for SBLM iterate acceptance and trust region resizing) and check for soft convergence (diminishing returns)

- void update_penalty (const RealVector &fns_center_truth, const RealVector &fns_star_truth)

  initialize and update the penaltyParameter

- void relax_constraints (const RealVector &lower_bnds, const RealVector &upper_bnds)

  relax constraints by updating bounds when current iterate is infeasible

Static Private Member Functions

- static void approx_subprob_objective_eval (const Variables &surrogate_vars, const Variables &recast_vars, const Response &surrogate_response, Response &recast_response)

  static function used to define the approximate subproblem objective.

- static void approx_subprob_constraint_eval (const Variables &surrogate_vars, const Variables &recast_vars, const Response &surrogate_response, Response &recast_response)

  static function used to define the approximate subproblem constraints.

- static void hom_objective_eval (int &mode, int &n, double ∗tau_and_x, double &f, double ∗grad_f, int &)

  static function used by NPSOL as the objective function in the homotopy constraint relaxation formulation.

- static void hom_constraint_eval (int &mode, int &ncnln, int &n, int &nrowj, int ∗needc, double ∗tau_and_x, double ∗c, double ∗cjac, int &nstate)

  static function used by NPSOL as the constraint function in the homotopy constraint relaxation formulation.

Private Attributes

- Real origTrustRegionFactor

  original user specification for trustRegionFactor

- Real trustRegionFactor

  the trust region factor is used to compute the total size of the trust region -- it is a percentage, e.g. for trustRegionFactor = 0.1, the actual size of the trust region will be 10% of the global bounds (upper bound - lower bound for each design variable).

- Real minTrustRegionFactor

  a soft convergence control: stop SBLM when the trust region factor is reduced below the value of minTrustRegionFactor

- Real trRatioContractValue

  trust region ratio min value: contract tr if ratio below this value

- Real trRatioExpandValue

  trust region ratio sufficient value: expand tr if ratio above this value

- Real gammaContract

  trust region contraction factor

- Real gammaExpand

  trust region expansion factor

- short approxSubProbObj

  type of approximate subproblem objective: ORIGINAL_OBJ, LAGRANGIAN_OBJ, or AUGMENTED_LAGRANGIAN_OBJ

- short approxSubProbCon

  type of approximate subproblem constraints: NO_CON, LINEARIZED_CON, or ORIGINAL_CON

- Model approxSubProbModel

  the approximate sub-problem formulation solved on each approximate minimization cycle: may be a shallow copy of iteratedModel, or may involve a RecastModel recursion applied to iteratedModel

- bool recastSubProb

  flag to indicate when approxSubProbModel involves a RecastModel recursion

- short trConstraintRelax

  type of trust region constraint relaxation for infeasible starting points: NO_RELAX or HOMOTOPY

- short meritFnType

  type of merit function used in trust region ratio logic: PENALTY_MERIT, ADAPTIVE_PENALTY_MERIT, LAGRANGIAN_MERIT, or AUGMENTED_LAGRANGIAN_MERIT

- short acceptLogic

  type of iterate acceptance test logic: FILTER or TR_RATIO

- int penaltyIterOffset

  iteration offset used to update the scaling of the penalty parameter for adaptive_penalty merit functions

- short convergenceFlag

  code indicating satisfaction of hard or soft convergence conditions

- short softConvCount

  number of consecutive candidate point rejections. If the count reaches softConvLimit, stop SBLM.

- short softConvLimit

  the limit on consecutive candidate point rejections. If exceeded by softConvCount, stop SBLM.

- bool truthGradientFlag

  flags the use/availability of truth gradients within the SBLM process

- bool approxGradientFlag

  flags the use/availability of surrogate gradients within the SBLM process

- bool truthHessianFlag

  flags the use/availability of truth Hessians within the SBLM process

- bool approxHessianFlag

  flags the use/availability of surrogate Hessians within the SBLM process

- short correctionType

  flags the use of surrogate correction techniques at the center of each trust region

- bool globalApproxFlag

  flags the use of a global data fit surrogate (rsm, ann, mars, kriging)

- bool multiptApproxFlag

  flags the use of a multipoint data fit surrogate (TANA)

- bool localApproxFlag

  flags the use of a local data fit surrogate (Taylor series)

- bool hierarchApproxFlag

  flags the use of a model hierarchy/multifidelity surrogate

- bool newCenterFlag

  flags the acceptance of a candidate point and the existence of a new trust region center

- bool daceCenterPtFlag

  flags the availability of the center point in the DACE evaluations for global approximations (CCD, Box-Behnken)

- bool multiLayerBypassFlag

  flags the simultaneous presence of two conditions: (1) additional layerings w/i actual_model (e.g., surrogateModel = layered/nested/layered -> actual_model = nested/layered), and (2) a user-specification to bypass all layerings within actual_model for the evaluation of truth data (responseCenterTruth and responseStarTruth).

- bool useDerivsFlag

  flag for the "use_derivatives" specification for which derivatives are to be evaluated at each DACE point in global surrogate builds.

- RealVector nonlinIneqLowerBndsSlack

  individual violations of nonlinear inequality constraint lower bounds

- RealVector nonlinIneqUpperBndsSlack

  individual violations of nonlinear inequality constraint upper bounds

- RealVector nonlinEqTargetsSlack

  individual violations of nonlinear equality constraint targets

- Real tau

  constraint relaxation parameter

- Real alpha

  constraint relaxation parameter backoff parameter (multiplier)

- Variables varsCenter

  variables at the trust region center

- Response responseCenterApprox

  approx response at trust region center

- Response responseStarApprox

  approx response at SBLM cycle minimum

- IntResponsePair responseCenterTruth

  truth response at trust region center

- IntResponsePair responseStarTruth

  truth response at SBLM cycle minimum

Static Private Attributes

- static SurrBasedLocalMinimizer $*$ sblmInstance

  pointer to SBLM instance used in static member functions

43.135.1 Detailed Description

Class for provably-convergent local surrogate-based optimization and nonlinear least squares. This minimizer uses a SurrogateModel to perform minimization based on local, global, or hierarchical surrogates. It achieves provable convergence through the use of a sequence of trust regions and the application of surrogate corrections at the trust region centers.

43.135.2 Member Function Documentation

43.135.2.1 void minimize_surrogates () [private, virtual]

Performs local surrogate-based minimization by minimizing local, global, or hierarchical surrogates over a series of trust regions. Trust region-based strategy to perform surrogate-based optimization in subregions (trust regions) of the parameter space. The minimizer operates on approximations in lieu of the more expensive simulation-based response functions. The size of the trust region is varied according to the goodness of the agreement between the approximations and the true response functions.

Implements SurrBasedMinimizer.

References Dakota::abort_handler(), Iterator::active_set(), Response::active_set(), Model::active_variables(), Graphics::add_datapoint(), DiscrepancyCorrection::apply(), SurrBasedLocalMinimizer::approxGradientFlag, SurrBasedLocalMinimizer::approxHessianFlag, SurrBasedMinimizer::approxSubProbMinimizer, SurrBasedLocalMinimizer::approxSubProbModel, Iterator::bestResponseArray, Iterator::bestVariablesArray, Model::build_approximation(), Model::component_parallel_mode(), DiscrepancyCorrection::compute(), Model::compute_response(), Model::continuous_lower_bounds(), Model::continuous_upper_bounds(), Model::continuous_variables(), Variables::continuous_variables(), SurrBasedLocalMinimizer::convergenceFlag, Variables::copy(), Dakota::copy_data(), SurrBasedLocalMinimizer::correctionType, Model::current_response(), Model::current_variables(), SurrBasedLocalMinimizer::daceCenterPtFlag, Dakota::dakota_graphics, Model::discrepancy_correction(), Model::evaluation_id(), SurrBasedLocalMinimizer::find_center_approx(), SurrBasedLocalMinimizer::find_center_truth(), SurrBasedLocalMinimizer::globalApproxFlag, SurrBasedLocalMinimizer::hard_convergence_check(), Iterator::is_null(), Iterator::iteratedModel, SurrBasedLocalMinimizer::localApproxFlag, Iterator::maxIterations, SurrBasedLocalMinimizer::minTrustRegionFactor, SurrBasedLocalMinimizer::multiLayerBypassFlag, SurrBasedLocalMinimizer::multiptApproxFlag, SurrBasedLocalMinimizer::newCenterFlag, Model::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Iterator::numContinuousVars, SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, SurrBasedLocalMinimizer::recastSubProb, SurrBasedLocalMinimizer::relax_constraints(), ActiveSet::request_values(), SurrBasedLocalMinimizer::reset(), Iterator::response_results(), SurrBasedLocalMinimizer::responseCenterApprox, SurrBasedLocalMinimizer::responseCenterTruth, SurrBasedLocalMinimizer::responseStarApprox, SurrBasedLocalMinimizer::responseStarTruth, Iterator::run_iterator(), Iterator::sampling_scheme(), SurrBasedMinimizer::sbIterNum, SurrBasedLocalMinimizer::sblmInstance, SurrBasedLocalMinimizer::softConvCount, SurrBasedLocalMinimizer::softConvLimit, Model::subordinate_iterator(), Model::surrogate_model(), Model::surrogate_response_mode(), SurrBasedLocalMinimizer::tr_bounds(), SurrBasedLocalMinimizer::tr_ratio_check(), SurrBasedLocalMinimizer::trConstraintRelax, SurrBasedLocalMinimizer::trustRegionFactor, Model::truth_model(), SurrBasedLocalMinimizer::truthGradientFlag, SurrBasedLocalMinimizer::truthHessianFlag, Response::update(), SurrBasedLocalMinimizer::useDerivsFlag, Iterator::variables_results(), and SurrBasedLocalMinimizer::varsCenter.

43.135.2.2 void hard_convergence_check (const Response & *response_truth*, const RealVector & *c_vars*, const RealVector & *lower_bnds*, const RealVector & *upper_bnds*) [private]

check for hard convergence (norm of projected gradient of merit function near zero) The hard convergence check computes the gradient of the merit function at the trust region center, performs a projection for active bound constraints (removing any gradient component directed into an active bound), and signals convergence if the 2-norm of this projected gradient is less than convergenceTol.

References SurrBasedLocalMinimizer::acceptLogic, SurrBasedLocalMinimizer::approxSubProbObj, SurrBasedMinimizer::constraint_violation(), Minimizer::constraintTol, SurrBasedLocalMinimizer::convergenceFlag, Iterator::convergenceTol, Response::function_gradients(), Response::function_values(), Iterator::iteratedModel, SurrBasedMinimizer::lagrangian_gradient(), SurrBasedLocalMinimizer::meritFnType, Iterator::numContinuousVars, Minimizer::numNonlinearConstraints, SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, Model::primary_response_fn_weights(), SurrBasedMinimizer::sbIterNum, SurrBasedLocalMinimizer::truthGradientFlag, SurrBasedMinimizer::update_augmented_lagrange_multipliers(), SurrBasedMinimizer::update_filter(), and SurrBasedMinimizer::update_lagrange_multipliers().

Referenced by SurrBasedLocalMinimizer::minimize_surrogates().

43.135.2.3 void tr_ratio_check (const RealVector & *c_vars_star*, const RealVector & *tr_lower_bnds*, const RealVector & *tr_upper_bnds*) `[private]`

compute trust region ratio (for SBLM iterate acceptance and trust region resizing) and check for soft convergence (diminishing returns) Assess acceptance of SBLM iterate (trust region ratio or filter) and compute soft convergence metrics (number of consecutive failures, min trust region size, etc.) to assess whether the convergence rate has decreased to a point where the process should be terminated (diminishing returns).

References SurrBasedLocalMinimizer::acceptLogic, SurrBasedLocalMinimizer::approxSubProbObj, SurrBasedMinimizer::augmented_lagrangian_merit(), SurrBasedMinimizer::constraint_violation(), Minimizer::constraintTol, Iterator::convergenceTol, SurrBasedMinimizer::etaSequence, Response::function_values(), SurrBasedLocalMinimizer::gammaContract, SurrBasedLocalMinimizer::gammaExpand, SurrBasedLocalMinimizer::globalApproxFlag, Iterator::iteratedModel, SurrBasedMinimizer::lagrangian_merit(), SurrBasedLocalMinimizer::meritFnType, SurrBasedLocalMinimizer::newCenterFlag, Iterator::numContinuousVars, SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, SurrBasedMinimizer::penalty_merit(), Model::primary_response_fn_weights(), SurrBasedLocalMinimizer::responseCenterApprox, SurrBasedLocalMinimizer::responseCenterTruth, SurrBasedLocalMinimizer::responseStarApprox, SurrBasedLocalMinimizer::responseStarTruth, SurrBasedLocalMinimizer::softConvCount, SurrBasedLocalMinimizer::trRatioContractValue, SurrBasedLocalMinimizer::trRatioExpandValue, SurrBasedLocalMinimizer::trustRegionFactor, SurrBasedMinimizer::update_augmented_lagrange_multipliers(), SurrBasedMinimizer::update_filter(), and SurrBasedLocalMinimizer::update_penalty().

Referenced by SurrBasedLocalMinimizer::minimize_surrogates().

43.135.2.4 void update_penalty (const RealVector & *fns_center_truth*, const RealVector & *fns_star_truth*) `[private]`

initialize and update the penaltyParameter Scaling of the penalty value is important to avoid rejecting SBLM iterates which must increase the objective to achieve a reduction in constraint violation. In the basic penalty case, the penalty is ramped exponentially based on the iteration counter. In the adaptive case, the ratio of relative change between center and star points for the objective and constraint violation values is used to rescale penalty values.

References SurrBasedMinimizer::alphaEta, SurrBasedLocalMinimizer::approxSubProbObj, SurrBasedMinimizer::constraint_violation(), Minimizer::constraintTol, SurrBasedMinimizer::eta, SurrBasedMinimizer::etaSequence, Iterator::iteratedModel, SurrBasedLocalMinimizer::meritFnType, Minimizer::objective(), SurrBasedLocalMinimizer::penaltyIterOffset, SurrBasedMinimizer::penaltyParameter, Model::primary_response_fn_weights(), and SurrBasedMinimizer::sbIterNum.

Referenced by SurrBasedLocalMinimizer::tr_ratio_check().

43.135.2.5 void approx_subprob_objective_eval (const Variables & *surrogate_vars*, const Variables & *recast_vars*, const Response & *surrogate_response*, Response & *recast_response*) [static, private]

static function used to define the approximate subproblem objective. Objective functions evaluator for solution of approximate subproblem using a RecastModel.

References Response::active_set_request_vector(), SurrBasedLocalMinimizer::approxSubProbCon, SurrBasedLocalMinimizer::approxSubProbModel, SurrBasedLocalMinimizer::approxSubProbObj, SurrBasedMinimizer::augmented_lagrangian_gradient(), SurrBasedMinimizer::augmented_lagrangian_merit(), Response::function_gradient(), Response::function_gradient_view(), Response::function_gradients(), Response::function_value(), Response::function_values(), Iterator::iteratedModel, SurrBasedMinimizer::lagrangian_gradient(), SurrBasedMinimizer::lagrangian_merit(), Model::nonlinear_eq_constraint_targets(), Model::nonlinear_ineq_constraint_lower_bounds(), Model::nonlinear_ineq_constraint_upper_bounds(), Minimizer::numUserPrimaryFns, Minimizer::objective(), Minimizer::objective_gradient(), SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, Model::primary_response_fn_weights(), and SurrBasedLocalMinimizer::sblmInstance.

Referenced by SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.135.2.6 void approx_subprob_constraint_eval (const Variables & *surrogate_vars*, const Variables & *recast_vars*, const Response & *surrogate_response*, Response & *recast_response*) [static, private]

static function used to define the approximate subproblem constraints. Constraint functions evaluator for solution of approximate subproblem using a RecastModel.

References Response::active_set_derivative_vector(), Response::active_set_request_vector(), SurrBasedLocalMinimizer::approxSubProbCon, SurrBasedLocalMinimizer::approxSubProbObj, Variables::continuous_variables(), Response::function_gradient(), Response::function_gradient_view(), Response::function_gradients(), Response::function_value(), Response::function_values(), Minimizer::numUserPrimaryFns, SurrBasedLocalMinimizer::responseCenterApprox, SurrBasedLocalMinimizer::sblmInstance, and SurrBasedLocalMinimizer::varsCenter.

Referenced by SurrBasedLocalMinimizer::SurrBasedLocalMinimizer().

43.135.2.7 void hom_objective_eval (int & *mode*, int & *n*, double * *tau_and_x*, double & *f*, double * *grad_f*, int &) [static, private]

static function used by NPSOL as the objective function in the homotopy constraint relaxation formulation. NPSOL objective functions evaluator for solution of homotopy constraint relaxation parameter optimization. This constrained optimization problem performs the update of the tau parameter in the homotopy heuristic approach used to relax the constraints in the original problem .

Referenced by SurrBasedLocalMinimizer::relax_constraints().

43.135.2.8 void hom_constraint_eval (int & *mode*, int & *ncnln*, int & *n*, int & *nrowj*, int * *needc*, double * *tau_and_x*, double * *c*, double * *cjac*, int & *nstate*) `[static, private]`

static function used by NPSOL as the constraint function in the homotopy constraint relaxation formulation. NPSOL constraint functions evaluator for solution of homotopy constraint relaxation parameter optimization. This constrained optimization problem performs the update of the tau parameter in the homotopy heuristic approach used to relax the constraints in the original problem.

References Response::active_set(), SurrBasedLocalMinimizer::approxSubProbModel, Model::compute_response(), Model::continuous_variables(), Model::current_response(), Response::function_gradients(), Response::function_values(), SurrBasedLocalMinimizer::nonlinEqTargetsSlack, SurrBasedLocalMinimizer::nonlinIneqLowerBndsSlack, SurrBasedLocalMinimizer::nonlinIneqUpperBndsSlack, Model::num_functions(), Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, ActiveSet::request_vector(), SurrBasedLocalMinimizer::sblmInstance, and SurrBasedLocalMinimizer::tau.

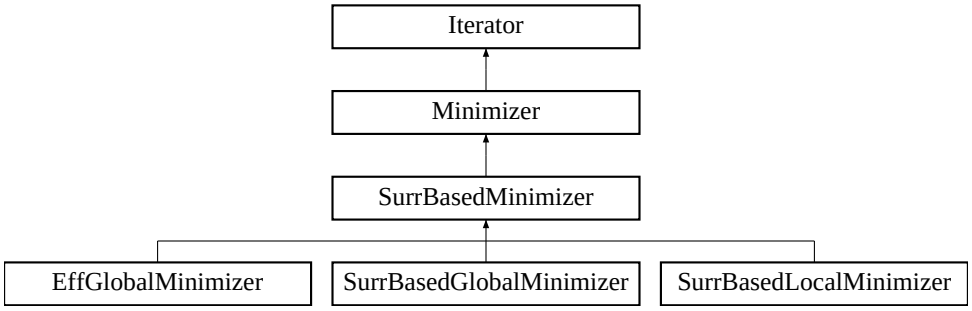
Referenced by SurrBasedLocalMinimizer::relax_constraints().

The documentation for this class was generated from the following files:

- SurrBasedLocalMinimizer.H
- SurrBasedLocalMinimizer.C

43.136 SurrBasedMinimizer Class Reference

Base class for local/global surrogate-based optimization/least squares. Inheritance diagram for SurrBasedMinimizer::



Protected Member Functions

- SurrBasedMinimizer (Model &model)

  constructor

- ~SurrBasedMinimizer ()

  destructor

- void initialize_graphics (bool graph_2d, bool tabular_data, const String &tabular_file)

  initialize graphics customized for surrogate-based iteration

- void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- void print_results (std::ostream &s)
- virtual void minimize_surrogates ()=0

  Used for computing the optimal solution using a surrogate-based approach. Redefines the Iterator::run() virtual function.

- void update_lagrange_multipliers (const RealVector &fn_vals, const RealMatrix &fn_grads)

  initialize and update Lagrange multipliers for basic Lagrangian

- void update_augmented_lagrange_multipliers (const RealVector &fn_vals)

  initialize and update the Lagrange multipliers for augmented Lagrangian

- bool update_filter (const RealVector &fn_vals)

  update a filter from a set of function values

- Real lagrangian_merit (const RealVector &fn_vals, const RealVector &primary_wts, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_tgts)

compute a Lagrangian function from a set of function values

- void lagrangian_gradient (const RealVector &fn_vals, const RealMatrix &fn_grads, const RealVector &primary_wts, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_tgts, RealVector &lag_grad)

  compute the gradient of the Lagrangian function

- Real augmented_lagrangian_merit (const RealVector &fn_vals, const RealVector &primary_wts, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_tgts)

  compute an augmented Lagrangian function from a set of function values

- void augmented_lagrangian_gradient (const RealVector &fn_vals, const RealMatrix &fn_grads, const RealVector &primary_wts, const RealVector &nln_ineq_l_bnds, const RealVector &nln_ineq_u_bnds, const RealVector &nln_eq_tgts, RealVector &alag_grad)

  compute the gradient of the augmented Lagrangian function

- Real penalty_merit (const RealVector &fn_vals, const RealVector &primary_wts)

  compute a penalty function from a set of function values

- void penalty_gradient (const RealVector &fn_vals, const RealMatrix &fn_grads, const RealVector &primary_wts, RealVector &pen_grad)

  compute the gradient of the penalty function

- Real constraint_violation (const RealVector &fn_vals, const Real &constraint_tol)

  compute the constraint violation from a set of function values

Protected Attributes

- Iterator approxSubProbMinimizer

  the minimizer used on the surrogate model to solve the approximate subproblem on each surrogate-based iteration

- int sbIterNum

  surrogate-based minimization iteration number

- RealVectorArray sbFilter

  Set of response function vectors defining a filter (objective vs. constraint violation) for iterate selection/rejection.

- RealVector lagrangeMult

  Lagrange multipliers for basic Lagrangian calculations.

- RealVector augLagrangeMult

  Lagrange multipliers for augmented Lagrangian calculations.

- Real penaltyParameter

  the penalization factor for violated constraints used in quadratic penalty calculations; increased in update_penalty()

- RealVector origNonlinIneqLowerBnds

  original nonlinear inequality constraint lower bounds (no relaxation)

- RealVector origNonlinIneqUpperBnds

  original nonlinear inequality constraint upper bounds (no relaxation)

- RealVector origNonlinEqTargets

  original nonlinear equality constraint targets (no relaxation)

- Real eta

  constant used in etaSequence updates

- Real alphaEta

  power for etaSequence updates when updating penalty

- Real betaEta

  power for etaSequence updates when updating multipliers

- Real etaSequence

  decreasing sequence of allowable constraint violation used in augmented Lagrangian updates (refer to Conn, Gould, and Toint, section 14.4)

43.136.1 Detailed Description

Base class for local/global surrogate-based optimization/least squares. These minimizers use a SurrogateModel to perform optimization based either on local trust region methods or global updating methods.

43.136.2 Member Function Documentation

43.136.2.1 void run () `[inline, protected, virtual]`

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented from Iterator.

References SurrBasedMinimizer::minimize_surrogates().

43.136.2.2 void print_results (std::ostream & *s*) `[protected, virtual]`

Redefines default iterator results printing to include optimization results (objective functions and constraints).

Reimplemented from Iterator.

References Dakota::abort_handler(), Iterator::activeSet, String::begins(), Iterator::bestResponseArray, Iterator::bestVariablesArray, Dakota::data_pairs, Model::interface_id(), Iterator::iteratedModel, Dakota::lookup_by_val(), Iterator::methodName, Iterator::numFunctions, Minimizer::numUserPrimaryFns, Minimizer::optimizationFlag, ActiveSet::request_values(), Model::truth_model(), and Dakota::write_data_partial().

43.136.2.3 void update_lagrange_multipliers (const RealVector & *fn_vals*, const RealMatrix & *fn_grads*) [protected]

initialize and update Lagrange multipliers for basic Lagrangian For the Rockafellar augmented Lagrangian, simple Lagrange multiplier updates are available which do not require the active constraint gradients. For the basic Lagrangian, Lagrange multipliers are estimated through solution of a nonnegative linear least squares problem.

References Dakota::abort_handler(), Minimizer::bigRealBoundSize, Minimizer::constraintTol, Iterator::iteratedModel, SurrBasedMinimizer::lagrangeMult, Iterator::numContinuousVars, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, Minimizer::objective_gradient(), SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, and Model::primary_response_fn_weights().

Referenced by SurrBasedLocalMinimizer::hard_convergence_check().

43.136.2.4 void update_augmented_lagrange_multipliers (const RealVector & *fn_vals*) [protected]

initialize and update the Lagrange multipliers for augmented Lagrangian For the Rockafellar augmented Lagrangian, simple Lagrange multiplier updates are available which do not require the active constraint gradients. For the basic Lagrangian, Lagrange multipliers are estimated through solution of a nonnegative linear least squares problem.

References SurrBasedMinimizer::augLagrangeMult, SurrBasedMinimizer::betaEta, Minimizer::bigRealBoundSize, SurrBasedMinimizer::etaSequence, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, SurrBasedMinimizer::origNonlinIneqUpperBnds, and SurrBasedMinimizer::penaltyParameter.

Referenced by SurrBasedLocalMinimizer::hard_convergence_check(), EffGlobalMinimizer::minimize_surrogates_on_model(), and SurrBasedLocalMinimizer::tr_ratio_check().

43.136.2.5 bool update_filter (const RealVector & *fn_vals*) [protected]

update a filter from a set of function values Update the sbFilter with fn_vals if new iterate is non-dominated.

References SurrBasedMinimizer::constraint_violation(), Iterator::iteratedModel, Minimizer::numNonlinearConstraints, Minimizer::objective(), Model::primary_response_fn_weights(), and SurrBasedMinimizer::sbFilter.

Referenced by SurrBasedLocalMinimizer::hard_convergence_check(), and SurrBasedLocalMinimizer::tr_ratio_check().

43.136.2.6 Real lagrangian_merit (const RealVector & *fn_vals*, const RealVector & *primary_wts*, const RealVector & *nln_ineq_l_bnds*, const RealVector & *nln_ineq_u_bnds*, const RealVector & *nln_eq_tgts*) [protected]

compute a Lagrangian function from a set of function values The Lagrangian function computation sums the objective function and the Lagrange multipler terms for inequality/equality constraints. This implementation follows the convention in Vanderplaats with g<=0 and h=0. The bounds/targets passed in may reflect the original constraints or the relaxed constraints.

References Minimizer::bigRealBoundSize, Minimizer::constraintTol, SurrBasedMinimizer::lagrangeMult, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, and Minimizer::objective().

Referenced by SurrBasedLocalMinimizer::approx_subprob_objective_eval(), and SurrBasedLocalMinimizer::tr_ratio_check().

43.136.2.7 Real augmented_lagrangian_merit (const RealVector & *fn_vals*, const RealVector & *primary_wts*, const RealVector & *nln_ineq_l_bnds*, const RealVector & *nln_ineq_u_bnds*, const RealVector & *nln_eq_tgts*) [protected]

compute an augmented Lagrangian function from a set of function values The Rockafellar augmented Lagrangian function sums the objective function, Lagrange multipler terms for inequality/equality constraints, and quadratic penalty terms for inequality/equality constraints. This implementation follows the convention in Vanderplaats with g<=0 and h=0. The bounds/targets passed in may reflect the original constraints or the relaxed constraints.

References SurrBasedMinimizer::augLagrangeMult, Minimizer::bigRealBoundSize, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, Minimizer::objective(), and SurrBasedMinimizer::penaltyParameter.

Referenced by SurrBasedLocalMinimizer::approx_subprob_objective_eval(), EffGlobalMinimizer::get_best_sample(), EffGlobalMinimizer::minimize_surrogates_on_model(), and SurrBasedLocalMinimizer::tr_ratio_check().

43.136.2.8 Real penalty_merit (const RealVector & *fn_vals*, const RealVector & *primary_wts*) [protected]

compute a penalty function from a set of function values The penalty function computation applies a quadratic penalty to any constraint violations and adds this to the objective function(s) p = f + r_p cv.

References SurrBasedMinimizer::constraint_violation(), Minimizer::constraintTol, Minimizer::objective(), and SurrBasedMinimizer::penaltyParameter.

Referenced by SurrBasedLocalMinimizer::tr_ratio_check().

43.136.2.9 Real constraint_violation (const RealVector & *fn_vals*, const Real & *constraint_tol*) [protected]

compute the constraint violation from a set of function values Compute the quadratic constraint violation defined as cv = g+^T g+ + h+^T h+. This implementation supports equality constraints and 2-sided inequalities. The constraint_tol allows for a small constraint infeasibility (used for penalty methods, but not Lagrangian methods).

References Minimizer::bigRealBoundSize, Minimizer::numNonlinearEqConstraints, Minimizer::numNonlinearIneqConstraints, Minimizer::numUserPrimaryFns, SurrBasedMinimizer::origNonlinEqTargets, SurrBasedMinimizer::origNonlinIneqLowerBnds, and SurrBasedMinimizer::origNonlinIneqUpperBnds.

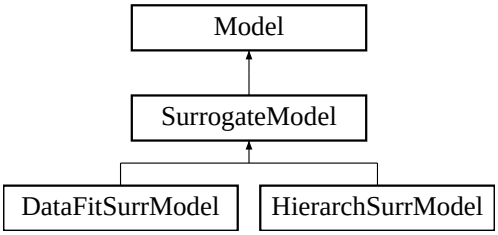
Referenced by SurrBasedLocalMinimizer::hard_convergence_check(), EffGlobalMinimizer::minimize_surrogates_on_model(), SurrBasedMinimizer::penalty_merit(), SurrBasedLocalMinimizer::relax_constraints(), SurrBasedLocalMinimizer::tr_ratio_check(), SurrBasedMinimizer::update_filter(), and SurrBasedLocalMinimizer::update_penalty().

The documentation for this class was generated from the following files:

- SurrBasedMinimizer.H
- SurrBasedMinimizer.C

43.137 SurrogateModel Class Reference

Base class for surrogate models (DataFitSurrModel and HierarchSurrModel). Inheritance diagram for SurrogateModel::



Protected Member Functions

- SurrogateModel (ProblemDescDB &problem_db)

  constructor

- SurrogateModel (ParallelLibrary &parallel_lib, const SharedVariablesData &svd, const ActiveSet &set, short output_level)

  alternate constructor

- ~SurrogateModel ()

  destructor

- Model & subordinate_model ()

  return truth_model()

- short surrogate_response_mode ()

  return responseMode

- DiscrepancyCorrection & discrepancy_correction ()

  return deltaCorr

- void check_submodel_compatibility (const Model &sub_model)

  verify compatibility between SurrogateModel attributes and attributes of the submodel (DataFitSurrModel::actualModel or HierarchSurrModel::highFidelityModel)

- bool force_rebuild ()

  evaluate whether a rebuild of the approximation should be forced based on changes in the inactive data

- void asv_mapping (const ShortArray &orig_asv, ShortArray &actual_asv, ShortArray &approx_asv, bool build_flag)

  distributes the incoming orig_asv among actual_asv and approx_asv

- void asv_mapping (const ShortArray &actual_asv, const ShortArray &approx_asv, ShortArray &combined_asv)

  reconstitutes a combined_asv from actual_asv and approx_asv

- void response_mapping (const Response &actual_response, const Response &approx_response, Response &combined_response)

  overlays actual_response and approx_response to update combined_response

Protected Attributes

- IntSet surrogateFnIndices

  for mixed response sets, this array specifies the response function subset that is approximated

- IntResponseMap surrResponseMap

  map of surrogate responses used in derived_synchronize() and derived_synchronize_nowait() functions

- IntRealVectorMap rawCVarsMap

  map of raw continuous variables used by apply_correction(). Model::varsList cannot be used for this purpose since it does not contain lower level variables sets from finite differencing.

- IntIntMap truthIdMap

  map from actualModel/highFidelityModel evaluation ids to DataFitSurrModel/HierarchSurrModel ids

- IntIntMap surrIdMap

  map from approxInterface/lowFidelityModel evaluation ids to DataFitSurrModel/HierarchSurrModel ids

- IntResponseMap cachedApproxRespMap

  map of approximate responses retrieved in derived_synchronize_nowait() that could not be returned since corresponding truth model response portions were still pending.

- short responseMode

  an enumeration that controls the response calculation mode in {DataFit,Hierarch}SurrModel approximate response computations

- size_t approxBuilds

  number of calls to build_approximation()

- RealVector referenceCLBnds

  stores a reference copy of active continuous lower bounds when the approximation is built; used to detect when a rebuild is required.

- RealVector referenceCUBnds

  stores a reference copy of active continuous upper bounds when the approximation is built; used to detect when a rebuild is required.

- IntVector referenceDILBnds

  stores a reference copy of active discrete int lower bounds when the approximation is built; used to detect when a rebuild is required.

- IntVector referenceDIUBnds

  stores a reference copy of active discrete int upper bounds when the approximation is built; used to detect when a rebuild is required.

- RealVector referenceDRLBnds

  stores a reference copy of active discrete real lower bounds when the approximation is built; used to detect when a rebuild is required.

- RealVector referenceDRUBnds

  stores a reference copy of active discrete real upper bounds when the approximation is built; used to detect when a rebuild is required.

- RealVector referenceICVars

  stores a reference copy of the inactive continuous variables when the approximation is built using a Distinct view; used to detect when a rebuild is required.

- IntVector referenceIDIVars

  stores a reference copy of the inactive discrete int variables when the approximation is built using a Distinct view; used to detect when a rebuild is required.

- RealVector referenceIDRVars

  stores a reference copy of the inactive discrete real variables when the approximation is built using a Distinct view; used to detect when a rebuild is required.

- DiscrepancyCorrection deltaCorr

  manages construction and application of correction functions that are applied to a surrogate model (DataFitSurr or HierarchSurr) in order to reproduce high fidelity data.

Private Attributes

- Variables truthModelVars

  copy of the truth model variables object used to simplify conversion among differing variable views in force_rebuild()

- Constraints truthModelCons

  copy of the truth model constraints object used to simplify conversion among differing variable views in force_rebuild()

43.137.1 Detailed Description

Base class for surrogate models (DataFitSurrModel and HierarchSurrModel). The SurrogateModel class provides common functions to derived classes for computing and applying corrections to approximations.

43.137.2 Member Function Documentation

43.137.2.1 bool force_rebuild () [protected, virtual]

evaluate whether a rebuild of the approximation should be forced based on changes in the inactive data This function forces a rebuild of the approximation according to the sub-model variables view, the approximation type, and whether the active approximation bounds or inactive variable values have changed since the last approximation build.

Reimplemented from Model.

References Constraints::all_continuous_lower_bounds(), Constraints::all_continuous_upper_bounds(), Variables::all_continuous_variables(), Constraints::all_discrete_int_lower_bounds(), Constraints::all_discrete_int_upper_bounds(), Variables::all_discrete_int_variables(), Constraints::all_discrete_real_lower_bounds(), Constraints::all_discrete_real_upper_bounds(), Variables::all_discrete_real_variables(), String::begins(), Model::continuous_lower_bounds(), Constraints::continuous_lower_bounds(), Model::continuous_upper_bounds(), Constraints::continuous_upper_bounds(), Variables::continuous_variables(), Constraints::copy(), Variables::copy(), Model::current_variables(), Model::currentVariables, Model::discrete_int_lower_bounds(), Constraints::discrete_int_lower_bounds(), Model::discrete_int_upper_bounds(), Constraints::discrete_int_upper_bounds(), Variables::discrete_int_variables(), Model::discrete_real_lower_bounds(), Constraints::discrete_real_lower_bounds(), Model::discrete_real_upper_bounds(), Constraints::discrete_real_upper_bounds(), Variables::discrete_real_variables(), Variables::inactive_continuous_variables(), Variables::inactive_discrete_int_variables(), Variables::inactive_discrete_real_variables(), Constraints::is_null(), Variables::is_null(), Model::is_null(), Model::model_type(), SurrogateModel::referenceCLBnds, SurrogateModel::referenceCUBnds, SurrogateModel::referenceDILBnds, SurrogateModel::referenceDIUBnds, SurrogateModel::referenceDRLBnds, SurrogateModel::referenceDRUBnds, SurrogateModel::referenceICVars, SurrogateModel::referenceIDIVars, SurrogateModel::referenceIDRVars, Model::subordinate_model(), Model::surrogateType, Model::truth_model(), SurrogateModel::truthModelCons, SurrogateModel::truthModelVars, Model::user_defined_constraints(), Model::userDefinedConstraints, and Variables::view().

Referenced by HierarchSurrModel::derived_asynch_compute_response(), DataFitSurrModel::derived_asynch_compute_response(), HierarchSurrModel::derived_compute_response(), and DataFitSurrModel::derived_compute_response().

43.137.3 Member Data Documentation

43.137.3.1 short responseMode [protected]

an enumeration that controls the response calculation mode in {DataFit,Hierarch}SurrModel approximate response computations SurrBasedLocalMinimizer toggles this mode since compute_correction() does not back out old corrections.

Referenced by HierarchSurrModel::derived_asynch_compute_response(), DataFitSurrModel::derived_asynch_compute_response(), HierarchSurrModel::derived_compute_response(), DataFitSurrModel::derived_compute_response(), HierarchSurrModel::derived_synchronize(), DataFitSurrModel::derived_synchronize(), DataFitSurrModel::derived_synchronize_approx(), HierarchSurrModel::derived_synchronize_nowait(), DataFitSurrModel::derived_synchronize_nowait(), SurrogateModel::surrogate_response_mode(), HierarchSurrModel::surrogate_response_mode(), and DataFitSurrModel::surrogate_response_mode().

43.137.3.2 size_t approxBuilds [protected]

number of calls to build_approximation() used as a flag to automatically build the approximation if one of the derived compute_response functions is called prior to build_approximation().

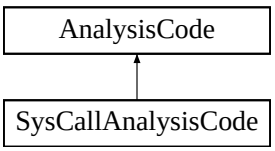
Referenced by DataFitSurrModel::append_approximation(), DataFitSurrModel::approximation_coefficients(), HierarchSurrModel::build_approximation(), DataFitSurrModel::build_approximation(), HierarchSurrModel::derived_asynch_compute_response(), DataFitSurrModel::derived_asynch_compute_response(), HierarchSurrModel::derived_compute_response(), DataFitSurrModel::derived_compute_response(), DataFitSurrModel::update_actual_model(), DataFitSurrModel::update_approximation(), DataFitSurrModel::update_from_actual_model(), and HierarchSurrModel::update_model().

The documentation for this class was generated from the following files:

- SurrogateModel.H
- SurrogateModel.C

43.138 SysCallAnalysisCode Class Reference

Derived class in the AnalysisCode class hierarchy which spawns simulations using system calls. Inheritance diagram for SysCallAnalysisCode::



Public Member Functions

- SysCallAnalysisCode (const ProblemDescDB &problem_db)

  constructor

- ~SysCallAnalysisCode ()

  destructor

- void spawn_evaluation (const bool block_flag)

  spawn a complete function evaluation

- void spawn_input_filter (const bool block_flag)

  spawn the input filter portion of a function evaluation

- void spawn_analysis (const int &analysis_id, const bool block_flag)

  spawn a single analysis as part of a function evaluation

- void spawn_output_filter (const bool block_flag)

  spawn the output filter portion of a function evaluation

43.138.1 Detailed Description

Derived class in the AnalysisCode class hierarchy which spawns simulations using system calls. SysCallAnalysisCode creates separate simulation processes using the C system() command. It utilizes CommandShell to manage shell syntax and asynchronous invocations.

43.138.2 Member Function Documentation

43.138.2.1 void spawn_evaluation (const bool *block_flag*)

spawn a complete function evaluation Put the SysCallAnalysisCode to the shell. This function is used when all portions of the function evaluation (i.e., all analysis drivers) are executed on the local processor.

References CommandShell::asynch_flag(), AnalysisCode::commandLineArgs, AnalysisCode::curWorkdir, Dakota::flush(), AnalysisCode::iFilterName, AnalysisCode::multipleParamsFiles, AnalysisCode::numPrograms, AnalysisCode::oFilterName, AnalysisCode::paramsFileName, AnalysisCode::programNames, AnalysisCode::resultsFileName, CommandShell::suppress_output_flag(), AnalysisCode::suppressOutputFlag, and AnalysisCode::useWorkdir.

Referenced by Dakota::perform_analysis(), and SysCallApplicInterface::spawn_application().

43.138.2.2 void spawn_input_filter (const bool *block_flag*)

spawn the input filter portion of a function evaluation Put the input filter to the shell. This function is used when multiple analysis drivers are spread between processors. No need to check for a Null input filter, as this is checked externally. Use of nonblocking shells is supported in this fn, although its use is currently prevented externally.

References CommandShell::asynch_flag(), AnalysisCode::commandLineArgs, AnalysisCode::curWorkdir, Dakota::flush(), AnalysisCode::iFilterName, AnalysisCode::paramsFileName, AnalysisCode::resultsFileName, CommandShell::suppress_output_flag(), AnalysisCode::suppressOutputFlag, and AnalysisCode::useWorkdir.

Referenced by SysCallApplicInterface::spawn_application().

43.138.2.3 void spawn_analysis (const int & *analysis_id*, const bool *block_flag*)

spawn a single analysis as part of a function evaluation Put a single analysis to the shell. This function is used when multiple analysis drivers are spread between processors. Use of nonblocking shells is supported in this fn, although its use is currently prevented externally.

References CommandShell::asynch_flag(), AnalysisCode::commandLineArgs, AnalysisCode::curWorkdir, Dakota::flush(), AnalysisCode::multipleParamsFiles, AnalysisCode::numPrograms, AnalysisCode::paramsFileName, AnalysisCode::programNames, AnalysisCode::resultsFileName, CommandShell::suppress_output_flag(), AnalysisCode::suppressOutputFlag, and AnalysisCode::useWorkdir.

Referenced by SysCallApplicInterface::derived_synchronous_local_analysis(), GridApplicInterface::derived_synchronous_local_analysis(), and SysCallApplicInterface::spawn_application().

43.138.2.4 void spawn_output_filter (const bool *block_flag*)

spawn the output filter portion of a function evaluation Put the output filter to the shell. This function is used when multiple analysis drivers are spread between processors. No need to check for a Null output filter, as this is checked externally. Use of nonblocking shells is supported in this fn, although its use is currently prevented externally.

References CommandShell::asynch_flag(), AnalysisCode::commandLineArgs, AnalysisCode::curWorkdir, Dakota::flush(), AnalysisCode::oFilterName, AnalysisCode::paramsFileName, AnalysisCode::resultsFileName, CommandShell::suppress_output_flag(), AnalysisCode::suppressOutputFlag, and AnalysisCode::useWorkdir.

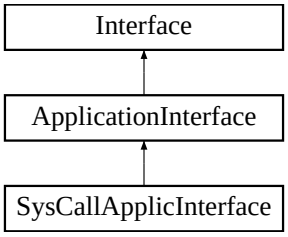
Referenced by SysCallApplicInterface::spawn_application().

The documentation for this class was generated from the following files:

- SysCallAnalysisCode.H
- SysCallAnalysisCode.C

43.139 SysCallApplicInterface Class Reference

Derived application interface class which spawns simulation codes using system calls. Inheritance diagram for SysCallApplicInterface::



Public Member Functions

- SysCallApplicInterface (const ProblemDescDB &problem_db)

  constructor

- ~SysCallApplicInterface ()

  destructor

- void derived_map (const Variables &vars, const ActiveSet &set, Response &response, int fn_eval_id)

  Called by map() and other functions to execute the simulation in synchronous mode. The portion of performing an evaluation that is specific to a derived class.

- void derived_map_asynch (const ParamResponsePair &pair)

  Called by map() and other functions to execute the simulation in asynchronous mode. The portion of performing an asynchronous evaluation that is specific to a derived class.

- void derived_synch (PRPQueue &prp_queue)
- void derived_synch_nowait (PRPQueue &prp_queue)
- int derived_synchronous_local_analysis (const int &analysis_id)
- const std::vector< String > & analysis_drivers () const

  retrieve the analysis drivers specification for application interfaces

- const AnalysisCode * analysis_code () const

  return AnalysisCode::fileNameMap when defined for derived Interface class

Private Member Functions

- void spawn_application (const bool block_flag)

  Spawn the application by managing the input filter, analysis drivers, and output filter. Called from derived_map() & derived_map_asynch().

- void derived_synch_kernel (PRPQueue &prp_queue)

  Convenience function for common code between derived_synch() & derived_synch_nowait().

- bool system_call_file_test (const std::string &root_file)

  detect completion of a function evaluation through existence of the necessary results file(s)

Private Attributes

- SysCallAnalysisCode sysCallSimulator

  SysCallAnalysisCode provides convenience functions for passing the input filter, the analysis drivers, and the output filter to a CommandShell in various combinations.

- IntSet sysCallSet

  set of function evaluation id's for active asynchronous system call evaluations

- IntShortMap failCountMap

  map linking function evaluation id's to number of response read failures

43.139.1 Detailed Description

Derived application interface class which spawns simulation codes using system calls. SysCallApplicInterface uses a SysCallAnalysisCode object for performing simulation invocations.

43.139.2 Member Function Documentation

43.139.2.1 void derived_synch (PRPQueue & *prp_queue*) `[inline, virtual]`

Check for completion of active asynch jobs (tracked with sysCallSet). Wait for at least one completion and complete all jobs that have returned. This satisifies a "fairness" principle, in the sense that a completed job will _always_ be processed (whereas accepting only a single completion could always accept the same completion - the case of very inexpensive fn. evals. - and starve some servers).

Reimplemented from ApplicationInterface.

References ApplicationInterface::completionSet, and SysCallApplicInterface::derived_synch_kernel().

43.139.2.2 void derived_synch_nowait (PRPQueue & *prp_queue*) `[inline, virtual]`

Check for completion of active asynch jobs (tracked with sysCallSet). Make one pass through sysCallSet & complete all jobs that have returned.

Reimplemented from ApplicationInterface.

References SysCallApplicInterface::derived_synch_kernel().

43.139.2.3 int derived_synchronous_local_analysis (const int & *analysis_id*) `[inline, virtual]`

This code provides the derived function used by ApplicationInterface::serve_analyses_synch().

Reimplemented from ApplicationInterface.

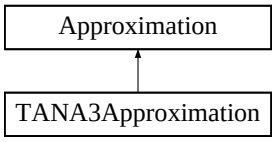
References SysCallAnalysisCode::spawn_analysis(), and SysCallApplicInterface::sysCallSimulator.

The documentation for this class was generated from the following files:

- SysCallApplicInterface.H
- SysCallApplicInterface.C

43.140 TANA3Approximation Class Reference

Derived approximation class for TANA-3 two-point exponential approximation (a multipoint approximation). Inheritance diagram for TANA3Approximation::



Public Member Functions

- TANA3Approximation ()

  default constructor

- TANA3Approximation (ProblemDescDB &problem_db, size_t num_vars)

  standard constructor

- TANA3Approximation (size_t num_vars, short data_order)

  alternate constructor

- ~TANA3Approximation ()

  destructor

Protected Member Functions

- int min_coefficients () const

  return the minimum number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- int num_constraints () const

  return the number of constraints to be enforced via an anchor point

- void build ()

  builds the approximation from scratch

- Real get_value (const RealVector &x)

  retrieve the approximate function value for a given parameter vector

- const RealVector & get_gradient (const RealVector &x)

  retrieve the approximate function gradient for a given parameter vector

- void clear_current ()

Private Member Functions

- void find_scaled_coefficients ()

  compute TANA coefficients based on scaled inputs

- void offset (const RealVector &x, RealVector &s)

  based on minX, apply offset scaling to x to define s

Private Attributes

- RealVector pExp

  vector of exponent values

- RealVector minX

  vector of minimum parameter values used in scaling

- RealVector scX1

  vector of scaled x1 values

- RealVector scX2

  vector of scaled x2 values

- Real H

  the scalar Hessian value in the TANA-3 approximation

43.140.1 Detailed Description

Derived approximation class for TANA-3 two-point exponential approximation (a multipoint approximation). The TANA3Approximation class provides a multipoint approximation based on matching value and gradient data from two points (typically the current and previous iterates) in parameter space. It forms an exponential approximation in terms of intervening variables.

43.140.2 Member Function Documentation

43.140.2.1 void build () [protected, virtual]

builds the approximation from scratch This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

References Dakota::abort_handler(), Approximation::approxData, Approximation::buildDataOrder, TANA3Approximation::find_scaled_coefficients(), TANA3Approximation::minX, Approximation::numVars, and TANA3Approximation::pExp.

43.140.2.2 void clear_current () [inline, protected, virtual]

Redefine default implementation to support history mechanism.

Reimplemented from Approximation.

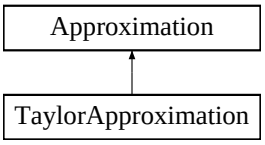
References Approximation::approxData.

The documentation for this class was generated from the following files:

- TANA3Approximation.H
- TANA3Approximation.C

43.141 TaylorApproximation Class Reference

Derived approximation class for first- or second-order Taylor series (a local approximation). Inheritance diagram for TaylorApproximation::



Public Member Functions

- TaylorApproximation ()

  default constructor

- TaylorApproximation (ProblemDescDB &problem_db, size_t num_vars)

  standard constructor

- TaylorApproximation (size_t num_vars, short data_order)

  alternate constructor

- ~TaylorApproximation ()

  destructor

Protected Member Functions

- int min_coefficients () const

  return the minimum number of samples (unknowns) required to build the derived class approximation type in numVars dimensions

- void build ()

  builds the approximation from scratch

- Real get_value (const RealVector &x)

  retrieve the approximate function value for a given parameter vector

- const RealVector & get_gradient (const RealVector &x)

  retrieve the approximate function gradient for a given parameter vector

- const RealSymMatrix & get_hessian (const RealVector &x)

  retrieve the approximate function Hessian for a given parameter vector

43.141.1 Detailed Description

Derived approximation class for first- or second-order Taylor series (a local approximation). The TaylorApproximation class provides a local approximation based on data from a single point in parameter space. It uses a zeroth-, first- or second-order Taylor series expansion: f(x) = f(x_c) for zeroth-order, plus grad(x_c)' (x - x_c) for first- and second-order, and plus (x - x_c)' Hess(x_c) (x - x_c) / 2 for second-order.

43.141.2 Member Function Documentation

43.141.2.1 void build () [protected, virtual]

builds the approximation from scratch This is the common base class portion of the virtual fn and is insufficient on its own; derived implementations should explicitly invoke (or reimplement) this base class contribution.

Reimplemented from Approximation.

References Dakota::abort_handler(), Approximation::approxData, Approximation::buildDataOrder, and Approximation::numVars.

The documentation for this class was generated from the following files:

- TaylorApproximation.H
- TaylorApproximation.C

43.142 TrackerHTTP Class Reference

TrackerHTTP: a usage tracking module that uses HTTP/HTTPS via the curl library.

Public Member Functions

- TrackerHTTP ()

  default constructor is allowed, but doesn't track methods used and outputs on all ranks

- TrackerHTTP (ProblemDescDB &problem_db, int world_rank=0)

  standard constructor with ProblemDescDB, rank

- ∼TrackerHTTP ()

  destructor to free handles

- void post_start ()

  post the start of an analysis and archive start time

- void post_finish (unsigned runtime=0)

  post the completion of an analysis including elapsed time

Private Member Functions

- void initialize (int world_rank=0)

  shared initialization functions across constructors

- void url_add_field (std::string &url, const char ∗keyword, const std::string &value, bool delimit=true) const

  append keyword/value pair to url in GET style (with &keyword=value); set delimit = false to omit the &

- void build_default_data (std::string &url, std::time_t &rawtime, const std::string &mode) const

  construct URL with shared information for start/finish

- void send_data_using_get (const std::string &urltopost) const

  transmit data to the web server using GET

- void send_data_using_post (const std::string &datatopost) const

  POST separate location and query; datatopost="name=daniel&project=curl".

- void populate_method_list (ProblemDescDB &problem_db)

  extract list of methods from problem database

- std::string get_uid () const

  get the real user ID

- std::string get_username () const

  get the username as reported by the environment

- std::string get_hostname () const

  get the system hostname

- std::string get_os () const

  get the operating system

- std::string get_datetime (const std::time_t &rawtime) const

  get the date and time as a string YYYYMMDDHHMMSS

Private Attributes

- CURL * curlPtr

  pointer to the curl handler instance

- FILE * devNull

  pointer to /dev/null

- std::string trackerLocation

  base URL for the tracker

- std::string proxyLocation

  if empty, proxy may still be specified via environment variables (unlike default CURL behavior)

- long timeoutSeconds

  seconds until the request will timeout (may have issues with signals)

- std::string methodList

  list of active methods

- std::string dakotaVersion

  DAKOTA version.

- std::time_t startTime

  cached starting time in raw seconds

- short outputLevel

  verbosity control

43.142.1 Detailed Description

TrackerHTTP: a usage tracking module that uses HTTP/HTTPS via the curl library.

43.142.2 Member Function Documentation

43.142.2.1 void send_data_using_get (const std::string & *urltopost*) const [private]

transmit data to the web server using GET whole url including location&fields

References TrackerHTTP::curlPtr, and TrackerHTTP::outputLevel.

43.142.2.2 void send_data_using_post (const std::string & *datatopost*) const [private]

POST separate location and query; datatopost="name=daniel&project=curl". separate location and query; datatopost="name=daniel&project=curl"

References TrackerHTTP::curlPtr, TrackerHTTP::outputLevel, and TrackerHTTP::trackerLocation.

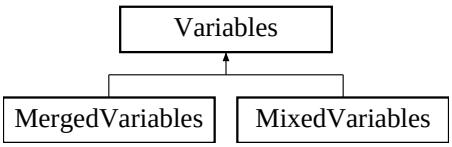
Referenced by TrackerHTTP::post_finish(), and TrackerHTTP::post_start().

The documentation for this class was generated from the following files:

- TrackerHTTP.H
- TrackerHTTP.C

43.143 Variables Class Reference

Base class for the variables class hierarchy. Inheritance diagram for Variables::



Public Member Functions

- Variables ()

  default constructor

- Variables (const ProblemDescDB &problem_db)

  standard constructor

- Variables (const SharedVariablesData &svd)

  alternate constructor for instantiations on the fly

- Variables (const Variables &vars)

  copy constructor

- virtual ~Variables ()

  destructor

- Variables operator= (const Variables &vars)

  assignment operator

- virtual void reshape (const SizetArray &vc_totals)

  reshapes an existing Variables object based on the incoming variablesComponents

- virtual void read (std::istream &s)

  read a variables object from an std::istream

- virtual void write (std::ostream &s) const

  write a variables object to an std::ostream

- virtual void write_aprepro (std::ostream &s) const

  write a variables object to an std::ostream in aprepro format

- virtual void read_annotated (std::istream &s)

  read a variables object in annotated format from an istream

- virtual void write_annotated (std::ostream &s) const

  write a variables object in annotated format to an std::ostream

- virtual void read_tabular (std::istream &s)

  read a variables object in tabular format from an istream

- virtual void write_tabular (std::ostream &s) const

  write a variables object in tabular format to an std::ostream

- virtual void read (BiStream &s)

  read a variables object from the binary restart stream

- virtual void write (BoStream &s) const

  write a variables object to the binary restart stream

- virtual void read (MPIUnpackBuffer &s)

  read a variables object from a packed MPI buffer

- virtual void write (MPIPackBuffer &s) const

  write a variables object to a packed MPI buffer

- size_t tv () const

  total number of vars

- size_t cv () const

  number of active continuous vars

- size_t cv_start () const

  start index of active continuous vars

- size_t div () const

  number of active discrete int vars

- size_t div_start () const

  start index of active discrete int vars

- size_t drv () const

  number of active discrete real vars

- size_t drv_start () const

  start index of active discrete real vars

- size_t icv () const

  number of inactive continuous vars

- size_t icv_start () const

start index of inactive continuous vars

- size_t idiv () const

  number of inactive discrete int vars

- size_t idiv_start () const

  start index of inactive discrete int vars

- size_t idrv () const

  number of inactive discrete real vars

- size_t idrv_start () const

  start index of inactive discrete real vars

- size_t acv () const

  total number of continuous vars

- size_t adiv () const

  total number of discrete integer vars

- size_t adrv () const

  total number of discrete real vars

- const SharedVariablesData & shared_data () const

  return sharedVarsData

- const Real & continuous_variable (size_t index) const

  return an active continuous variable

- const RealVector & continuous_variables () const

  return the active continuous variables

- void continuous_variable (const Real &c_var, size_t index)

  set an active continuous variable

- void continuous_variables (const RealVector &c_vars)

  set the active continuous variables

- int discrete_int_variable (size_t index) const

  return an active discrete integer variable

- const IntVector & discrete_int_variables () const

  return the active discrete integer variables

- void discrete_int_variable (int di_var, size_t index)

  set an active discrete integer variable

- void discrete_int_variables (const IntVector &di_vars)

  set the active discrete integer variables

- const Real & discrete_real_variable (size_t index) const

  return an active discrete real variable

- const RealVector & discrete_real_variables () const

  return the active discrete real variables

- void discrete_real_variable (const Real &dr_var, size_t index)

  set an active discrete real variable

- void discrete_real_variables (const RealVector &dr_vars)

  set the active discrete real variables

- StringMultiArrayConstView continuous_variable_labels () const

  return the active continuous variable labels

- void continuous_variable_labels (StringMultiArrayConstView cv_labels)

  set the active continuous variable labels

- void continuous_variable_label (const String &cv_label, size_t index)

  set an active continuous variable label

- StringMultiArrayConstView discrete_int_variable_labels () const

  return the active discrete integer variable labels

- void discrete_int_variable_labels (StringMultiArrayConstView div_labels)

  set the active discrete integer variable labels

- void discrete_int_variable_label (const String &div_label, size_t index)

  set an active discrete integer variable label

- StringMultiArrayConstView discrete_real_variable_labels () const

  return the active discrete real variable labels

- void discrete_real_variable_labels (StringMultiArrayConstView drv_labels)

  set the active discrete real variable labels

- void discrete_real_variable_label (const String &drv_label, size_t index)

  set an active discrete real variable label

- UShortMultiArrayConstView continuous_variable_types () const

  return the active continuous variable types

- UShortMultiArrayConstView discrete_int_variable_types () const
  return the active discrete integer variable types
- UShortMultiArrayConstView discrete_real_variable_types () const
  return the active discrete real variable types
- SizetMultiArrayConstView continuous_variable_ids () const
  return the active continuous variable position identifiers
- const SizetArray & merged_discrete_ids () const
  returns the list of discrete variables merged into a continuous array
- const RealVector & inactive_continuous_variables () const
  return the inactive continuous variables
- void inactive_continuous_variables (const RealVector &ic_vars)
  set the inactive continuous variables
- const IntVector & inactive_discrete_int_variables () const
  return the inactive discrete variables
- void inactive_discrete_int_variables (const IntVector &idi_vars)
  set the inactive discrete variables
- const RealVector & inactive_discrete_real_variables () const
  return the inactive discrete variables
- void inactive_discrete_real_variables (const RealVector &idr_vars)
  set the inactive discrete variables
- StringMultiArrayConstView inactive_continuous_variable_labels () const
  return the inactive continuous variable labels
- void inactive_continuous_variable_labels (StringMultiArrayConstView ic_vars)
  set the inactive continuous variable labels
- StringMultiArrayConstView inactive_discrete_int_variable_labels () const
  return the inactive discrete variable labels
- void inactive_discrete_int_variable_labels (StringMultiArrayConstView idi_vars)
  set the inactive discrete variable labels
- StringMultiArrayConstView inactive_discrete_real_variable_labels () const
  return the inactive discrete variable labels
- void inactive_discrete_real_variable_labels (StringMultiArrayConstView idr_vars)

set the inactive discrete variable labels

- UShortMultiArrayConstView inactive_continuous_variable_types () const
  return the inactive continuous variable types
- UShortMultiArrayConstView inactive_discrete_int_variable_types () const
  return the inactive discrete integer variable types
- UShortMultiArrayConstView inactive_discrete_real_variable_types () const
  return the inactive discrete real variable types
- SizetMultiArrayConstView inactive_continuous_variable_ids () const
  return the inactive continuous variable position identifiers
- const RealVector & all_continuous_variables () const
  returns a single array with all continuous variables
- void all_continuous_variables (const RealVector &ac_vars)
  sets all continuous variables using a single array
- void all_continuous_variable (const Real &ac_var, size_t index)
  set a variable within the all continuous array
- const IntVector & all_discrete_int_variables () const
  returns a single array with all discrete variables
- void all_discrete_int_variables (const IntVector &adi_vars)
  sets all discrete variables using a single array
- void all_discrete_int_variable (int adi_var, size_t index)
  set a variable within the all discrete array
- const RealVector & all_discrete_real_variables () const
  returns a single array with all discrete variables
- void all_discrete_real_variables (const RealVector &adr_vars)
  sets all discrete variables using a single array
- void all_discrete_real_variable (const Real &adr_var, size_t index)
  set a variable within the all discrete array
- StringMultiArrayView all_continuous_variable_labels () const
  returns a single array with all continuous variable labels
- void all_continuous_variable_labels (StringMultiArrayConstView acv_labels)
  sets all continuous variable labels using a single array

- void all_continuous_variable_label (const String &acv_label, size_t index)
  set a label within the all continuous label array
- StringMultiArrayView all_discrete_int_variable_labels () const
  returns a single array with all discrete variable labels
- void all_discrete_int_variable_labels (StringMultiArrayConstView adiv_labels)
  sets all discrete variable labels using a single array
- void all_discrete_int_variable_label (const String &adiv_label, size_t index)
  set a label within the all discrete label array
- StringMultiArrayView all_discrete_real_variable_labels () const
  returns a single array with all discrete variable labels
- void all_discrete_real_variable_labels (StringMultiArrayConstView adrv_labels)
  sets all discrete variable labels using a single array
- void all_discrete_real_variable_label (const String &adrv_label, size_t index)
  set a label within the all discrete label array
- UShortMultiArrayConstView all_continuous_variable_types () const
  return all continuous variable types
- UShortMultiArrayConstView all_discrete_int_variable_types () const
  return all discrete variable types
- UShortMultiArrayConstView all_discrete_real_variable_types () const
  return all discrete variable types
- SizetMultiArrayConstView all_continuous_variable_ids () const
  return all continuous variable position identifiers
- Variables copy () const
  for use when a deep copy is needed (the representation is _not_ shared)
- const std::pair< short, short > & view () const
  returns variablesView
- std::pair< short, short > get_view (const ProblemDescDB &problem_db) const
  defines variablesView from problem_db attributes
- void inactive_view (short view2)
  sets the inactive view based on higher level (nested) context

- const String & variables_id () const

  returns the variables identifier string

- const SizetArray & variables_components_totals () const

  returns the number of variables for each of the constitutive components

- bool is_null () const

  function to check variablesRep (does this envelope contain a letter)

Protected Member Functions

- Variables (BaseConstructor, const ProblemDescDB &problem_db, const std::pair< short, short > &view)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- Variables (BaseConstructor, const SharedVariablesData &svd)

  constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139)

- virtual void build_active_views ()

  construct active views of all variables arrays

- virtual void build_inactive_views ()

  construct inactive views of all variables arrays

- void build_views ()

  construct active/inactive views of all variables arrays

Protected Attributes

- SharedVariablesData sharedVarsData

  reference-counted instance of shared variables data: id's, labels, counts

- RealVector allContinuousVars

  array combining all of the continuous variables (design, uncertain, state)

- IntVector allDiscreteIntVars

  array combining all of the discrete integer variables (design, state)

- RealVector allDiscreteRealVars

  array combining all of the discrete real variables (design, state)

- size_t cvStart

start index of active continuous variables within allContinuousVars

- size_t divStart

  start index of active discrete integer variables within allDiscreteIntVars

- size_t drvStart

  start index of active discrete real variables within allDiscreteRealVars

- size_t icvStart

  start index of inactive continuous variables within allContinuousVars

- size_t idivStart

  start index of inactive discrete integer variables w/i allDiscreteIntVars

- size_t idrvStart

  start index of inactive discrete real variables within allDiscreteRealVars

- size_t numCV

  number of active continuous variables

- size_t numDIV

  number of active discrete integer variables

- size_t numDRV

  number of active discrete real variables

- size_t numICV

  number of inactive continuous variables

- size_t numIDIV

  number of inactive discrete integer variables

- size_t numIDRV

  number of inactive discrete real variables

- RealVector continuousVars

  the active continuous variables array view

- IntVector discreteIntVars

  the active discrete integer variables array view

- RealVector discreteRealVars

  the active discrete real variables array view

- RealVector inactiveContinuousVars

  the inactive continuous variables array view

- IntVector inactiveDiscreteIntVars

  the inactive discrete integer variables array view

- RealVector inactiveDiscreteRealVars

  the inactive discrete real variables array view

Private Member Functions

- Variables * get_variables (const ProblemDescDB &problem_db)

  Used by the standard envelope constructor to instantiate the correct letter class.

- Variables * get_variables (const SharedVariablesData &svd) const

  Used by the alternate envelope constructors, by read functions, and by copy() to instantiate a new letter class.

- void check_view_compatibility ()

  perform sanity checks on view.first and view.second after update

Private Attributes

- Variables * variablesRep

  pointer to the letter (initialized only for the envelope)

- int referenceCount

  number of objects sharing variablesRep

Friends

- bool operator== (const Variables &vars1, const Variables &vars2)

  equality operator

- bool operator!= (const Variables &vars1, const Variables &vars2)

  inequality operator

- std::size_t hash_value (const Variables &vars)

  hash_value

- bool binary_equal_to (const Variables &vars1, const Variables &vars2)

  binary_equal_to (since 'operator==' is not suitable for boost/hash_set)

43.143.1 Detailed Description

Base class for the variables class hierarchy. The Variables class is the base class for the class hierarchy providing design, uncertain, and state variables for continuous and discrete domains within a Model. Using the fundamental arrays from the input specification, different derived classes define different views of the data. For memory efficiency and enhanced polymorphism, the variables hierarchy employs the "letter/envelope idiom" (see Coplien "Advanced C++", p. 133), for which the base class (Variables) serves as the envelope and one of the derived classes (selected in Variables::get_variables()) serves as the letter.

43.143.2 Constructor & Destructor Documentation

43.143.2.1 Variables ()

default constructor The default constructor: variablesRep is NULL in this case (a populated problem_db is needed to build a meaningful Variables object). This makes it necessary to check for NULL in the copy constructor, assignment operator, and destructor.

43.143.2.2 Variables (const ProblemDescDB & *problem_db*)

standard constructor This is the primary envelope constructor which uses problem_db to build a fully populated variables object. It only needs to extract enough data to properly execute get_variables(problem_db), since the constructor overloaded with BaseConstructor builds the actual base class data inherited by the derived classes.

References Dakota::abort_handler(), Variables::get_variables(), and Variables::variablesRep.

43.143.2.3 Variables (const SharedVariablesData & *svd*)

alternate constructor for instantiations on the fly This is the alternate envelope constructor for instantiations on the fly. This constructor executes get_variables(view), which invokes the default derived/base constructors, followed by a resize() based on vars_comps.

References Dakota::abort_handler(), Variables::get_variables(), and Variables::variablesRep.

43.143.2.4 Variables (const Variables & *vars*)

copy constructor Copy constructor manages sharing of variablesRep and incrementing of referenceCount.

References Variables::referenceCount, and Variables::variablesRep.

43.143.2.5 ~Variables () `[virtual]`

destructor Destructor decrements referenceCount and only deletes variablesRep when referenceCount reaches zero.

References Variables::referenceCount, and Variables::variablesRep.

43.143.2.6 Variables (BaseConstructor, const ProblemDescDB & *problem_db*, const std::pair< short, short > & *view*) [protected]

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_variables() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_variables() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~Variables).

43.143.2.7 Variables (BaseConstructor, const SharedVariablesData & *svd*) [protected]

constructor initializes the base class part of letter classes (BaseConstructor overloading avoids infinite recursion in the derived class constructors - Coplien, p. 139) This constructor is the one which must build the base class data for all derived classes. get_variables() instantiates a derived class letter and the derived constructor selects this base class constructor in its initialization list (to avoid the recursion of the base class constructor calling get_variables() again). Since the letter IS the representation, its representation pointer is set to NULL (an uninitialized pointer causes problems in ~Variables).

43.143.3 Member Function Documentation

43.143.3.1 Variables operator= (const Variables & *vars*)

assignment operator Assignment operator decrements referenceCount for old variablesRep, assigns new variablesRep, and increments referenceCount for new variablesRep.

References Variables::referenceCount, and Variables::variablesRep.

43.143.3.2 Variables copy () const

for use when a deep copy is needed (the representation is _not_ shared) Deep copies are used for history mechanisms such as bestVariablesArray and data_pairs since these must catalogue copies (and should not change as the representation within currentVariables changes).

References Variables::allContinuousVars, Variables::allDiscreteIntVars, Variables::allDiscreteRealVars, Variables::build_views(), Variables::get_variables(), Variables::sharedVarsData, and Variables::variablesRep.

Referenced by Model::asynch_compute_response(), ApplicationInterface::continuation(), RecastModel::derived_asynch_compute_response(), EffGlobalMinimizer::EffGlobalMinimizer(), SurrogateModel::force_rebuild(), LeastSq::LeastSq(), SurrBasedLocalMinimizer::minimize_surrogates(), Optimizer::Optimizer(), COLINOptimizer::post_run(), Analyzer::read_variables_responses(), RecastModel::RecastModel(), COLINOptimizer::resize_final_points(), DiscrepancyCorrection::search_db(), SurrBasedLocalMinimizer::SurrBasedLocalMinimizer(), Analyzer::update_best(), and NonDLocalReliability::update_mpp_search_data().

43.143.3.3 void build_views () [inline, protected]

construct active/inactive views of all variables arrays

= EMPTY)

= EMPTY)

References Variables::build_active_views(), Variables::build_inactive_views(), Variables::sharedVarsData, SharedVariablesData::view(), and Variables::view().

Referenced by Variables::copy(), MergedVariables::MergedVariables(), MixedVariables::MixedVariables(), Variables::read(), Variables::read_annotated(), MixedVariables::reshape(), and MergedVariables::reshape().

43.143.3.4 Variables * get_variables (const ProblemDescDB & *problem_db*) [private]

Used by the standard envelope constructor to instantiate the correct letter class. Initializes variablesRep to the appropriate derived type, as given by problem_db attributes. The standard derived class constructors are invoked.

References Variables::get_view(), and Variables::view().

Referenced by Variables::copy(), Variables::read(), Variables::read_annotated(), and Variables::Variables().

43.143.3.5 Variables * get_variables (const SharedVariablesData & *svd*) const [private]

Used by the alternate envelope constructors, by read functions, and by copy() to instantiate a new letter class. Initializes variablesRep to the appropriate derived type, as given by view. The default derived class constructors are invoked.

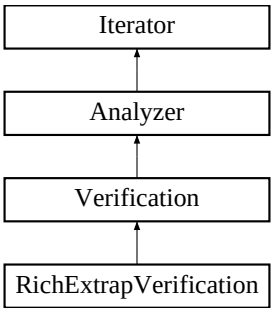
References SharedVariablesData::view().

The documentation for this class was generated from the following files:

- DakotaVariables.H
- DakotaVariables.C

43.144 Verification Class Reference

Base class for managing common aspects of verification studies. Inheritance diagram for Verification::



Protected Member Functions

- Verification (Model &model)

  constructor

- Verification (NoDBBaseConstructor, Model &model)

  alternate constructor for instantiations "on the fly"

- ~Verification ()

  destructor

- void run ()

  run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post

- void print_results (std::ostream &s)

  print the final iterator results

- virtual void perform_verification ()=0

  Redefines the run_iterator virtual function for the PStudy/DACE branch.

43.144.1 Detailed Description

Base class for managing common aspects of verification studies. The Verification base class manages common data and functions, such as those involving ...

43.144.2 Member Function Documentation

43.144.2.1 void run () [inline, protected, virtual]

run portion of run_iterator; implemented by all derived classes and may include pre/post steps in lieu of separate pre/post Virtual run function for the iterator class hierarchy. All derived classes need to redefine it.

Reimplemented from Iterator.

References Verification::perform_verification().

43.144.2.2 void print_results (std::ostream & *s*) [protected, virtual]

print the final iterator results This virtual function provides additional iterator-specific final results outputs beyond the function evaluation summary printed in finalize_run().

Reimplemented from Analyzer.

Reimplemented in RichExtrapVerification.

The documentation for this class was generated from the following files:

- DakotaVerification.H
- DakotaVerification.C

Chapter 44

File Documentation

44.1 dll_api.C File Reference

This file contains a DakotaRunner class, which launches DAKOTA.

Namespaces

- namespace Dakota

  The primary namespace for DAKOTA.

Functions

- void DAKOTA_DLL_FN dakota_create (int ∗dakota_ptr_int, char ∗logname)

  create and configure a new DakotaRunner, adding it to list of instances

- int DAKOTA_DLL_FN dakota_readInput (int id, char ∗dakotaInput)

  command DakotaRunner instance id to read from file dakotaInput

- void DAKOTA_DLL_FN dakota_get_variable_info (int id, char ∗∗∗pVarNames, int ∗pNumVarNames, char ∗∗∗pRespNames, int ∗pNumRespNames)

  return the variable and response names

- int DAKOTA_DLL_FN dakota_start (int id)

  command DakotaRunner instance id to start (plugin interface and run strategy)

- void DAKOTA_DLL_FN dakota_destroy (int id)

  delete Dakota runner instance id and remove from active list

- void DAKOTA_DLL_FN dakota_stop (int ∗id)

  command DakotaRunner instance id to stop execution

- const char *DAKOTA_DLL_FN dakota_getStatus (int id)

  return current results output as a string

- int get_mc_ptr_int ()

  get the DAKOTA pointer to ModelCenter

- void set_mc_ptr_int (int ptr_int)

  set the DAKOTA pointer to ModelCenter

- int get_dc_ptr_int ()

  get the DAKOTA pointer to ModelCenter current design point

- void set_dc_ptr_int (int ptr_int)

  set the DAKOTA pointer to ModelCenter current design point

Variables

- PRPCache data_pairs

  contains all parameter/response pairs.

44.1.1 Detailed Description

This file contains a DakotaRunner class, which launches DAKOTA.

44.1.2 Function Documentation

44.1.2.1 void DAKOTA_DLL_FN dakota_stop (int * *id*)

command DakotaRunner instance id to stop execution

TODO: trick application to quit through the syscall interface or throw exception.

44.2 dll_api.h File Reference

API for DLL interactions.

Functions

- void DAKOTA_DLL_FN dakota_create (int ∗dakota_ptr_int, char ∗logname)

  create and configure a new DakotaRunner, adding it to list of instances

- int DAKOTA_DLL_FN dakota_readInput (int id, char ∗dakotaInput)

  command DakotaRunner instance id to read from file dakotaInput

- int DAKOTA_DLL_FN dakota_start (int id)

  command DakotaRunner instance id to start (plugin interface and run strategy)

- void DAKOTA_DLL_FN dakota_destroy (int id)

  delete Dakota runner instance id and remove from active list

- void DAKOTA_DLL_FN dakota_stop (int ∗id)

  command DakotaRunner instance id to stop execution

- const char ∗DAKOTA_DLL_FN dakota_getStatus (int id)

  return current results output as a string

- int DAKOTA_DLL_FN get_mc_ptr_int ()

  get the DAKOTA pointer to ModelCenter

- void DAKOTA_DLL_FN set_mc_ptr_int (int ptr_int)

  set the DAKOTA pointer to ModelCenter

- int DAKOTA_DLL_FN get_dc_ptr_int ()

  get the DAKOTA pointer to ModelCenter current design point

- void DAKOTA_DLL_FN set_dc_ptr_int (int ptr_int)

  set the DAKOTA pointer to ModelCenter current design point

- void DAKOTA_DLL_FN dakota_get_variable_info (int id, char ∗∗∗pVarNames, int ∗pNumVarNames, char ∗∗∗pRespNames, int ∗pNumRespNames)

  return the variable and response names

44.2.1 Detailed Description

API for DLL interactions.

44.2.2 Function Documentation

44.2.2.1 void DAKOTA_DLL_FN dakota_stop (int * *id*)

command DakotaRunner instance id to stop execution

TODO: trick application to quit through the syscall interface or throw exception.

44.3 JEGAOptimizer.C File Reference

Contains the implementation of the JEGAOptimizer class.

Classes

- class Evaluator

  An evaluator specialization that knows how to interact with Dakota.

- class EvaluatorCreator

  A specialization of the JEGA::FrontEnd::EvaluatorCreator that creates a new instance of a Evaluator.

- class Driver

  A subclass of the JEGA front end driver that exposes the individual protected methods to execute the algorithm.

Namespaces

- namespace Dakota

  The primary namespace for DAKOTA.

Functions

- template<typename T >
  string asstring (const T &val)

  Creates a string from the argument val using an ostringstream.

44.3.1 Detailed Description

Contains the implementation of the JEGAOptimizer class.

44.4 JEGAOptimizer.H File Reference

Contains the definition of the JEGAOptimizer class.

Classes

- class JEGAOptimizer

  A version of Dakota::Optimizer for instantiation of John Eddy's Genetic Algorithms (JEGA).

Namespaces

- namespace Dakota

  The primary namespace for DAKOTA.

44.4.1 Detailed Description

Contains the definition of the JEGAOptimizer class.

44.5 library_mode.C File Reference

file containing a mock simulator main for testing DAKOTA in library mode

Namespaces

- namespace Dakota

  The primary namespace for DAKOTA.

Functions

- void nidr_set_input_string (const char ∗)

  Set input to NIDR via string argument instead of input file.

- int **nidr_save_exedir** (const char ∗, int)
- void run_dakota_parse (const char ∗dakota_input_file)

  Function to encapsulate the DAKOTA object instantiations for mode 1: parsing an input file.

- void run_dakota_data ()

  Function to encapsulate the DAKOTA object instantiations for mode 2: direct Data class instantiation.

- void run_dakota_mixed (const char ∗dakota_input_file)

  Function to encapsulate the DAKOTA object instantiations for mode 3: mixed parsing and direct updating.

- void model_interface_plugins (Dakota::ProblemDescDB &problem_db)
- int main (int argc, char ∗argv[ ])

  A mock simulator main for testing DAKOTA in library mode.

- static void my_callback_function (void ∗ptr)

44.5.1 Detailed Description

file containing a mock simulator main for testing DAKOTA in library mode

44.5.2 Function Documentation

44.5.2.1 void run_dakota_parse (const char ∗ *dakota_input_file*)

Function to encapsulate the DAKOTA object instantiations for mode 1: parsing an input file. This function parses from an input file to define the ProblemDescDB data.

References ProblemDescDB::lock(), ProblemDescDB::manage_inputs(), model_interface_plugins(), Strategy::run_strategy(), and ParallelLibrary::world_rank().

Referenced by main().

44.5.2.2 void run_dakota_mixed (const char * *dakota_input_file*)

Function to encapsulate the DAKOTA object instantiations for mode 3: mixed parsing and direct updating. This function showcases multiple features. For parsing, either an input file (dakota_input_file != NULL) or a default input string (dakota_input_file == NULL) are shown. This parsed input is then mixed with input from three sources: (1) input from a user-supplied callback function, (2) updates to the DB prior to Strategy instantiation, (3) updates directly to Iterators/Models following Strategy instantiation.

References ProblemDescDB::broadcast(), ProblemDescDB::get_dsa(), ProblemDescDB::lock(), model_interface_plugins(), ProblemDescDB::model_list(), ParallelLibrary::mpirun_flag(), my_-callback_function(), nidr_set_input_string(), ProblemDescDB::parse_inputs(), ProblemDescDB::post_-process(), ProblemDescDB::resolve_top_method(), Strategy::run_strategy(), ProblemDescDB::set(), and ParallelLibrary::world_rank().

Referenced by main().

44.5.2.3 void model_interface_plugins (Dakota::ProblemDescDB & *problem_db*)

Iterate over models and plugin appropriate interface: serial rosenbrock or parallel textbook.

References Dakota::abort_handler(), Interface::analysis_drivers(), Interface::assign_rep(), Interface::interface_-type(), ProblemDescDB::model_list(), ParallelLevel::server_intra_communicator(), and ProblemDescDB::set_-db_model_nodes().

Referenced by Dakota::run_dakota_data(), run_dakota_mixed(), and run_dakota_parse().

44.5.2.4 int main (int *argc*, char * *argv*[ ])

A mock simulator main for testing DAKOTA in library mode. Uses alternative instantiation syntax as described in the library mode documentation within the Developers Manual. Tests several problem specification modes: (1) run_dakota_parse: reads all problem specification data from an input file (2) run_dakota_data: creates all problem specification from direct Data instance instantiations. (3) run_dakota_mixed: a mixture of input parsing (by file or default string) and direct data updates, where the data updates occur: (a) via the DB prior to Strategy instantiation, and (b) via Iterators/Models following Strategy instantiation. Usage: dakota_library_mode [-m] [dakota.in]

References ParallelLibrary::detect_parallel_launch(), Dakota::run_dakota_data(), run_dakota_mixed(), and run_-dakota_parse().

44.5.2.5 static void my_callback_function (void * *ptr*) `[static]`

Example of user-provided callback function to override input specified and managed by NIDR, e.g., from an input deck.

References ProblemDescDB::get_dsa(), ProblemDescDB::get_string(), ProblemDescDB::resolve_top_method(), and ProblemDescDB::set().

Referenced by run_dakota_mixed().

44.6 library_split.C File Reference

file containing a mock simulator main for testing DAKOTA in library mode on a split communicator

Functions

- void manage_mpi (MPI_Comm &my_comm, int &color)

  Split MPI_COMM_WORLD, returning the comm and color.

- void gen_dakota_input (const int &color, std::string &input)

  Return the appropriate DAKOTA input based on color (1 or 2).

- void run_dakota (const MPI_Comm &comm, const std::string &input, const int &color)

  Launch DAKOTA on passed communicator, tagging output/error with color.

- void collect_results ()

  Wait for and collect results from DAKOTA runs.

- void nidr_set_input_string (const char ∗)

  Set input to NIDR via string argument instead of input file.

- int main (int argc, char ∗argv[ ])

  Driver routine for testing library mode with partitioned MPI_Comm. This test fixture requires MPI and can be run on 3--8 processors.

44.6.1 Detailed Description

file containing a mock simulator main for testing DAKOTA in library mode on a split communicator

44.7 main.C File Reference

file containing the main program for DAKOTA

Functions

- void fpinit_ASL ()
- int **nidr_save_exedir** (const char ∗, int)
- int main (int argc, char ∗argv[ ])

  The main DAKOTA program.

44.7.1 Detailed Description

file containing the main program for DAKOTA

44.7.2 Function Documentation

44.7.2.1 void fpinit_ASL ()

Floating-point initialization from AMPL: switch to 53-bit rounding if appropriate, to eliminate some cross-platform differences.

Referenced by main().

44.7.2.2 int main (int *argc*, char ∗ *argv*[ ])

The main DAKOTA program. Manage command line inputs, input files, restart file(s), output streams, and top level parallel iterator communicators. Instantiate the Strategy and invoke its run_strategy() virtual function.

References Dakota::abort_handler(), fpinit_ASL(), CommandLineHandler::instantiate_flag(), ProblemDescDB::lock(), ProblemDescDB::manage_inputs(), ParallelLibrary::output_helper(), GetLongOpt::retrieve(), Strategy::run_strategy(), ParallelLibrary::specify_outputs_restart(), and ParallelLibrary::world_rank().

44.8 restart_util.C File Reference

file containing the DAKOTA restart utility main program

Namespaces

- namespace Dakota

  The primary namespace for DAKOTA.

Functions

- void print_restart (int argc, char **argv, String print_dest)

  print a restart file

- void print_restart_tabular (int argc, char **argv, String print_dest)

  print a restart file (tabular format)

- void read_neutral (int argc, char **argv)

  read a restart file (neutral file format)

- void repair_restart (int argc, char **argv, String identifier_type)

  repair a restart file by removing corrupted evaluations

- void concatenate_restart (int argc, char **argv)

  concatenate multiple restart files

- int **nidr_save_exedir** (const char *, int)
- int main (int argc, char *argv[ ])

  The main program for the DAKOTA restart utility.

44.8.1 Detailed Description

file containing the DAKOTA restart utility main program

44.8.2 Function Documentation

44.8.2.1 int main (int *argc*, char * *argv*[ ])

The main program for the DAKOTA restart utility. Parse command line inputs and invoke the appropriate utility function (print_restart(), print_restart_tabular(), read_neutral(), repair_restart(), or concatenate_restart()).

References Dakota::concatenate_restart(), Dakota::print_restart(), Dakota::print_restart_tabular(), Dakota::read_-neutral(), and Dakota::repair_restart().

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