

System Preprocessors

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1 SysPro: a System preProcessors library

1.1 Introduction

This is a library of preprocessors for numerical problems, that is, mappings of one numerical problem into another, presumably more simple one, of the same type. For example, scaling a linear system. The SysPro library operates in two modes:

- exhaustive mode: all possible choices of a preprocessor are explored in sequence; this mode is set by command line options.
- intelligent mode: based on problem properties, a suitable choice for each preprocessor is made.

See [Usage modes](#) for more details.

Each preprocessor has the following structure, which is executed in the [Preprocessed-Solution\(\)](#) routine:

- a global setup is performed. This is a good place for computing problem features with the AnaMod library.
- a specific setup is performed; this can for instance disable certain preprocessor choices based on the computed problem features.
- a selection is made; this can be
 - a first choice, if the preprocessor is applied in exhaustive mode
 - an intelligent choice, if the exhaustive mode is off, and an intelligent choice routine exists
 - some default choice otherwise

In case of exhaustive mode, the following steps are executed inside a loop over all choices for this preprocessor, and possible all numerical option settings:

- the start function transforms the problem into a preprocessed problem
- if a next preprocessor is defined, it is applied; otherwise, the problem solving routine is applied (see [Preprocessor declaration](#)).
- the end function backtransforms the solution of the preprocessed problem into that of the original problem.

1.2 Topics

[Use of the SysPro package](#)

[Preprocessor reporting](#) and [Tracing the preprocessors](#)

[The Linear package for SysPro](#)

[The interface to other packages](#)

[Command line options handling](#)

Author

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Version

1.3

Date

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1.3 Change log

1.3 2008/08/20 : [DeclarePreprocessor\(\)](#) has an extra argument for global deallocation at the end of a program run. Currently used in the ksp preprocessor.

2008/05/10 : end function now has two NumericalProblem parameters; this is necessary for freeing the recursive problem.

2007 : Accomodated the array length parameter in anamod/nmd

2 The Linear package for SysPro

A linear system is a special case of a numerical problem. This file contains the routines for creating, deleting, and duplicating linear systems.

[Definition of a linear system](#)

[Transformations for linear systems](#)

2.1 Transformations for linear systems

[Flip the sign of a matrix](#)

[Eliminate fully determined \(singleton\) rows from a matrix](#)

[Permutation / load balancing](#)

[Scale a linear system](#)

[Approximate the coefficient matrix](#)

[The iterative method](#)

[The preconditioner](#)

The linear package for SysPro can use the NMD and AnaMod libraries, but does not require them. Any dependencies on NMD and Anamod should all be restricted to [com-putec](#).

The mechanism of preprocessed solving through forward and backward transformations can be applied to all sorts of numerical problems. At present, we only supply code for linear system solving; see [linearfile](#).

2.2 Flip the sign of a matrix

Most code for iterative methods and preconditioners assumes somewhere that the sign of a matrix is predominantly positive. Hence, we flip the sign of matrices that have no positive diagonal elements.

2.3 Eliminate fully determined (singleton) rows from a matrix

In a linear system, any variable whose matrix row has only a single element is independent of the rest of the system, in the sense that the other variables can be solved independently of it. The singleton preprocessor eliminates such rows, and performs the backsubstitution.

2.4 Permutation / load balancing

Linear system solving is sensitive in several ways to permutations and load balancing applied to the system. This dependency typically comes through the preconditioner: incomplete factorizations are sensitive to permutations, and block Jacobi and Schwarz preconditioners are sensitive to load distributions, even without any permutation applied.

2.5 Scale a linear system

This preprocessor can perform pointwise left, right, and symmetric scalings of a linear system by the diagonal of its coefficient matrix.

2.6 Approximate the coefficient matrix

A preconditioner need not be derived from the coefficient matrix. For instance, in the case of a higher order finite element matrix, incomplete factorization preconditioner are better derived from a linear element discretization of the same problem, since this matrix will be an M-matrix.

This preprocessor can perform the following approximations:

- symmetric: take the symmetric part of the coefficient matrix
- gustafsson: apply the Gustafsson modified element matrix transformation (see reference [GUS] below).

```
[GUS]
@article{Gu:modified_element,
author = {Ivar Gustafsson},
title = {An Incomplete Factorization Preconditioning Method
        based on Modification of Element Matrices},
journal = {BIT},
year = {1996},
volume = {36},
pages = {86--100}
}
```

2.7 The iterative method

The iterative method is not really a transformation, but it is the last choice made in a preprocessor loop before the final solver is called. This means that no new matrix analysis is performed after applying this transformation.

2.8 The preconditioner

Choosing a preconditioner changes a linear system into a preconditioned system. However, this is not a transformation of any coefficient matrix, so this preprocessor is handled a bit differently from the previous ones.

3 Definition of a linear system

A linear system has the following components:

- A : coefficient matrix
- B : a matrix from which to build a preconditioner. Often this will just be A.

- `rhs` : the right hand side
- `sol` : a known solution, if any; there is a boolean to indicate
- `init` : a starting guess for iterative methods whether a solution is known.
- `ctx` : a void pointer for storing an arbitrary data item; this can be used by the user.

See [CreateLinearSystem\(\)](#), [DeleteLinearSystem\(\)](#), [LinearSystemSetParts\(\)](#), [LinearSystemGetParts\(\)](#), [LinearSystemInheritParts\(\)](#).

See also [linearsolution](#).

4 linearsolution

There is an object to store the solution of a linear system.

The solution of a linear system is stored in a data structure that contains

- `out` : the computed output vector
- `statistics` : an NMD object. See [LinearSolutionCreateStatistics\(\)](#).

See [CreateLinearSolution\(\)](#), [LinearSolutionDelete\(\)](#), [LinearSolutionCopy\(\)](#), [LinearCopyNumericalSolution\(\)](#),

5 Solution Statistics

The `LinearSolution` object carries an `NMD_metadata` object that contains performance measurements. This object is initially empty, so we need to build its content.

6 The linear solution context

We use the context pointer in a `LinearSolution` object to store diagnostics. This pointer is blindly copied in [LinearSolutionCopy\(\)](#) (unlike the solution vector, which is replicated) so we have to be careful with deallocating.

7 Command line options handling

Being based on Petsc, SysPro can tailor its workings by commandline options. Options are handled by [PreprocessorsOptionsHandling\(\)](#). This routine needs to be called ex-

plicity by the user, after all calls to [DeclarePreprocessor\(\)](#). Commandline options can be set from the program source by the Petsc call `PetscOptionsSetValue()`.

The following commandline options are understood.

- `"-syspro_exhaustive"` : every preprocessor is cycled exhaustively, unless otherwise limited.
- `"-syspro_someprocessor exhaustive"` : the specified preprocessor is tested exhaustively.
- `"-syspro_someprocessor choice1,choice2,..."` : the specified preprocessor takes on the specified values. This induces cycling on only the specified preprocessor; if the `"-syspro_exhaustive"` option for exhaustive cycling of all preprocessors is given, the limited cycling takes precedence.
- `"-syspro_someprocessor not,choice1,choice2,..."` : limited cycling is setup, except that the the specified choices will not be used. (See [TransformObjectsUseOnly\(\)](#) for details.)
- `"-syspro_someprocessor_somechoice_values v1,v2,v3,..."` : if a preprocessor choice has option values, this sets the values. This is also induces exhaustive cycling over this preprocessor. Note: unless the cycling is explicitly limited 'somechoice' (see the previous item), the exhaustive mode will cycle over all choices of this preprocessor.

Any preprocessor can declare its own option handler routine. The option names it handles can be anything, but should presumably not clash with the above formats. E.g., use `"-syspro_pc_iterative"` rather than `"-syspro_pc iterative"`.

8 Use of the SysPro package

8.1 Setup of the SysPro system

The setup of SysPro has to be done once per program run.

8.1.1 Global declarations

All use of SysPro has to be inside calls to [SysProInitialize\(\)](#) and [SysProFinalize\(\)](#). These allocate and deallocate global data structures. You could place them right next to `MPI_Initialize/Finalize` or `PetscInitialize/Finalize` calls. The [SysProFinalize\(\)](#) call can also be used to deallocate data that was constructed during preprocessor setup.

Another step in the global setup of SysPro is a call to [SysProDeclareFunctions\(\)](#), This declares functions that are of use to all preprocessors that will be declared later.

8.1.2 Preprocessor declaration

Preprocessors are declared with calls to [DeclarePreprocessor\(\)](#), which installs the setup functions and the forward / backward transformations.

Further specifications can be given for a specific preprocessor:

- [DeclarePreprocessorIntelligentChoice\(\)](#) for installing a routine that will intelligently pick a preprocessor choice.
- see [Computational modules interface](#) for metadata category handling.

8.2 Setup and invocation

After the setup as described above, [PreprocessorsOptionsHandling\(\)](#) can be called to provide the user with runtime control (see section [Usage modes](#)) over the workings of SysPro.

Preprocessed problem solving is activated by a call to [PreprocessedProblemSolving\(\)](#). This causes all declared preprocessors to be applied in sequence. Finally, the ultimately remaining problem is solved with the routine declared by [PreprocessorsDeclareProblemSolver\(\)](#).

8.3 Usage modes

SysPro can be used in several modes:

- one can specify the exact preprocessor values (or several values);
- one can specify to test exhaustively the values of one preprocessor or all of them;
- SysPro can intelligently pick the appropriate preprocessor.

The intelligent preprocessor choice uses a model where each preprocessor has a measure of how applicable it is; the SysPro system then picks the most appropriate preprocessor from a given class. See [Suitability functions](#).

See [Command line options handling](#) for details on specific and exhaustive testing.

8.4 Predefined preprocessors

The SysPro package comes with a number of predefined preprocessors, mostly geared towards linear system processing.

9 lineartransform

10 The interface to other packages

SysPro by itself is not of a lot of use: it is a framework for tying together transformations and operations. There is also an interface for computing metadata.

[Computational modules interface](#)

10.1 Computational modules interface

SysPro has a facility for computing or retrieving metadata about the numerical problems it deals with. The interface comprises

- specification of preserved categories under preprocessor application with [PreprocessorSetPreservedCategories\(\)](#).

THE FOLLOWING FACILITY IS DISABLED

Standard it comes with a dummy library `libsysprocompute.a` of routines that simply say "failed to compute/retrieve data". If the user has an actual computation package (such as AnaMod), then that can be interfaced by providing implementations of the routines [SysProComputeQuantity\(\)](#) and [SysProRetrieveQuantity\(\)](#).

11 Context handling

In order to carry application-specific information and temporaries around, there are a few opaque handle contexts in syspro.

A NumericalProblem structure is defined to have a context. This is cloned at the application of a preprocessor, and deleted when its application is finished.

See [SysProGetContextFunctions\(\)](#), [SysProProblemCloneContext\(\)](#), [SysProProblemDeleteContext\(\)](#).

In order to offer flexibility, there are several possibilities for user objects to be stored under opaque (`void*`) pointers.

11.1 contexts

Each preprocessor that has declared a `contextcreate` function, will create that context at the start of its traversal. This context is then globally registered with [RegisterPreprocessorContext\(\)](#) under the name of this preprocessor, so that other preprocessor can have access to it with [PreprocessorGetContext\(\)](#).

There is one special context, which is stored under the `solution` handle. This one is not created by default. See the "linear" package for an example of how to use it.

11.2 contexts

The `start_function` can create a context, which is input to the `end_function`. This context serves to preserve data that is necessary for the inverse transformation that is applied in the `start_function`.

12 Preprocessor reporting

For purposes of reporting, there are routines for retrieving the names of all preprocessors in sequence. This is the general idea:

```
ierr = GetFirstPreprocessor(&name); CHKERRQ(ierr);
while (name) {
    .....
    ierr = GetNextPreprocessor(&name); CHKERRQ(ierr);
}
```

Similarly, [StartRetrievingCurrentPreprocessors\(\)](#) and [ContinueRetrievingCurrentPreprocessors\(\)](#) get the class and specific choice of the currently active preprocessors.

With [StartRetrievingAllPreprocessors\(\)](#) and [ContinueRetrievingAllPreprocessors\(\)](#) one can get the classes, and in each class all defined choices.

The specific reporting functions are:

- [TabReportPreprocessors\(\)](#) : report on currently active preprocessors; suitable for database file output
- [ReportEnabledPreprocessors\(\)](#) : report on non-disabled choices for a given preprocessor
- [ReportSysProCallStackState\(\)](#) : report currently active preprocessors

13 Tracing the preprocessors

The SysPro package does not by default print out anything, other than severe error messages (Petsc macro SETERRQ) that accompany an abort.

However, you can specify a trace function, which can further be tuned by specifying a trace context.

See [SysProDeclareTraceFunction\(\)](#), [SysProDeclareTraceContext\(\)](#), [SysProTraceMessage\(\)](#).

14 Preprocessor definition

14.1 Class definition

A class of preprocessors (such as scaling, preconditioning) is defined using the function [NewTransform\(\)](#).

14.2 Individual preprocessor definition

The individual preprocessors (left scaling, preprocessing by ILU) are defined in a function that is passed as the `specific_setup` argument to [DeclarePreprocessor\(\)](#). This function makes calls to [NewTransformObject\(\)](#), [TransformObjectIntAnnotate\(\)](#) et cetera. See for instance file [pc.c](#) .

15 Suitability functions

The general mechanism for choosing between algorithms is that of 'suitability functions'. We associate with each specific preprocessor (for instance scaling/left) a function that returns either a fuzzy truth value (0--1) or 'unknown' (-1). See [TransformObjectSetSuitabilityFunction\(\)](#), [TransformObjectGetSuitabilityFunction\(\)](#). See also [Preprocessor definition](#) about specific preprocessor construction.

At the start of a preprocessor invocation, in [PreprocessorSpecificSetup\(\)](#), the suitability functions of all choices are evaluated, and the choices are marked as unsuitable (if the evaluate is zero), or ranked otherwise.

The only implemented suitability functions are for the linear problem; see [Suitability functions for the linear problem](#).

16 Data Structure Index

16.1 Data Structures

Here are the data structures with brief descriptions:

LinearSolution_	12
LinearSystem_	14
NumericalProblem_	16
PreprocessorsGlobalInfo_	17

SalsaTransform_	20
SalsaTransformObject_	22
singleton_struct	26
SystemPreprocessor_	27

17 File Index

17.1 File List

Here is a list of all files with brief descriptions:

approximating.c	29
compute.c (System/Anamod and NMD interface)	32
distribution.c	33
flipsign.c	36
ksp.c	38
kspmonitor.c	41
linear.c	43
linear_impl.h	52
linksp.h	54
linpc.h	55
Make.inc	57
options.c	57
pc.c	58
pcstuff.c	61
preprocess.c	63
reporting.c	75
scaling.c	81

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sysprolinear.h	106
sysprosuit.h	116
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u15.c	153
u16.c	153
u2.c	154
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18 Data Structure Documentation

18.1 LinearSolution_ Struct Reference

```
#include <linear_impl.h>
```

Data Fields

- int [cookie](#)
- Vec [Out](#)
- NMD_metadata [statistics](#)
- void * [ctx](#)

18.1.1 Detailed Description

Definition at line 27 of file [linear_impl.h](#).

18.1.2 Field Documentation

18.1.2.1 int LinearSolution_::cookie

Definition at line 28 of file [linear_impl.h](#).

Referenced by [CreateLinearSolution\(\)](#).

18.1.2.2 void* LinearSolution_::ctx

Definition at line 37 of file [linear_impl.h](#).

Referenced by [LinearDeleteNumericalSolutionContext\(\)](#), [LinearSolutionCopy\(\)](#), [LinearSolutionGetContext\(\)](#), and [LinearSolutionSetContext\(\)](#).

18.1.2.3 Vec LinearSolution_::Out

Definition at line 29 of file [linear_impl.h](#).

Referenced by [LinearSolutionCopy\(\)](#), [LinearSolutionDelete\(\)](#), [LinearSolutionGetVector\(\)](#), and [LinearSolutionSetVector\(\)](#).

18.1.2.4 NMD_metadata LinearSolution_::statistics

Definition at line 30 of file [linear_impl.h](#).

Referenced by [CreateLinearSolution\(\)](#), [LinearSolutionCopy\(\)](#), [LinearSolutionCopyStats\(\)](#), [LinearSolutionCreateStatistics\(\)](#), [LinearSolutionDelete\(\)](#), and [LinearSolutionGetStatistics\(\)](#).

The documentation for this struct was generated from the following file:

- [linear_impl.h](#)

18.2 LinearSystem_ Struct Reference

```
#include <linear_impl.h>
```

Data Fields

- MPI_Comm [comm](#)
- void * [ctx](#)
- int [cookie](#)
- int [partsoriginal](#)
- Mat [A](#)
- Mat [B](#)
- Vec [Rhs](#)
- Vec [Sol](#)
- Vec [Init](#)
- Vec [Tmp](#)
- PetscTruth [known_solution](#)
- NMD_metadata [metadata](#)

18.2.1 Detailed Description

Definition at line 18 of file `linear_impl.h`.

18.2.2 Field Documentation

18.2.2.1 Mat LinearSystem_::A

Definition at line 22 of file `linear_impl.h`.

Referenced by `LinearSystemCopy()`, `LinearSystemDelete()`, `LinearSystemDuplicate()`, `LinearSystemDuplicatePointers()`, `LinearSystemGetParts()`, `LinearSystemInheritParts()`, and `LinearSystemSetParts()`.

18.2.2.2 Mat LinearSystem_::B

Definition at line 22 of file `linear_impl.h`.

Referenced by `LinearSystemCopy()`, `LinearSystemDelete()`, `LinearSystemDuplicate()`, `LinearSystemDuplicatePointers()`, `LinearSystemGetParts()`, `LinearSystemInheritParts()`, and `LinearSystemSetParts()`.

18.2.2.3 MPI_Comm LinearSystem_::comm

Definition at line 19 of file `linear_impl.h`.

18.2.2.4 int LinearSystem_::cookie

Definition at line 20 of file linear_impl.h.

Referenced by CreateLinearSystem().

18.2.2.5 void* LinearSystem_::ctx

Definition at line 19 of file linear_impl.h.

Referenced by LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetContext(), and LinearSystemSetContext().

18.2.2.6 Vec LinearSystem_::init

Definition at line 22 of file linear_impl.h.

Referenced by LinearSystemCopy(), LinearSystemDelete(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetParts(), LinearSystemInheritParts(), and LinearSystemSetParts().

18.2.2.7 PetscTruth LinearSystem_::known_solution

Definition at line 23 of file linear_impl.h.

Referenced by LinearSystemCopy(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetKnownSolution(), and LinearSystemSetKnownSolution().

18.2.2.8 NMD_metadata LinearSystem_::metadata

Definition at line 24 of file linear_impl.h.

Referenced by LinearSystemCopy(), LinearSystemDuplicatePointers(), LinearSystemGetMetadata(), and LinearSystemSetMetadata().

18.2.2.9 int LinearSystem_::partsoriginal

Definition at line 21 of file linear_impl.h.

Referenced by CreateLinearSystem(), LinearSystemCopy(), LinearSystemDelete(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemInheritParts(), and LinearSystemSetParts().

18.2.2.10 Vec LinearSystem_::rhs

Definition at line 22 of file linear_impl.h.

Referenced by LinearSystemCopy(), LinearSystemDelete(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetParts(), LinearSystemGetTmpVector(), LinearSystemInheritParts(), and LinearSystemSetParts().

18.2.2.11 Vec LinearSystem_::Sol

Definition at line 22 of file linear_impl.h.

Referenced by LinearSystemCopy(), LinearSystemDelete(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetParts(), LinearSystemInheritParts(), and LinearSystemSetParts().

18.2.2.12 Vec LinearSystem_::Tmp

Definition at line 22 of file linear_impl.h.

Referenced by LinearSystemDelete(), and LinearSystemGetTmpVector().

The documentation for this struct was generated from the following file:

- [linear_impl.h](#)

18.3 NumericalProblem_ Struct Reference

```
#include <syspro_impl.h>
```

Data Fields

- MPI_Comm [comm](#)
- void * [ctx](#)

18.3.1 Detailed Description

Definition at line 13 of file syspro_impl.h.

18.3.2 Field Documentation

18.3.2.1 MPI_Comm NumericalProblem_::comm

Definition at line 14 of file syspro_impl.h.

Referenced by create_solver(), NumericalProblemGetComm(), and specific_distribution_choices().

18.3.2.2 void* NumericalProblem_::ctx

Definition at line 14 of file syspro_impl.h.

Referenced by LinearSystemDuplicate(), LinearSystemDuplicatePointers(), and SysProblemCloneContext().

The documentation for this struct was generated from the following file:

- [syspro_impl.h](#)

18.4 PreprocessorsGlobalInfo_ Struct Reference

Data Fields

- `PetscErrorCode(* problemmonitor)(NumericalProblem)`
- `PetscErrorCode(* classstaticsetup)(const char *)`
- `PetscErrorCode(* classdynamicsetup)(const char *, NumericalProblem)`
This routine is executed on the creation of a new preprocessor.
- `PetscErrorCode(* classproblemcloner)(const char *, const char *, int, NumericalProblem, NumericalProblem)`
This routine is invoked at the start of each preprocessor class.
- `PetscErrorCode(* computecategory)(char *, NumericalProblem)`
This routine is called everytime a new problem is created with a class/option pair.
- `PetscErrorCode(* metadataacomputer)(char *, char *, Mat, void *, PetscTruth *)`
This routine is called in sequence with the names of the required metadata categories.
- `PetscErrorCode(* clonecontext)(const char *, const char *, void *, void **)`
- `PetscErrorCode(* freecontext)(void *)`
- `PetscErrorCode(* problemsolver)(NumericalProblem, void *, NumericalSolution *)`
- `PetscErrorCode(* problemdelete)(NumericalProblem)`
- `PetscErrorCode(* errortracer)(NumericalProblem, NumericalSolution, const char *)`
- `PetscErrorCode(* solutioncreator)(NumericalProblem, NumericalSolution *)`
- `PetscErrorCode(* solutioncopy)(NumericalSolution, NumericalSolution)`
- `PetscErrorCode(* solutiondelete)(NumericalSolution)`
- `PetscErrorCode(* solutioncontextdelete)(NumericalSolution)`

18.4.1 Detailed Description

Definition at line 165 of file preprocess.c.

18.4.2 Field Documentation

18.4.2.1 `PetscErrorCode(* PreprocessorsGlobalInfo_::classdynamicsetup)(const char *, NumericalProblem)`

This routine is executed on the creation of a new preprocessor.

It can be used to install standard options in the preprocessor transform object.

Definition at line 172 of file preprocess.c.

Referenced by PreprocessedSolution(), and SysProDeclareFunctions().

18.4.2.2 PetscErrorCode(* PreprocessorsGlobalInfo_::classproblemcloner)(const char *, const char *, int, NumericalProblem, NumericalProblem)

This routine is invoked at the start of each preprocessor class.

It is not supposed to contain problem-dependent actions. It is useful for printing trace messages, and performing analysis on each incoming problem.

Definition at line 179 of file preprocess.c.

Referenced by SysProDeclareFunctions().

18.4.2.3 PetscErrorCode(* PreprocessorsGlobalInfo_::classstaticsetup)(const char *)

Definition at line 167 of file preprocess.c.

Referenced by DeclarePreprocessor(), and SysProDeclareFunctions().

18.4.2.4 PetscErrorCode(* PreprocessorsGlobalInfo_::clonecontext)(const char *, const char *, void *, void **)

Definition at line 188 of file preprocess.c.

Referenced by SysProDeclareFunctions(), and SysProGetContextFunctions().

18.4.2.5 PetscErrorCode(* PreprocessorsGlobalInfo_::computecategory)(char *, NumericalProblem)

This routine is called everytime a new problem is created with a class/option pair.

It can be used to copy preserved metadata elements

Definition at line 183 of file preprocess.c.

Referenced by ChooseFirstTransform().

18.4.2.6 PetscErrorCode(* PreprocessorsGlobalInfo_::errortracer)(NumericalProblem, NumericalSolution, const char *)

Definition at line 192 of file preprocess.c.

Referenced by PreprocessedProblemSolving(), PreprocessedSolution(), SysProDeclareErrorTracer(), SysProGetErrorTracer(), and SysProPreprocessorEndFunction().

18.4.2.7 PetscErrorCode(* PreprocessorsGlobalInfo_::freecontext)(void *)

Definition at line 189 of file preprocess.c.

Referenced by SysProDeclareFunctions(), and SysProGetContextFunctions().

18.4.2.8 PetscErrorCode(* PreprocessorsGlobalInfo_::metadatacomputer)(char *, char *, Mat, void *, PetscTruth *)

This routine is called in sequence with the names of the required metadata categories.

Definition at line 187 of file preprocess.c.

18.4.2.9 PetscErrorCode(* PreprocessorsGlobalInfo_ - ::problemdelete)(NumericalProblem)

Definition at line 191 of file preprocess.c.

Referenced by SysProDeclareFunctions(), and SysProPreprocessorEndFunction().

18.4.2.10 PetscErrorCode(* PreprocessorsGlobalInfo_ - ::problemmonitor)(NumericalProblem)

Definition at line 166 of file preprocess.c.

Referenced by PreprocessorSpecificSetup(), and SysProDeclareProblemMonitor().

18.4.2.11 PetscErrorCode(* PreprocessorsGlobalInfo_ - ::problemsolver)(NumericalProblem, void *, NumericalSolution *)

Definition at line 190 of file preprocess.c.

Referenced by PreprocessedProblemSolving(), PreprocessedSolution(), and SysProDeclareFunctions().

18.4.2.12 PetscErrorCode(* PreprocessorsGlobalInfo_ - ::solutioncontextdelete)(NumericalSolution)

Definition at line 196 of file preprocess.c.

Referenced by PreprocessedSolution(), and SysProDeclareFunctions().

18.4.2.13 PetscErrorCode(* PreprocessorsGlobalInfo_ - ::solutioncopy)(NumericalSolution, NumericalSolution)

Definition at line 194 of file preprocess.c.

Referenced by SysProDeclareFunctions(), and SysProPreprocessorEndFunction().

18.4.2.14 `PetscErrorCode(* PreprocessorsGlobalInfo_ -
::solutioncreator)(NumericalProblem, NumericalSolution
*)`

Definition at line 193 of file preprocess.c.

Referenced by SysProDeclareFunctions(), and SysProPreprocessorEndFunction().

18.4.2.15 `PetscErrorCode(* PreprocessorsGlobalInfo_ -
::solutiondelete)(NumericalSolution)`

Definition at line 195 of file preprocess.c.

Referenced by PreprocessedSolution(), SysProDeclareFunctions(), and SysProPreprocessorEndFunction().

The documentation for this struct was generated from the following file:

- [preprocess.c](#)

18.5 SalsaTransform_ Struct Reference

```
#include <syspro_impl.h>
```

Data Fields

- int [cookie](#)
- char * [name](#)
- PetscTruth [userchoices](#)
- [SalsaTransformObject](#) * [transformobjects](#)
- PetscErrorCode(* [suitabilityctxtester](#))(void *)
- int [alloc_objects](#)
- int [n_objects](#)
- int * [aprioriselection](#)
- int [n_annotate_c](#)
- char ** [annotations_c](#)
- int [n_annotate_i](#)
- char ** [annotations_i](#)

18.5.1 Detailed Description

Definition at line 32 of file syspro_impl.h.

18.5.2 Field Documentation

18.5.2.1 int SalsaTransform_::alloc_objects

Definition at line 37 of file syspro_impl.h.

Referenced by NewTransform(), and NewTransformObject().

18.5.2.2 char** SalsaTransform_::annotations_c

Definition at line 38 of file syspro_impl.h.

Referenced by DeregisterTransform(), SysProDefineCharAnnotation(), and TransformCharAnnotationGetIndex().

18.5.2.3 char** SalsaTransform_::annotations_i

Definition at line 39 of file syspro_impl.h.

Referenced by DeregisterTransform(), SysProDefineIntAnnotation(), TransformIntAnnotationGetIndex(), and TransformObjectGetIntAnnotation().

18.5.2.4 int * SalsaTransform_::aprioriselection

Definition at line 37 of file syspro_impl.h.

Referenced by DeregisterTransform(), NewTransform(), PreprocessorApplyAprioriSelection(), and PreprocessorSaveAprioriSelection().

18.5.2.5 int SalsaTransform_::cookie

Definition at line 33 of file syspro_impl.h.

Referenced by NewTransform().

18.5.2.6 int SalsaTransform_::n_annotate_c

Definition at line 38 of file syspro_impl.h.

Referenced by SysProDefineCharAnnotation(), and TransformCharAnnotationGetIndex().

18.5.2.7 int SalsaTransform_::n_annotate_i

Definition at line 39 of file syspro_impl.h.

Referenced by SysProDefineIntAnnotation(), TransformIntAnnotationGetIndex(), and TransformObjectGetIntAnnotation().

18.5.2.8 int SalsaTransform_::n_objects

Definition at line 37 of file syspro_impl.h.

Referenced by `ContinueRetrievingAllPreprocessors()`, `DeregisterTransform()`, `NewTransform()`, `NewTransformObject()`, `PreprocessorApplyAprioriSelection()`, `PreprocessorSaveAprioriSelection()`, `PreprocessorSpecificSetup()`, `SalsaTransformIntegrityTest()`, `TransformGetNextUnmarkedItem()`, `TransformGetNUnmarked()`, `TransformGetObjects()`, `TransformObjectGetByName()`, `TransformObjectsGetNames()`, `TransformObjectsMarkAll()`, `TransformObjectsUnmarkAll()`, `TransformReportEnabled()`, and `TransformReportTeXTable()`.

18.5.2.9 `char* SalsaTransform_::name`

Definition at line 34 of file `syspro_impl.h`.

Referenced by `NewTransform()`, `TransformGetName()`, `TransformItemDescribeLong()`, `TransformItemDescribeShort()`, `TransformItemOptionMark()`, `TransformObjectGetTransformName()`, and `TransformObjectsUseOnly()`.

18.5.2.10 `PetscErrorCode(* SalsaTransform_::suitabilityctxtester)(void *)`

Definition at line 36 of file `syspro_impl.h`.

Referenced by `SalsaTransformIntegrityTest()`, `SetSuitabilityContextTester()`, and `TestSuitabilityContext()`.

18.5.2.11 `SalsaTransformObject* SalsaTransform_::transformobjects`

Definition at line 35 of file `syspro_impl.h`.

Referenced by `DeregisterTransform()`, `NewTransform()`, `NewTransformObject()`, `PreprocessorApplyAprioriSelection()`, `PreprocessorSaveAprioriSelection()`, `PreprocessorSpecificSetup()`, `SalsaTransformIntegrityTest()`, `TransformGetNextUnmarkedItem()`, `TransformGetNUnmarked()`, `TransformGetObjects()`, `TransformObjectGetByName()`, `TransformObjectsGetNames()`, `TransformObjectsMarkAll()`, `TransformObjectsUnmarkAll()`, `TransformReportEnabled()`, and `TransformReportTeXTable()`.

18.5.2.12 `PetscTruth SalsaTransform_::userchoices`

Definition at line 34 of file `syspro_impl.h`.

Referenced by `TransformGetUserChoices()`, and `TransformSetUserChoices()`.

The documentation for this struct was generated from the following file:

- [syspro_impl.h](#)

18.6 SalsaTransformObject_ Struct Reference

Data Fields

- int [cookie](#)
- const char * [name](#)

- const char * [explanation](#)
- [SalsaTransform](#) transform
- int [n_options](#)
- int [alloc_options](#)
- int * [options](#)
- const char * [option](#)
- const char ** [optionexplanation](#)
- int * [options_marked](#)
- int [active_option](#)
- int [alloc_annotate_c](#)
- const char ** [annotate_c](#)
- int [alloc_annotate_i](#)
- int * [annotate_i](#)
- int [marked](#)
- PetscErrorCode(* [suitabilityfunction](#))(NumericalProblem, void *, [SuitabilityValue](#) *)
- void * [suitabilityctx](#)

18.6.1 Detailed Description

Definition at line 8 of file transform.c.

18.6.2 Field Documentation

18.6.2.1 int SalsaTransformObject_::active_option

Definition at line 13 of file transform.c.

18.6.2.2 int SalsaTransformObject_::alloc_annotate_c

Definition at line 14 of file transform.c.

Referenced by TransformObjectCharAnnotate().

18.6.2.3 int SalsaTransformObject_::alloc_annotate_i

Definition at line 15 of file transform.c.

Referenced by TransformObjectIntAnnotate().

18.6.2.4 int SalsaTransformObject_::alloc_options

Definition at line 12 of file transform.c.

Referenced by TransformObjectAddOption().

18.6.2.5 const char SalsaTransformObject_::annotate_c**

Definition at line 14 of file transform.c.

Referenced by FreeTransformObject(), and TransformObjectCharAnnotate().

18.6.2.6 int * SalsaTransformObject_::annotate_i

Definition at line 15 of file transform.c.

Referenced by FreeTransformObject(), TransformObjectGetIntAnnotation(), and TransformObjectIntAnnotate().

18.6.2.7 int SalsaTransformObject_::cookie

Definition at line 9 of file transform.c.

Referenced by NewTransformObject().

18.6.2.8 const char * SalsaTransformObject_::explanation

Definition at line 10 of file transform.c.

Referenced by TransformItemDescribeLong(), TransformObjectSetExplanation(), and TransformReportTeXTable().

18.6.2.9 int SalsaTransformObject_::marked

Definition at line 16 of file transform.c.

Referenced by PreprocessorApplyAprioriSelection(), PreprocessorSaveAprioriSelection(), TransformGetNextUnmarkedItem(), TransformGetNUnmarked(), TransformItemOptionMark(), TransformObjectGetMark(), TransformObjectMark(), and TransformObjectUnmark().

18.6.2.10 int SalsaTransformObject_::n_options

Definition at line 12 of file transform.c.

Referenced by FreeTransformObject(), TransformItemDescribeShort(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformItemOptionMark(), TransformItemOptionsUseOnly(), TransformObjectAddOption(), TransformObjectAddOptionExplanation(), TransformObjectMark(), TransformObjectUnmark(), and TransformReportTeXTable().

18.6.2.11 const char* SalsaTransformObject_::name

Definition at line 10 of file transform.c.

Referenced by FreeTransformObject(), NewTransformObject(), TransformGetNextUnmarkedItem(), TransformItemDescribeShort(), TransformObjectAddOption(), TransformObjectGetByName(), TransformObjectGetName(), TransformObjectsGetNames(), and

TransformReportTeXTable().

18.6.2.12 `const char* SalsaTransformObject_::option`

Definition at line 12 of file transform.c.

Referenced by TransformObjectDefineOption().

18.6.2.13 `const char ** SalsaTransformObject_::optionexplanation`

Definition at line 12 of file transform.c.

Referenced by FreeTransformObject(), TransformObjectAddOption(), and TransformObjectAddOptionExplanation().

18.6.2.14 `int * SalsaTransformObject_::options`

Definition at line 12 of file transform.c.

Referenced by FreeTransformObject(), TransformItemDescribeLong(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformItemOptionMark(), TransformObjectAddOption(), TransformObjectAddOptionExplanation(), and TransformReportTeXTable().

18.6.2.15 `int * SalsaTransformObject_::options_marked`

Definition at line 13 of file transform.c.

Referenced by FreeTransformObject(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformItemOptionMark(), TransformObjectAddOption(), TransformObjectMark(), and TransformObjectUnmark().

18.6.2.16 `void * SalsaTransformObject_::suitabilityctx`

Definition at line 19 of file transform.c.

Referenced by TransformObjectGetSuitabilityFunction(), and TransformObjectSetSuitabilityFunction().

18.6.2.17 `PetscErrorCode(* SalsaTransformObject_ - ::suitabilityfunction)(NumericalProblem, void *, SuitabilityValue *)`

Definition at line 18 of file transform.c.

Referenced by TransformObjectGetSuitabilityFunction(), and TransformObjectSetSuitabilityFunction().

18.6.2.18 `SalsaTransform SalsaTransformObject_::transform`

Definition at line 11 of file transform.c.

Referenced by `NewTransformObject()`, `TransformObjectCharAnnotate()`, `TransformObjectGetIntAnnotation()`, `TransformObjectGetTransformName()`, and `TransformObjectIntAnnotate()`.

The documentation for this struct was generated from the following file:

- [transform.c](#)

18.7 singleton_struct Struct Reference

Data Fields

- int `n`
- int `t`
- VecScatter `extractor`

18.7.1 Detailed Description

Definition at line 18 of file `singleton.c`.

18.7.2 Field Documentation

18.7.2.1 VecScatter singleton_struct::extractor

Definition at line 18 of file `singleton.c`.

Referenced by `back_singleton()`, and `eliminate_singletons()`.

18.7.2.2 int singleton_struct::n

Definition at line 18 of file `singleton.c`.

Referenced by `eliminate_singletons()`.

18.7.2.3 int singleton_struct::t

Definition at line 18 of file `singleton.c`.

Referenced by `back_singleton()`, and `eliminate_singletons()`.

The documentation for this struct was generated from the following file:

- [singleton.c](#)

18.8 SystemPreprocessor_ Struct Reference

```
#include <syspro_impl.h>
```

Data Fields

- const char * [name](#)
- [SalsaTransform](#) transform
- const char * [preserved](#)
- const char * [required](#)
- PetscTruth [exhaustive](#)
- PetscErrorCode(* [setup](#))(NumericalProblem, [SalsaTransform](#))
- PetscErrorCode(* [unset](#))(NumericalProblem)
- PetscErrorCode(* [ctxcreate](#))(NumericalProblem, void **)
- PetscErrorCode(* [ctxdelete](#))(void *)
- PetscErrorCode(* [start_function](#))(const char *, int, PetscTruth, [NumericalProblem](#), [NumericalProblem](#) *, void *, void **, PetscTruth *)
- PetscErrorCode(* [end_function](#))(const char *, PetscTruth, void *, void *, [NumericalProblem](#), [NumericalProblem](#), [NumericalSolution](#), [NumericalSolution](#))
- PetscErrorCode(* [optionshandling](#))()
- PetscErrorCode(* [intelligence](#))(NumericalProblem, const char **, const char **)

18.8.1 Detailed Description

Definition at line 17 of file syspro_impl.h.

18.8.2 Field Documentation

18.8.2.1 PetscErrorCode(* [SystemPreprocessor_::ctxcreate](#))(NumericalProblem, void **)

Definition at line 24 of file syspro_impl.h.

Referenced by [DeclarePreprocessor\(\)](#), and [PreprocessedSolution\(\)](#).

18.8.2.2 PetscErrorCode(* [SystemPreprocessor_::ctxdelete](#))(void *)

Definition at line 25 of file syspro_impl.h.

Referenced by [DeclarePreprocessor\(\)](#), and [PreprocessedSolution\(\)](#).

18.8.2.3 PetscErrorCode(* SystemPreprocessor_::end_function)(const char *, PetscTruth, void *, void *, NumericalProblem, NumericalProblem, NumericalSolution, NumericalSolution)

Definition at line 27 of file syspro_impl.h.

Referenced by DeclarePreprocessor(), and SysProPreprocessorEndFunction().

18.8.2.4 PetscTruth SystemPreprocessor_::exhaustive

Definition at line 21 of file syspro_impl.h.

Referenced by DeclarePreprocessor(), PreprocessedSolution(), and PreprocessorsOptionsHandling().

18.8.2.5 PetscErrorCode(* SystemPreprocessor_::intelligence)(NumericalProblem, const char **, const char **)

Definition at line 29 of file syspro_impl.h.

Referenced by ChooseFirstTransform(), and DeclarePreprocessorIntelligentChoice().

18.8.2.6 const char* SystemPreprocessor_::name

Definition at line 18 of file syspro_impl.h.

Referenced by ChooseFirstTransform(), ContinueRetrievingAllPreprocessors(), ContinueRetrievingCurrentPreprocessors(), DeclarePreprocessor(), GetNextPreprocessor(), SuccessorPreprocessor(), SysProFinalize(), and SysproPreprocessorStartFunction().

18.8.2.7 PetscErrorCode(* SystemPreprocessor_::optionshandling)()

Definition at line 28 of file syspro_impl.h.

Referenced by DeclarePCPreprocessor(), and PreprocessorsOptionsHandling().

18.8.2.8 const char* SystemPreprocessor_::preserved

Definition at line 20 of file syspro_impl.h.

Referenced by PreprocessorGetPreservedCategories(), PreprocessorSetPreservedCategories(), and SysProFinalize().

18.8.2.9 const char * SystemPreprocessor_::required

Definition at line 20 of file syspro_impl.h.

Referenced by ChooseFirstTransform(), and DeclarePreprocessorRequiredCategories().

18.8.2.10 PetscErrorCode(* SystemPreprocessor_::setup)(NumericalProblem, SalsaTransform)

Definition at line 22 of file syspro_impl.h.

Referenced by DeclarePreprocessor(), and PreprocessorSpecificSetup().

18.8.2.11 PetscErrorCode(* SystemPreprocessor_::start_function)(const char *, int, PetscTruth, NumericalProblem, NumericalProblem *, void *, void **, PetscTruth *)

Definition at line 26 of file syspro_impl.h.

Referenced by DeclarePreprocessor(), and SysproPreprocessorStartFunction().

18.8.2.12 SalsaTransform SystemPreprocessor_::transform

Definition at line 19 of file syspro_impl.h.

Referenced by ContinueRetrievingAllPreprocessors(), DeclarePreprocessor(), PreprocessedSolution(), PreprocessorApplyAprioriSelection(), PreprocessorSaveAprioriSelection(), SysProFinalize(), and TransformGetByName().

18.8.2.13 PetscErrorCode(* SystemPreprocessor_::unset)(NumericalProblem)

Definition at line 23 of file syspro_impl.h.

Referenced by DeclarePreprocessor(), and PreprocessedSolution().

The documentation for this struct was generated from the following file:

- [syspro_impl.h](#)

19 File Documentation

19.1 approximating.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "petsc.h"
#include "petscis.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
```

```
#include "linear_impl.h"
```

Defines

- `#define PREPROCESSOR "approximation"`

Functions

- static PetscErrorCode [MatSymmetricPart](#) ([NumericalProblem](#) inproblem, [NumericalProblem](#) outproblem)
- static PetscErrorCode [MatGustafssonMod](#) ([NumericalProblem](#) inproblem, [NumericalProblem](#) outproblem)
- static PetscErrorCode [setup_approximation_choices](#) ()
- static PetscErrorCode [specific_approximation_choices](#) ([NumericalProblem](#) inproblem, [SalsaTransform](#) transform)
- static PetscErrorCode [approximate_system](#) (const char *type, int nopt, PetscTruth overwrite, [NumericalProblem](#) inproblem, [NumericalProblem](#) *outproblem, void *gctx, void **ctx, PetscTruth *success)
- static PetscErrorCode [unapproximate_system](#) (const char *type, PetscTruth overwrite, void *gctx, void *ctx, [NumericalProblem](#) problem, [NumericalProblem](#) nextproblem, [NumericalSolution](#) before, [NumericalSolution](#) after)
- PetscErrorCode [DeclareApproximationPreprocessor](#) (void)

19.1.1 Detailed Description

Definition in file [approximating.c](#).

19.1.2 Define Documentation

19.1.2.1 `#define PREPROCESSOR "approximation"`

Definition at line 39 of file [approximating.c](#).

Referenced by [DeclareApproximationPreprocessor\(\)](#), [setup_approximation_choices\(\)](#), and [specific_approximation_choices\(\)](#).

19.1.3 Function Documentation

19.1.3.1 static PetscErrorCode [approximate_system](#) (const char * *type*, int *nopt*, PetscTruth *overwrite*, [NumericalProblem](#) *inproblem*, [NumericalProblem](#) * *outproblem*, void * *gctx*, void ** *ctx*, PetscTruth * *success*) [static]

Definition at line 220 of file [approximating.c](#).

References CHKERRQ(), ierr, LinearSystemDuplicatePointers(), LinearSystemGetParts(), MatGustafssonMod(), and MatSymmetricPart().

Referenced by DeclareApproximationPreprocessor().

19.1.3.2 PetscErrorCode DeclareApproximationPreprocessor (void)

Definition at line 280 of file approximating.c.

References approximate_system(), CHKERRQ(), DeclarePreprocessor(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_approximation_choices(), specific_approximation_choices(), and unapproximate_system().

19.1.3.3 static PetscErrorCode MatGustafssonMod (NumericalProblem *inproblem*, NumericalProblem *outproblem*) [static]

Definition at line 92 of file approximating.c.

References CHKERRQ(), ierr, LinearSystemGetParts(), and LinearSystemSetParts().

Referenced by approximate_system().

19.1.3.4 static PetscErrorCode MatSymmetricPart (NumericalProblem *inproblem*, NumericalProblem *outproblem*) [static]

Definition at line 44 of file approximating.c.

References CHKERRQ(), ierr, LinearSystemGetParts(), LinearSystemSetParts(), SysProComputeQuantity(), and SysProRetrieveQuantity().

Referenced by approximate_system().

19.1.3.5 static PetscErrorCode setup_approximation_choices () [static]

Definition at line 146 of file approximating.c.

References CHKERRQ(), ierr, NewTransformObject(), PREPROCESSOR, TransformGetByName(), and TransformObjectSetExplanation().

Referenced by DeclareApproximationPreprocessor().

19.1.3.6 static PetscErrorCode specific_approximation_choices (NumericalProblem *inproblem*, SalsaTransform *transform*) [static]

This is the 'specific setup' phase of the approximation preprocessor. See [Usage modes](#) for details.

This routine eliminates the Gustafsson approximation for diagonally dominant systems, and the symmetric for symmetric systems.

Definition at line 178 of file approximating.c.

References CHKERRQ(), ierr, LinearSystemGetParts(), PREPROCESSOR, SysProRe-

trieveQuantity(), TransformObjectGetByName(), and TransformObjectMark().

Referenced by DeclareApproximationPreprocessor().

19.1.3.7 static PetscErrorCode unapproximate_system (const char * type, PetscTruth *overwrite*, void * gctx, void * ctx, NumericalProblem *problem*, NumericalProblem *nextproblem*, NumericalSolution *before*, NumericalSolution *after*)
[static]

Definition at line 265 of file approximating.c.

References CHKERRQ(), ierr, and LinearSolutionCopy().

Referenced by DeclareApproximationPreprocessor().

19.2 compute.c File Reference

System/Anamod and NMD interface.

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "petscmat.h"
#include "syspro.h"
#include "syspro_impl.h"
```

Functions

- PetscErrorCode [PreprocessorSetPreservedCategories](#) (const char *preprocess, const char *cats)
- PetscErrorCode [PreprocessorGetPreservedCategories](#) (const char *preprocess, const char **cats)
- PetscErrorCode [DeclarePreprocessorRequiredCategories](#) (char *name, char *required)

19.2.1 Detailed Description

System/Anamod and NMD interface.

Definition in file [compute.c](#).

19.2.2 Function Documentation

19.2.2.1 PetscErrorCode DeclarePreprocessorRequiredCategories (char * *name*, char * *required*)

Indicate which metadata categories need to be computed for a successful application of this preprocessor.

Arguments:

- *name* : name of the current preprocessor
- *required* : comma-separated list of metadata categories

Definition at line 75 of file compute.c.

References CHKERRQ(), ierr, SystemPreprocessor_::required, and SystemPreprocessorGetByName().

19.2.2.2 PetscErrorCode PreprocessorGetPreservedCategories (const char * *preprocess*, const char ** *cats*)

Definition at line 55 of file compute.c.

References CHKERRQ(), ierr, SystemPreprocessor_::preserved, and SystemPreprocessorGetByName().

19.2.2.3 PetscErrorCode PreprocessorSetPreservedCategories (const char * *preprocess*, const char * *cats*)

Definition at line 33 of file compute.c.

References CHKERRQ(), ierr, SystemPreprocessor_::preserved, and SystemPreprocessorGetByName().

Referenced by DeclareApproximationPreprocessor(), DeclareDistributionPreprocessor(), DeclareFlipsignPreprocessor(), DeclareKSPPreprocessor(), DeclarePCPreprocessor(), DeclareScalingPreprocessor(), and DeclareSingletonPreprocessor().

19.3 distribution.c File Reference

```
#include <stdlib.h>
#include "petscmat.h"
#include "petscconf.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "linear_impl.h"
```



```
#include "anamod.h"
```

Defines

- `#define PREPROCESSOR "distribution"`

Functions

- `int SpectrumComputeUnpreconditionedSpectrum ()`
- `static PetscErrorCode setup_distribution_choices ()`
- `static PetscErrorCode specific_distribution_choices (NumericalProblem problem, SalsaTransform tf)`
- `static PetscErrorCode sans_partition (const char *type, NumericalProblem inproblem, int nparts, IS *local_to_global, VecScatter *perm)`
- `static PetscErrorCode distribute_system (const char *type, int nopt, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem *outproblem, void *gctx, void **ctx, PetscTruth *success)`
- `static PetscErrorCode undistribute_system (const char *scaling_type, PetscTruth overwrite, void *gctx, void *ctx, NumericalProblem problem, NumericalProblem nextproblem, NumericalSolution before, NumericalSolution after)`
- `PetscErrorCode DeclareDistributionPreprocessor (void)`

19.3.1 Detailed Description

Definition in file [distribution.c](#).

19.3.2 Define Documentation

19.3.2.1 `#define PREPROCESSOR "distribution"`

Definition at line 20 of file [distribution.c](#).

Referenced by [DeclareDistributionPreprocessor\(\)](#), and [setup_distribution_choices\(\)](#).

19.3.3 Function Documentation

19.3.3.1 `PetscErrorCode DeclareDistributionPreprocessor (void)`

Definition at line 298 of file [distribution.c](#).

References [CHKERRQ\(\)](#), [DeclarePreprocessor\(\)](#), [distribute_system\(\)](#), [ierr](#), [PREPROCESSOR](#), [PreprocessorSetPreservedCategories\(\)](#), [setup_distribution_choices\(\)](#), [specific_distribution_choices\(\)](#), and [undistribute_system\(\)](#).

19.3.3.2 static PetscErrorCode distribute_system (const char * *type*, int *nopt*, PetscTruth *overwrite*, NumericalProblem *inproblem*, NumericalProblem * *outproblem*, void * *gctx*, void ** *ctx*, PetscTruth * *success*) [static]

Definition at line 186 of file distribution.c.

References CHKERRQ(), ierr, LinearSystemDuplicatePointers(), LinearSystemGetParts(), LinearSystemSetParts(), and sans_partition().

Referenced by DeclareDistributionPreprocessor().

19.3.3.3 static PetscErrorCode sans_partition (const char * *type*, NumericalProblem *inproblem*, int *nparts*, IS * *local_to_global*, VecScatter * *perm*) [static]

Definition at line 91 of file distribution.c.

References CHKERRQ(), ierr, LinearSystemGetParts(), and SysProComputeQuantity().

Referenced by distribute_system().

19.3.3.4 static PetscErrorCode setup_distribution_choices () [static]

Definition at line 25 of file distribution.c.

References CHKERRQ(), ierr, NewTransformObject(), PREPROCESSOR, SysProDefineIntAnnotation(), TransformGetByName(), TransformObjectIntAnnotate(), and TransformObjectSetExplanation().

Referenced by DeclareDistributionPreprocessor().

19.3.3.5 static PetscErrorCode specific_distribution_choices (NumericalProblem *problem*, SalsaTransform *tf*) [static]

Definition at line 69 of file distribution.c.

References CHKERRQ(), NumericalProblem_::comm, ierr, TransformGetObjects(), TransformObjectGetIntAnnotation(), and TransformObjectMark().

Referenced by DeclareDistributionPreprocessor().

19.3.3.6 int SpectrumComputeUnpreconditionedSpectrum ()

19.3.3.7 static PetscErrorCode undistribute_system (const char * *scaling_type*, PetscTruth *overwrite*, void * *gctx*, void * *ctx*, NumericalProblem *problem*, NumericalProblem *nextproblem*, NumericalSolution *before*, NumericalSolution *after*) [static]

Definition at line 268 of file distribution.c.

References CHKERRQ(), ierr, LinearSolutionCopyStats(), and LinearSolutionGetVector().

Referenced by `DeclareDistributionPreprocessor()`.

19.4 flipsign.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "petsc.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "linear_impl.h"
#include "anamod.h"
```

Defines

- `#define PREPROCESSOR "flipsign"`

Functions

- static PetscErrorCode `flipsign` (const char *type, int nopt, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem *outproblem, void *gctx, void **ctx, PetscTruth *success)
- static PetscErrorCode `back_flipsign` (const char *flipsign_type, PetscTruth overwrite, void *gctx, void *ctx, NumericalProblem nextproblem, NumericalProblem problem, NumericalSolution flipped, NumericalSolution straight)
- static PetscErrorCode `setup_flipsign_choices` ()
- static PetscErrorCode `specific_flipsign_choices` (NumericalProblem theproblem, SalsaTransform flipsign)
- PetscErrorCode `DeclareFlipsignPreprocessor` (void)

19.4.1 Detailed Description

Definition in file `flipsign.c`.

19.4.2 Define Documentation

19.4.2.1 `#define PREPROCESSOR "flipsign"`

Definition at line 19 of file `flipsign.c`.

Referenced by `DeclareFlpsignPreprocessor()`, `setup_flpsign_choices()`, and `specific_flpsign_choices()`.

19.4.3 Function Documentation

19.4.3.1 `static PetscErrorCode back_flpsign (const char * flpsign_type, PetscTruth overwrite, void * gctx, void * ctx, NumericalProblem nextproblem, NumericalProblem problem, NumericalSolution flipped, NumericalSolution straight)`
[static]

Definition at line 85 of file `flpsign.c`.

References `CHKERRQ()`, `ierr`, and `LinearSolutionCopy()`.

Referenced by `DeclareFlpsignPreprocessor()`.

19.4.3.2 `PetscErrorCode DeclareFlpsignPreprocessor (void)`

Definition at line 168 of file `flpsign.c`.

References `back_flpsign()`, `CHKERRQ()`, `DeclarePreprocessor()`, `ierr`, `PREPROCESSOR`, `PreprocessorSetPreservedCategories()`, `setup_flpsign_choices()`, and `specific_flpsign_choices()`.

19.4.3.3 `static PetscErrorCode flpsign (const char * type, int nopt, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem * outproblem, void * gctx, void ** ctx, PetscTruth * success)` [static]

Definition at line 24 of file `flpsign.c`.

References `CHKERRQ()`, `ierr`, `LinearSystemDuplicatePointers()`, `LinearSystemGetParts()`, `LinearSystemSetParts()`, and `SysProComputeQuantity()`.

19.4.3.4 `static PetscErrorCode setup_flpsign_choices ()` [static]

This routine is only called when the flpsign preprocessor is created by `DeclarePreprocessor()` inside `DeclareFlpsignPreprocessor()`

Definition at line 114 of file `flpsign.c`.

References `CHKERRQ()`, `ierr`, `NewTransformObject()`, `PREPROCESSOR`, `TransformGetByName()`, and `TransformObjectSetExplanation()`.

Referenced by `DeclareFlpsignPreprocessor()`.

19.4.3.5 `static PetscErrorCode specific_flpsign_choices (NumericalProblem theproblem, SalsaTransform flpsign)` [static]

This is the 'specific setup' phase of the flpsign preprocessor. See [Usage modes](#) for details.

It disables either the identity or the flip routine, to leave only the one applicable to this particular system.

Definition at line 143 of file flpsign.c.

References [CHKERRQ\(\)](#), [ierr](#), [PREPROCESSOR](#), [SysProComputeQuantity\(\)](#), [TransformObjectGetByName\(\)](#), and [TransformObjectMark\(\)](#).

Referenced by [DeclareFlpsignPreprocessor\(\)](#).

19.5 ksp.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "string.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "sysprosuit.h"
#include "anamod.h"
#include "linksp.h"
#include "petscmat.h"
#include "petscpc.h"
#include "petscksp.h"
```

Defines

- `#define` [PREPROCESSOR](#) "ksp"

Functions

- static PetscErrorCode [is_gmres_method](#) (KSPTType kspt, PetscTruth *f)
- static PetscErrorCode [setup_ksp_choices](#) ()
- static PetscErrorCode [unset_ksp](#) ()
- static PetscErrorCode [disable_ksp](#) ([NumericalProblem](#) theproblem, [SalsaTransform](#) ksp)
- static PetscErrorCode [set_ksp_options](#) ([SalsaTransformObject](#) tf, int kspv)
- static PetscErrorCode [setup_ksp](#) (const char *kspt, int kspv, PetscTruth overwrite, [NumericalProblem](#) inproblem, [NumericalProblem](#) *outproblem, void *gctx, void **ctx, PetscTruth *success)

- static PetscErrorCode [unset_ksp](#) (const char *kspt, PetscTruth overwrite, void *gctx, void *ctx, [NumericalProblem](#) inproblem, [NumericalProblem](#) nextproblem, [NumericalSolution](#) old, [NumericalSolution](#) nnew)
- PetscErrorCode [DeclareKSPPreprocessor](#) (void)
- PetscErrorCode [SysProLinearInstallCustomKSPMonitor](#) (KSP solver)
- PetscErrorCode [SysProLinearDeclareCustomKSPMonitor](#) (PetscErrorCode(*monitor)(KSP, int, PetscReal, void *), void *data)

Variables

- int [gmrescycleid](#)
- PetscErrorCode(* [custommonitor](#))(KSP, int, PetscReal, void *) = NULL
- void * [monitordata](#) = NULL

19.5.1 Define Documentation

19.5.1.1 #define PREPROCESSOR "ksp"

Definition at line 22 of file ksp.c.

Referenced by [DeclareKSPPreprocessor\(\)](#), [setup_ksp_choices\(\)](#), and [unset_ksp\(\)](#).

19.5.2 Function Documentation

19.5.2.1 PetscErrorCode DeclareKSPPreprocessor (void)

Definition at line 368 of file ksp.c.

References [CHKERRQ\(\)](#), [DeclarePreprocessor\(\)](#), [disable_ksp\(\)](#), [ierr](#), [PREPROCESSOR](#), [PreprocessorSetPreservedCategories\(\)](#), [setup_ksp\(\)](#), [setup_ksp_choices\(\)](#), [unset_ksp\(\)](#), and [unset_ksp\(\)](#).

19.5.2.2 static PetscErrorCode disable_ksp ([NumericalProblem](#) *theproblem*, [SalsaTransform](#) *ksp*) [static]

Definition at line 166 of file ksp.c.

References [CHKERRQ\(\)](#), [ierr](#), [PreprocessorGetSetting\(\)](#), [TransformGetObjects\(\)](#), [TransformObjectGetByName\(\)](#), [TransformObjectGetIntAnnotation\(\)](#), [TransformObjectGetName\(\)](#), [TransformObjectMark\(\)](#), and [TransformObjectsUnmarkAll\(\)](#).

Referenced by [DeclareKSPPreprocessor\(\)](#).

19.5.2.3 static PetscErrorCode is_gmres_method (KSPTType *kspt*, PetscTruth * *f*)
[static]

Definition at line 27 of file ksp.c.

References CHKERRQ(), ierr, TransformObjectGetByName(), TransformObjectGetIntAnnotation(), and TRUTH.

Referenced by setup_ksp().

19.5.2.4 static PetscErrorCode set_ksp_options (SalsaTransformObject *tf*, int *kspv*)
[static]

Definition at line 231 of file ksp.c.

References CHKERRQ(), ierr, TransformObjectGetIntAnnotation(), and TransformObjectGetName().

Referenced by setup_ksp().

19.5.2.5 static PetscErrorCode setup_ksp (const char * *kspt*, int *kspv*, PetscTruth *overwrite*, NumericalProblem *inproblem*, NumericalProblem * *outproblem*, void * *gctx*, void ** *ctx*, PetscTruth * *success*) [static]

Definition at line 299 of file ksp.c.

References CHKERRQ(), gmrescycleid, ierr, is_gmres_method(), LinearSystemDuplicatePointers(), PreprocessorGetContext(), set_ksp_options(), SysProLinearInstallCustomKSPMonitor(), and TransformObjectGetByName().

Referenced by DeclareKSPPreprocessor().

19.5.2.6 static PetscErrorCode setup_ksp_choices () [static]

Definition at line 40 of file ksp.c.

References CHKERRQ(), gmrescycleid, ierr, NewTransformObject(), onlyforsymmetricproblem(), PREPROCESSOR, SetSuitabilityContextTester(), SysProDefineCharAnnotation(), SysProDefineIntAnnotation(), TransformGetByName(), TransformObjectAddOption(), TransformObjectDefineOption(), TransformObjectIntAnnotate(), TransformObjectSetExplanation(), and TransformObjectSetSuitabilityFunction().

Referenced by DeclareKSPPreprocessor().

19.5.2.7 PetscErrorCode SysProLinearDeclareCustomKSPMonitor (PetscErrorCode(*)(KSP, int, PetscReal, void *) *monitor*, void * *data*)

Definition at line 409 of file ksp.c.

References custommonitor.

19.5.2.8 PetscErrorCode SysProLinearInstallCustomKSPMonitor (KSP solver)

Definition at line 395 of file ksp.c.

References CHKERRQ(), custommonitor, and ierr.

Referenced by setup_ksp().

19.5.2.9 static PetscErrorCode unset_ksp (const char * kspt, PetscTruth overwrite, void * gctx, void * ctx, NumericalProblem inproblem, NumericalProblem nextproblem, NumericalSolution old, NumericalSolution nnew) [static]

Definition at line 347 of file ksp.c.

References CHKERRQ(), ierr, and LinearSolutionCopy().

Referenced by DeclareKSPPreprocessor().

19.5.2.10 static PetscErrorCode unset_ksp () [static]

Definition at line 151 of file ksp.c.

References CHKERRQ(), ierr, PREPROCESSOR, TransformObjectGetByName(), and TransformObjectGetSuitabilityFunction().

Referenced by DeclareKSPPreprocessor().

19.5.3 Variable Documentation

19.5.3.1 PetscErrorCode(* custommonitor)(KSP, int, PetscReal, void *) = NULL

Definition at line 390 of file ksp.c.

Referenced by SysProLinearDeclareCustomKSPMonitor(), and SysProLinearInstallCustomKSPMonitor().

19.5.3.2 int gmrescycleid

Definition at line 23 of file ksp.c.

Referenced by setup_ksp(), and setup_ksp_choices().

19.5.3.3 void* monitordata = NULL

Definition at line 391 of file ksp.c.

19.6 kspmonitor.c File Reference

```
#include <stdlib.h>
```



```
#include <stdio.h>
#include <math.h>
#include "syspro.h"
#include "sysprolinear.h"
```

Defines

- `#define ITER_STAGNATION` -21
- `#define ITER_DIVERGENCE` -22

Functions

- static PetscErrorCode `estimate_completion_from_hist` (double *hist, int n, double rtol, int tracing, int *est)
- PetscErrorCode `MonitorAdjustMaxit` (KSP ksp, int it, PetscReal cg_err, void *data)

Variables

- int `gmrescycleid`

19.6.1 Define Documentation

19.6.1.1 `#define ITER_DIVERGENCE` -22

Definition at line 8 of file kspmonitor.c.

Referenced by `estimate_completion_from_hist()`, and `MonitorAdjustMaxit()`.

19.6.1.2 `#define ITER_STAGNATION` -21

Definition at line 7 of file kspmonitor.c.

Referenced by `estimate_completion_from_hist()`, and `MonitorAdjustMaxit()`.

19.6.2 Function Documentation

19.6.2.1 static PetscErrorCode `estimate_completion_from_hist` (double * hist, int n, double rtol, int tracing, int * est) [static]

Definition at line 13 of file kspmonitor.c.

References `ITER_DIVERGENCE`, and `ITER_STAGNATION`.

Referenced by `MonitorAdjustMaxit()`.

19.6.2.2 PetscErrorCode MonitorAdjustMaxit (KSP ksp, int it, PetscReal cg_err, void * data)

This routine analyzes the convergence history, and if the iterative method is still making progress, extends the maximum number of iterations.

Definition at line 83 of file kspmonitor.c.

References CHKERRQ(), estimate_completion_from_hist(), ierr, ITER_DIVERGENCE, and ITER_STAGNATION.

19.6.3 Variable Documentation

19.6.3.1 int gmrescycleid

Definition at line 23 of file ksp.c.

Referenced by setup_ksp(), and setup_ksp_choices().

19.7 linear.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "syspro_impl.h"
#include "sysprolinear.h"
#include "linear_impl.h"
#include "petscmat.h"
#include "nmd.h"
#include "anamod.h"
```

Functions

- PetscErrorCode [LinearPackageSetUp](#) ()
- PetscErrorCode [CreateLinearSystem](#) (MPI_Comm comm, [LinearSystem](#) *system)
- PetscErrorCode [LinearSystemDelete](#) ([LinearSystem](#) system)
- PetscErrorCode [LinearDeleteNumericalProblem](#) ([NumericalProblem](#) sys)
- PetscErrorCode [LinearSystemSetParts](#) ([LinearSystem](#) system, Mat A, Mat B, Vec Rhs, Vec Sol, Vec Init)
- PetscErrorCode [LinearSystemInheritParts](#) ([LinearSystem](#) system, Mat A, Mat B, Vec Rhs, Vec Sol, Vec Init)
- PetscErrorCode [LinearSystemGetParts](#) ([LinearSystem](#) system, Mat *A, Mat *B, Vec *Rhs, Vec *Sol, Vec *Init)

- PetscErrorCode [LinearSystemSetContext](#) ([LinearSystem](#) system, void *ctx)
- PetscErrorCode [LinearSystemGetContext](#) ([LinearSystem](#) system, void **ctx)
- PetscErrorCode [LinearSystemSetKnownSolution](#) ([LinearSystem](#) sys, PetscTruth sol)
- PetscErrorCode [LinearSystemGetKnownSolution](#) ([LinearSystem](#) sys, PetscTruth *sol)
- PetscErrorCode [LinearSystemSetMetadata](#) ([LinearSystem](#) system, NMD_metadata nmd)
- PetscErrorCode [LinearSystemGetMetadata](#) ([LinearSystem](#) system, NMD_metadata *nmd)
- PetscErrorCode [LinearSystemGetTmpVector](#) ([LinearSystem](#) sys, Vec *tmp)
- PetscErrorCode [LinearSystemDuplicatePointers](#) ([LinearSystem](#) problem, [LinearSystem](#) *newproblem)
- PetscErrorCode [LinearSystemDuplicate](#) ([LinearSystem](#) problem, [LinearSystem](#) *newproblem)
- PetscErrorCode [LinearSystemCopy](#) ([LinearSystem](#) old, [LinearSystem](#) lnew)
- PetscErrorCode [CreateLinearSolution](#) ([LinearSolution](#) *sol)
- PetscErrorCode [LinearCreateNumericalSolution](#) ([NumericalProblem](#) prob, [NumericalSolution](#) *sol)
- PetscErrorCode [LinearSolutionDelete](#) ([LinearSolution](#) sol)
- PetscErrorCode [LinearDeleteNumericalSolution](#) ([NumericalSolution](#) sol)
- PetscErrorCode [LinearSolutionCopy](#) ([LinearSolution](#) old, [LinearSolution](#) lnew)
- PetscErrorCode [LinearCopyNumericalSolution](#) ([NumericalSolution](#) old, [NumericalSolution](#) nnew)
- PetscErrorCode [CreateDefaultLinearSolution](#) ([NumericalProblem](#) problem, [NumericalSolution](#) *rsol)
- PetscErrorCode [LinearSolutionSetVector](#) ([LinearSolution](#) sol, Vec out)
- PetscErrorCode [LinearSolutionGetVector](#) ([LinearSolution](#) sol, Vec *out)
- PetscErrorCode [LinearSolutionCreateStatistics](#) ([LinearSolution](#) sol)
- PetscErrorCode [LinearSolutionGetStatistics](#) ([LinearSolution](#) sol, NMD_metadata *s)
- PetscErrorCode [LinearSolutionCopyStats](#) ([LinearSolution](#) in, [LinearSolution](#) out)
- PetscErrorCode [LinearSolutionSetContext](#) ([LinearSolution](#) sol, void *ctx)
- PetscErrorCode [LinearSolutionGetContext](#) ([LinearSolution](#) sol, void **ctx)
- PetscErrorCode [LinearDeleteNumericalSolutionContext](#) ([NumericalSolution](#) sol)
- PetscErrorCode [LinearSystemTrueDistance](#) ([LinearSystem](#) system, [LinearSolution](#) linsol, PetscReal *rnm)
- PetscErrorCode [LinearSystemTrueDistancePrint](#) ([NumericalProblem](#) problem, [NumericalSolution](#) solution, char *caption)
- PetscErrorCode [PreprocessedLinearSystemSolution](#) ([LinearSystem](#) sys, [LinearSolution](#) *sol)

19.7.1 Detailed Description

Definition in file [linear.c](#).

19.7.2 Function Documentation

19.7.2.1 PetscErrorCode CreateDefaultLinearSolution (NumericalProblem *problem*, NumericalSolution * *rsol*)

Definition at line 528 of file [linear.c](#).

References [CHKERRQ\(\)](#), [CreateLinearSolution\(\)](#), [ierr](#), [LinearSolutionSetVector\(\)](#), [LinearSystemGetParts\(\)](#), and [SYSPROCHECKVALIDLINSYS](#).

19.7.2.2 PetscErrorCode CreateLinearSolution (LinearSolution * *sol*)

Definition at line 411 of file [linear.c](#).

References [CHKERRQ\(\)](#), [LinearSolution_::cookie](#), [ierr](#), [LINSOLCOOKIE](#), and [LinearSolution_::statistics](#).

Referenced by [CreateDefaultLinearSolution\(\)](#), and [LinearCreateNumericalSolution\(\)](#).

19.7.2.3 PetscErrorCode CreateLinearSystem (MPI_Comm *comm*, LinearSystem * *system*)

Allocate the structure for a linear system

Definition at line 74 of file [linear.c](#).

References [CHKERRQ\(\)](#), [LinearSystem_::cookie](#), [ierr](#), [LINSYSCOOKIE](#), and [LinearSystem_::partsoriginal](#).

Referenced by [LinearSystemDuplicate\(\)](#), [LinearSystemDuplicatePointers\(\)](#), and [main\(\)](#).

19.7.2.4 PetscErrorCode LinearCopyNumericalSolution (NumericalSolution *old*, NumericalSolution *nnew*)

This routine is essentially [LinearSolutionCopy\(\)](#), except that it does casts of the arguments so that it can be used as the `solutioncopy` member of [SysProDeclareFunctions\(\)](#)

Definition at line 515 of file [linear.c](#).

References [CHKERRQ\(\)](#), [ierr](#), and [LinearSolutionCopy\(\)](#).

19.7.2.5 PetscErrorCode LinearCreateNumericalSolution (NumericalProblem *prob*, NumericalSolution * *sol*)

Shell routine around [CreateLinearSolution\(\)](#) to save you some type casting.

If the first argument is not NULL, its matrix is extracted and used to create the vector of

the solution object.

Definition at line 432 of file linear.c.

References [CHKERRQ\(\)](#), [CreateLinearSolution\(\)](#), [ierr](#), [LinearSolutionSetVector\(\)](#), and [LinearSystemGetParts\(\)](#).

Referenced by [main\(\)](#), and [solvelinear\(\)](#).

19.7.2.6 PetscErrorCode LinearDeleteNumericalProblem (NumericalProblem sys)

This is like [LinearSystemDelete\(\)](#), except that the argument has been cast so that this routine can be used as the `problemdelete` argument of [SysProDeclareFunctions\(\)](#).

Definition at line 122 of file linear.c.

References [CHKERRQ\(\)](#), [ierr](#), and [LinearSystemDelete\(\)](#).

Referenced by [main\(\)](#).

19.7.2.7 PetscErrorCode LinearDeleteNumericalSolution (NumericalSolution sol)

This is like [LinearSolutionDelete\(\)](#), except that the argument has been cast so that this routine can be used as the `solutiondelete` argument of [SysProDeclareFunctions\(\)](#).

Definition at line 477 of file linear.c.

References [CHKERRQ\(\)](#), [ierr](#), and [LinearSolutionDelete\(\)](#).

Referenced by [main\(\)](#).

19.7.2.8 PetscErrorCode LinearDeleteNumericalSolutionContext (NumericalSolution sol)

Definition at line 650 of file linear.c.

References [LinearSolution_::ctx](#), and [SYSPROCHECKVALIDLINSOL](#).

19.7.2.9 PetscErrorCode LinearPackageSetUp ()

Definition at line 65 of file linear.c.

19.7.2.10 PetscErrorCode LinearSolutionCopy (LinearSolution old, LinearSolution new)

Copy one linear solution object into another. This clearly only works if their vectors are similarly layed out.

The context pointer is blindly copied. We may have to think about this a bit more.

See also [LinearCopyNumericalSolution\(\)](#).

Definition at line 496 of file linear.c.

References [CHKERRQ\(\)](#), [LinearSolution_::ctx](#), [ierr](#), [LinearSolution_::Out](#), [LinearSolution_](#)

::statistics, and SYSPROCHECKVALIDLINSOLa.

Referenced by back_flipsign(), LinearCopyNumericalSolution(), unapproximate_system(), unset_ksp(), and unset_pc().

19.7.2.11 PetscErrorCode LinearSolutionCopyStats (LinearSolution *in*, LinearSolution *out*)

Definition at line 611 of file linear.c.

References CHKERRQ(), ierr, LinearSolution_::statistics, and SYSPROCHECKVALIDLINSOLa.

Referenced by back_singleton(), undistribute_system(), and unscale_system().

19.7.2.12 PetscErrorCode LinearSolutionCreateStatistics (LinearSolution *sol*)

Definition at line 573 of file linear.c.

References CHKERRQ(), ierr, LinearSolution_::statistics, and SYSPROCHECKVALIDLINSOL.

19.7.2.13 PetscErrorCode LinearSolutionDelete (LinearSolution *sol*)

Delete a linear solution.

This does not affect the context stored in the solution. That needs a special purpose routine.

See also [LinearDeleteNumericalSolution\(\)](#).

Definition at line 459 of file linear.c.

References CHKERRQ(), ierr, LinearSolution_::Out, LinearSolution_::statistics, and SYSPROCHECKVALIDLINSOL.

Referenced by LinearDeleteNumericalSolution().

19.7.2.14 PetscErrorCode LinearSolutionGetContext (LinearSolution *sol*, void ** *ctx*)

Definition at line 640 of file linear.c.

References LinearSolution_::ctx, and SYSPROCHECKVALIDLINSOL.

19.7.2.15 PetscErrorCode LinearSolutionGetStatistics (LinearSolution *sol*, NMD_metadata * *s*)

Definition at line 601 of file linear.c.

References LinearSolution_::statistics, and SYSPROCHECKVALIDLINSOL.

19.7.2.16 PetscErrorCode LinearSolutionGetVector (LinearSolution sol, Vec * out)

Definition at line 557 of file linear.c.

References `LinearSolution_::Out`, and `SYSPROCHECKVALIDLINSOL`.

Referenced by `back_singleton()`, `LinearSystemTrueDistance()`, `LinearSystemTrueDistancePrint()`, `main()`, `undistribute_system()`, and `unscale_system()`.

19.7.2.17 PetscErrorCode LinearSolutionSetContext (LinearSolution sol, void * ctx)

Definition at line 630 of file linear.c.

References `LinearSolution_::ctx`, and `SYSPROCHECKVALIDLINSOL`.

19.7.2.18 PetscErrorCode LinearSolutionSetVector (LinearSolution sol, Vec out)

Definition at line 547 of file linear.c.

References `LinearSolution_::Out`, and `SYSPROCHECKVALIDLINSOL`.

Referenced by `back_singleton()`, `CreateDefaultLinearSolution()`, `LinearCreateNumericalSolution()`, and `solveLinear()`.

19.7.2.19 PetscErrorCode LinearSystemCopy (LinearSystem old, LinearSystem new)

Copy the values of the components of an old linear system into a new. The new system has to have been created with [LinearSystemDuplicate\(\)](#) because this routine assumes that the data structures are already in place.

Definition at line 368 of file linear.c.

References `LinearSystem_::A`, `ALLPARTSNEW`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::known_solution`, `LinearSystem_::metadata`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYSa`.

Referenced by `scale_system()`.

19.7.2.20 PetscErrorCode LinearSystemDelete (LinearSystem system)

Definition at line 89 of file linear.c.

References `LinearSystem_::A`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, `SYSPROCHECKVALIDLINSYS`, and `LinearSystem_::Tmp`.

Referenced by `LinearDeleteNumericalProblem()`.

19.7.2.21 `PetscErrorCode LinearSystemDuplicate (LinearSystem problem, LinearSystem * newproblem)`

Allocate a new linear system, and create copies in it of the data structure, but not the values, of the components of the old system.

See also [LinearSystemCopy\(\)](#).

Definition at line 323 of file `linear.c`.

References `LinearSystem_::A`, `ALLPARTSNEW`, `LinearSystem_::B`, `CHKERRQ()`, `CreateLinearSystem()`, `NumericalProblem_::ctx`, `LinearSystem_::ctx`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::known_solution`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `scale_system()`.

19.7.2.22 `PetscErrorCode LinearSystemDuplicatePointers (LinearSystem problem, LinearSystem * newproblem)`

Allocate a new linear system and give it the components of the old by pointer duplication.

Definition at line 294 of file `linear.c`.

References `LinearSystem_::A`, `LinearSystem_::B`, `CHKERRQ()`, `CreateLinearSystem()`, `NumericalProblem_::ctx`, `LinearSystem_::ctx`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::known_solution`, `LinearSystem_::metadata`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `approximate_system()`, `distribute_system()`, `eliminate_singletons()`, `flip-sign()`, `setup_ksp()`, and `setup_pc()`.

19.7.2.23 `PetscErrorCode LinearSystemGetContext (LinearSystem system, void ** ctx)`

Definition at line 227 of file `linear.c`.

References `LinearSystem_::ctx`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `eliminate_singletons()`.

19.7.2.24 `PetscErrorCode LinearSystemGetKnownSolution (LinearSystem sys, PetscTruth * sol)`

Definition at line 247 of file `linear.c`.

References `LinearSystem_::known_solution`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `LinearSystemTrueDistancePrint()`.

19.7.2.25 `PetscErrorCode LinearSystemGetMetadata (LinearSystem system, NMD_metadata * nmd)`

Definition at line 267 of file linear.c.

References `LinearSystem_::metadata`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `SysProComputeQuantity()`, `SysProFreeQuantities()`, and `SysProRemoveQuantity()`.

19.7.2.26 `PetscErrorCode LinearSystemGetParts (LinearSystem system, Mat * A, Mat * B, Vec * Rhhs, Vec * Sol, Vec * Init)`

Get the matrices and vectors of the system

Definition at line 202 of file linear.c.

References `LinearSystem_::A`, `LinearSystem_::B`, `LinearSystem_::Init`, `LinearSystem_::Rhhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `approximate_system()`, `back_singleton()`, `CreateDefaultLinearSolution()`, `distribute_system()`, `eliminate_singletons()`, `flipsign()`, `LinearCreateNumericalSolution()`, `LinearSystemTrueDistance()`, `LinearSystemTrueDistancePrint()`, `MatGustafssonMod()`, `MatSymmetricPart()`, `sans_partition()`, `scale_system()`, `setup_pc()`, `solveLinear()`, `specific_approximation_choices()`, `SysProComputeQuantity()`, `SysProRetrieveQuantity()`, and `unset_pc()`.

19.7.2.27 `PetscErrorCode LinearSystemGetTmpVector (LinearSystem sys, Vec * tmp)`

Definition at line 277 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSystem_::Rhhs`, `SYSPROCHECKVALIDLINSYS`, and `LinearSystem_::Tmp`.

Referenced by `LinearSystemTrueDistance()`, and `LinearSystemTrueDistancePrint()`.

19.7.2.28 `PetscErrorCode LinearSystemInheritParts (LinearSystem system, Mat A, Mat B, Vec Rhhs, Vec Sol, Vec Init)`

Declare the matrices and vectors for a linear system. Unlike in [LinearSystemSetParts\(\)](#), here the parts are marked as not original, so they will not be deleted in `DeleteLinearSystem()`.

Definition at line 175 of file linear.c.

References `LinearSystem_::A`, `ALLPARTSNEW`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

19.7.2.29 PetscErrorCode LinearSystemSetContext (LinearSystem system, void * ctx)

Definition at line 217 of file linear.c.

References LinearSystem_::ctx, and SYSPROCHECKVALIDLINSYS.

Referenced by eliminate_singletons().

19.7.2.30 PetscErrorCode LinearSystemSetKnownSolution (LinearSystem sys, PetscTruth sol)

Definition at line 237 of file linear.c.

References LinearSystem_::known_solution, and SYSPROCHECKVALIDLINSYS.

19.7.2.31 PetscErrorCode LinearSystemSetMetadata (LinearSystem system, NMD_metadata nmd)

Definition at line 257 of file linear.c.

References LinearSystem_::metadata, and SYSPROCHECKVALIDLINSYS.

19.7.2.32 PetscErrorCode LinearSystemSetParts (LinearSystem system, Mat A, Mat B, Vec Rhs, Vec Sol, Vec Init)

Declare the matrices and vectors for a linear system.

Arguments:

- system
- A : the matrix
- B : operator to construct the preconditioner from; if NULL, (or identical to A), A will be used
- rhs : right hand side
- sol : storage for the computed solution
- init : (optional) nontrivial starting vector for iterative solution

Definition at line 145 of file linear.c.

References LinearSystem_::A, LinearSystem_::B, CHKERRQ(), ierr, LinearSystem_::Init, LinearSystem_::partsoriginal, LinearSystem_::Rhs, LinearSystem_::Sol, and SYSPROCHECKVALIDLINSYS.

Referenced by distribute_system(), eliminate_singletons(), flipsign(), main(), MatGustafssonMod(), MatSymmetricPart(), and setup_pc().

19.7.2.33 `PetscErrorCode LinearSystemTrueDistance (LinearSystem system,
LinearSolution linsol, PetscReal * rnrm)`

Definition at line 664 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolutionGetVector()`, `LinearSystemGetParts()`, and `LinearSystemGetTmpVector()`.

Referenced by `LinearSystemTrueDistancePrint()`.

19.7.2.34 `PetscErrorCode LinearSystemTrueDistancePrint (NumericalProblem problem,
NumericalSolution solution, char * caption)`

Definition at line 684 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolutionGetVector()`, `LinearSystemGetKnownSolution()`, `LinearSystemGetParts()`, `LinearSystemGetTmpVector()`, `LinearSystemTrueDistance()`, `SYSPROCHECKVALIDLINSOL`, and `SYSPROCHECKVALIDLINSYS`.

19.7.2.35 `PetscErrorCode PreprocessedLinearSystemSolution (LinearSystem sys,
LinearSolution * sol)`

Definition at line 717 of file linear.c.

References `CHKERRQ()`, `ierr`, `PreprocessedProblemSolving()`, `RegisterPreprocessorContext()`, and `SYSPROCHECKVALIDLINSYS`.

19.8 linear_impl.h File Reference

```
#include "petscmat.h"  
#include "petscvec.h"  
#include "petscksp.h"  
#include "nmd.h"  
#include "syspro_impl.h"
```

Data Structures

- struct [LinearSystem_](#)
- struct [LinearSolution_](#)

Defines

- #define [LINSYSCOOKIE](#) 3297
- #define [LINSOLCOOKIE](#) 3298

- #define `SYSPROCHECKVALIDLINSYS(i)` {SYSPROCHECKVALID(i,LINSYSCookie,"linear system");}
- #define `SYSPROCHECKVALIDLINSYSa(i, a)` {SYSPROCHECKVALIDa(i,LINSYSCookie,"linear system",a);}
- #define `SYSPROCHECKVALIDLINSOL(i)` {SYSPROCHECKVALID(i,LINSOLCookie,"linear solution");}
- #define `SYSPROCHECKVALIDLINSOLa(i, a)` {SYSPROCHECKVALIDa(i,LINSOLCookie,"linear solution",a);}
- #define `ALLPARTSNEW` (1+2+4+8+16)

19.8.1 Define Documentation

19.8.1.1 #define ALLPARTSNEW (1+2+4+8+16)

Definition at line 17 of file linear_impl.h.

Referenced by LinearSystemCopy(), LinearSystemDuplicate(), and LinearSystemInheritParts().

19.8.1.2 #define LINSOLCOOKIE 3298

Definition at line 11 of file linear_impl.h.

Referenced by CreateLinearSolution().

19.8.1.3 #define LINSYSCookie 3297

Definition at line 10 of file linear_impl.h.

Referenced by CreateLinearSystem().

19.8.1.4 #define SYSPROCHECKVALIDLINSOL(i) {SYSPROCHECKVALID(i,LINSOLCookie,"linear solution");}

Definition at line 14 of file linear_impl.h.

Referenced by LinearDeleteNumericalSolutionContext(), LinearSolutionCreateStatistics(), LinearSolutionDelete(), LinearSolutionGetContext(), LinearSolutionGetStatistics(), LinearSolutionGetVector(), LinearSolutionSetContext(), LinearSolutionSetVector(), and LinearSystemTrueDistancePrint().

19.8.1.5 #define SYSPROCHECKVALIDLINSOLa(i, a) {SYSPROCHECKVALIDa(i,LINSOLCookie,"linear solution",a);}

Definition at line 15 of file linear_impl.h.

Referenced by LinearSolutionCopy(), and LinearSolutionCopyStats().

```
19.8.1.6 #define SYSPROCHECKVALIDLINSYS( i
        ) {SYSPROCHECKVALID(i,LINSYSCOOKIE,"linear
        system");}
```

Definition at line 12 of file linear_impl.h.

Referenced by CreateDefaultLinearSolution(), LinearSystemDelete(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetContext(), LinearSystemGetKnownSolution(), LinearSystemGetMetadata(), LinearSystemGetParts(), LinearSystemGetTmpVector(), LinearSystemInheritParts(), LinearSystemSetContext(), LinearSystemSetKnownSolution(), LinearSystemSetMetadata(), LinearSystemSetParts(), LinearSystemTrueDistancePrint(), and PreprocessedLinearSystemSolution().

```
19.8.1.7 #define SYSPROCHECKVALIDLINSYSa( i, a
        ) {SYSPROCHECKVALIDa(i,LINSYSCOOKIE,"linear system",a);}
```

Definition at line 13 of file linear_impl.h.

Referenced by LinearSystemCopy().

19.9 linksp.h File Reference

```
#include "petscksp.h"
```

Functions

- PetscErrorCode [SysProLinearInstallCustomKSPMonitor](#) (KSP)
- PetscErrorCode [SysProLinearDeclareCustomKSPMonitor](#) (PetscErrorCode(*)(KSP, int, PetscReal, void *), void *)

19.9.1 Function Documentation

```
19.9.1.1 PetscErrorCode SysProLinearDeclareCustomKSPMonitor ( PetscErrorCode(*)(KSP, int,
        PetscReal, void *), void * )
```

Definition at line 409 of file ksp.c.

References custommonitor.

```
19.9.1.2 PetscErrorCode SysProLinearInstallCustomKSPMonitor ( KSP )
```

Definition at line 395 of file ksp.c.

References CHKERRQ(), custommonitor, and ierr.

Referenced by setup_ksp().

19.10 linpc.h File Reference

```
#include "petscpc.h"
```

Defines

- `#define` [PCRAMS](#) "rasm"
- `#define` [PCSILU](#) "silu"
- `#define` [PCBOOMERAMG](#) "boomeramg"
- `#define` [PCEUCLID](#) "euclid"
- `#define` [PCPARASAILS](#) "parasails"
- `#define` [PCPILUT](#) "pilut"
- `#define` [PCMUMPS](#) "mumps"
- `#define` [PCSPOOLES](#) "spooles"
- `#define` [PCSUPERLU](#) "superlu"
- `#define` [PCUMFPACK](#) "umfpack"
- `#define` [PCBS95](#) "bs95"

Functions

- PetscErrorCode [SetPetscOptionsForPC](#) (PC pc, PCType pct0, int pcv, int pcvv)
- PetscErrorCode [set_preconditioner_base_matrix](#) (PCType, Mat, Mat *)
- PetscErrorCode [set_pc_options](#) (PCType pct, int pcv, int pcvv)
- PetscErrorCode [pc_short_string](#) (KSPTYPE, int, int, char **)

19.10.1 Define Documentation

19.10.1.1 `#define` [PCBOOMERAMG](#) "boomeramg"

Definition at line 10 of file `linpc.h`.

Referenced by `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.2 `#define` [PCBS95](#) "bs95"

Definition at line 20 of file `linpc.h`.

Referenced by `pc_short_string()`, `set_preconditioner_base_matrix()`, `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.3 `#define` [PCEUCLID](#) "euclid"

Definition at line 11 of file `linpc.h`.

Referenced by `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.4 `#define PCMUMPS "mumps"`

Definition at line 15 of file linpc.h.

Referenced by `set_preconditioner_base_matrix()`, `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.5 `#define PCPARASAILS "parasails"`

Definition at line 12 of file linpc.h.

Referenced by `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.6 `#define PCPILUT "pilut"`

Definition at line 13 of file linpc.h.

Referenced by `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.7 `#define PCRAM "rasm"`

Definition at line 7 of file linpc.h.

Referenced by `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.8 `#define PCSILU "silu"`

Definition at line 8 of file linpc.h.

Referenced by `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.9 `#define PCSPOOLES "spooles"`

Definition at line 16 of file linpc.h.

Referenced by `set_preconditioner_base_matrix()`, `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.10 `#define PCSUPERLU "superlu"`

Definition at line 17 of file linpc.h.

Referenced by `set_preconditioner_base_matrix()`, `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.1.11 `#define PCUMFPACK "umfpack"`

Definition at line 18 of file linpc.h.

Referenced by `set_preconditioner_base_matrix()`, `SetPetscOptionsForPC()`, and `setup_pc_choices()`.

19.10.2 Function Documentation

19.10.2.1 PetscErrorCode pc_short_string (KSPTYPE , int , int , char **)

Definition at line 111 of file pcstuff.c.

References CHKERRQ(), ierr, and PCBS95.

19.10.2.2 PetscErrorCode set_pc_options (PCTYPE *pct*, int *pcv*, int *pcvv*)

19.10.2.3 PetscErrorCode set_preconditioner_base_matrix (PCTYPE , Mat , Mat *)

Definition at line 258 of file pcstuff.c.

References CHKERRQ(), ierr, PCBS95, PCMUMPS, PCSPOOLES, PCSUPERLU, and PCUMFPACK.

Referenced by setup_pc().

19.10.2.4 PetscErrorCode SetPetscOptionsForPC (PC *pc*, PCTYPE *pct0*, int *pcv*, int *pcvv*)

Definition at line 304 of file pcstuff.c.

References CHKERRQ(), ierr, PCBOOMERAMG, PCBS95, PCEUCLID, PCMUMPS, PCPARASAILS, PCPILUT, PCRAMS, PCSILU, PCSPOOLES, PCSUPERLU, PCUMFPACK, and set_blocked_sub_pc().

Referenced by setup_pc().

19.11 Make.inc File Reference

19.12 options.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "syspro.h"
#include "sysprotransform.h"
#include "syspro_impl.h"
```

Defines

- #define TYPELEN 200

Functions

- PetscErrorCode [SysProShowOptions](#) (MPI_Comm comm)
- PetscErrorCode [PreprocessorsOptionsHandling](#) ()

19.12.1 Define Documentation

19.12.1.1 #define TYPELEN 200

Referenced by [PreprocessorsOptionsHandling\(\)](#).

19.12.2 Function Documentation

19.12.2.1 PetscErrorCode PreprocessorsOptionsHandling ()

Process commandline options that control the behaviour of SysPro. For more information see [Command line options handling](#).

Definition at line 72 of file options.c.

References [CHKERRQ\(\)](#), [SystemPreprocessor_::exhaustive](#), [GetFirstPreprocessor\(\)](#), [GetNextPreprocessor\(\)](#), [ierr](#), [SystemPreprocessor_::optionshandling](#), [PreprocessorSaveAprioriSelection\(\)](#), [ReportEnabledPreprocessors\(\)](#), [SystemPreprocessorGetByName\(\)](#), [TransformGetByName\(\)](#), [TransformGetNextUnmarkedItem\(\)](#), [TransformGetNUnmarked\(\)](#), [TransformItemOptionsUseOnly\(\)](#), [TransformObjectGetName\(\)](#), [TransformObjectsUseOnly\(\)](#), [TransformSetUserChoices\(\)](#), [TRUTH](#), and [TYPELEN](#).

Referenced by [main\(\)](#).

19.12.2.2 PetscErrorCode SysProShowOptions (MPI_Comm comm)

Display all available options.

Definition at line 45 of file options.c.

References [CHKERRQ\(\)](#), [ContinueRetrievingAllPreprocessors\(\)](#), [ierr](#), and [StartRetrievingAllPreprocessors\(\)](#).

19.13 pc.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "syspro.h"
#include "syspro_impl.h"
```

```
#include "sysprolinear.h"
#include "sysprotransform.h"
#include "linear_impl.h"
#include "linpc.h"
#include "linksp.h"
#include "petsc.h"
#include "petscmat.h"
#include "petscpc.h"
#include "petscksp.h"
#include "anamod.h"
```

Defines

- `#define PREPROCESSOR "pc"`

Functions

- static PetscErrorCode [setup_pc_choices](#) ()
- static PetscErrorCode [disable_pcs](#) ([NumericalProblem](#) theproblem, [SalsaTransform](#) pc)
- static PetscErrorCode [pcoptionshandling](#) ()
- static PetscErrorCode [create_solver](#) ([NumericalProblem](#) prob, void **ctx)
- static PetscErrorCode [destroy_solver](#) (void *ctx)
- static PetscErrorCode [setup_pc](#) (const char *type, int pcv, PetscTruth overwrite, [NumericalProblem](#) inproblem, [NumericalProblem](#) *outproblem, void *gctx, void **ctx, PetscTruth *success)
- static PetscErrorCode [unset_pc](#) (const char *type, PetscTruth overwrite, void *gctx, void *ctx, [NumericalProblem](#) thisproblem, [NumericalProblem](#) upproblem, [NumericalSolution](#) old, [NumericalSolution](#) nnew)
- PetscErrorCode [DeclarePCPreprocessor](#) (void)

19.13.1 Define Documentation

19.13.1.1 `#define PREPROCESSOR "pc"`

Definition at line 23 of file pc.c.

Referenced by [DeclarePCPreprocessor\(\)](#), [pcoptionshandling\(\)](#), and [setup_pc_choices\(\)](#).

19.13.2 Function Documentation

19.13.2.1 `static PetscErrorCode create_solver (NumericalProblem prob, void ** ctx)`
`[static]`

Create a solver and install a monitor that dynamically increases the maximum number of iterations.

Definition at line 274 of file pc.c.

References CHKERRQ(), NumericalProblem_::comm, and ierr.

Referenced by DeclarePCPreprocessor().

19.13.2.2 `PetscErrorCode DeclarePCPreprocessor (void)`

Definition at line 392 of file pc.c.

References CHKERRQ(), create_solver(), DeclarePreprocessor(), destroy_solver(), disable_pcs(), ierr, SystemPreprocessor_::optionshandling, pcoptionshandling(), PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_pc(), setup_pc_choices(), SystemPreprocessorGetByName(), and unset_pc().

19.13.2.3 `static PetscErrorCode destroy_solver (void * ctx)` `[static]`

Definition at line 294 of file pc.c.

References CHKERRQ(), and ierr.

Referenced by DeclarePCPreprocessor().

19.13.2.4 `static PetscErrorCode disable_pcs (NumericalProblem theproblem, SalsaTransform pc)` `[static]`

Definition at line 217 of file pc.c.

References CHKERRQ(), ierr, SysProRetrieveQuantity(), TransformObjectGetByName(), and TransformObjectMark().

Referenced by DeclarePCPreprocessor().

19.13.2.5 `static PetscErrorCode pcoptionshandling ()` `[static]`

Disable certain preconditioners based on commandline options.

At the moment this is only disabling of direct solvers if the user asks for iterative only.

Definition at line 240 of file pc.c.

References CHKERRQ(), ierr, PREPROCESSOR, RetrieveAllPreprocessorValues(), TransformObjectGetByName(), TransformObjectGetIntAnnotation(), and TransformObjectMark().

Referenced by DeclarePCPreprocessor().

19.13.2.6 `static PetscErrorCode setup_pc (const char * type, int pcv, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem * outproblem, void * gctx, void ** ctx, PetscTruth * success) [static]`

Definition at line 314 of file pc.c.

References CHKERRQ(), ierr, LinearSystemDuplicatePointers(), LinearSystemGetParts(), LinearSystemSetParts(), PreprocessorGetContext(), set_preconditioner_base_matrix(), SetPetscOptionsForPC(), and TRUTH.

Referenced by DeclarePCPreprocessor().

19.13.2.7 `static PetscErrorCode setup_pc_choices () [static]`

Definition at line 27 of file pc.c.

References CHKERRQ(), ierr, NewTransformObject(), PCBOOMERAMG, PCBS95, PCEUCLID, PCMUMPS, PCPARASAILS, PCPILUT, PCRAMS, PCSILU, PCSPOOLES, PC-SUPERLU, PCUMFPACK, PREPROCESSOR, SysProDefineIntAnnotation(), TransformGetByName(), TransformObjectAddOption(), TransformObjectAddOptionExplanation(), TransformObjectDefineOption(), TransformObjectIntAnnotate(), and TransformObjectSetExplanation().

Referenced by DeclarePCPreprocessor().

19.13.2.8 `static PetscErrorCode unset_pc (const char * type, PetscTruth overwrite, void * gctx, void * ctx, NumericalProblem thisproblem, NumericalProblem upproblem, NumericalSolution old, NumericalSolution nnew) [static]`

Definition at line 369 of file pc.c.

References CHKERRQ(), ierr, LinearSolutionCopy(), and LinearSystemGetParts().

Referenced by DeclarePCPreprocessor().

19.14 pcstuff.c File Reference

```
#include <stdlib.h>
#include "petscpc.h"
#include "petscksp.h"
#include "anamod.h"
#include "linpc.h"
```

Functions

- static PetscErrorCode [set_blocked_sub_pc](#) (int pcv)

- PetscErrorCode [pc_string](#) (KSPTYPE *pct*, int *pcv*, int *pcvv*, char ***s*)
- PetscErrorCode [pc_short_string](#) (KSPTYPE *pct*, int *pcv*, int *pcvv*, char ***s*)
- static PetscErrorCode [ilu_stats_function](#) (PC *pc*, void **ctx*)
- PetscErrorCode [get_pc_stats_function](#) (PCTYPE *pct*, int(**f)(PC, void *))
- PetscErrorCode [set_preconditioner_base_matrix](#) (PCTYPE *pct*, Mat *B*, Mat **Buse*)
- PetscErrorCode [SetPetscOptionsForPC](#) (PC *pc*, PCTYPE *pct0*, int *pcv*, int *pcvv*)

19.14.1 Function Documentation

19.14.1.1 PetscErrorCode [get_pc_stats_function](#) (PCTYPE *pct*, int(**f)(PC, void *) *f*)

Definition at line 243 of file pcstuff.c.

References [CHKERRQ\(\)](#), [ierr](#), and [ilu_stats_function\(\)](#).

19.14.1.2 static PetscErrorCode [ilu_stats_function](#) (PC *pc*, void * *ctx*) [static]

Definition at line 226 of file pcstuff.c.

Referenced by [get_pc_stats_function\(\)](#).

19.14.1.3 PetscErrorCode [pc_short_string](#) (KSPTYPE *pct*, int *pcv*, int *pcvv*, char ** *s*)

Definition at line 111 of file pcstuff.c.

References [CHKERRQ\(\)](#), [ierr](#), and [PCBS95](#).

19.14.1.4 PetscErrorCode [pc_string](#) (KSPTYPE *pct*, int *pcv*, int *pcvv*, char ** *s*)

Definition at line 61 of file pcstuff.c.

References [CHKERRQ\(\)](#), and [ierr](#).

19.14.1.5 static PetscErrorCode [set_blocked_sub_pc](#) (int *pcv*) [static]

Set the parameter value for a pc; this routine is only called for parametrised pcs

Definition at line 13 of file pcstuff.c.

References [CHKERRQ\(\)](#), and [ierr](#).

Referenced by [SetPetscOptionsForPC\(\)](#).

19.14.1.6 PetscErrorCode [set_preconditioner_base_matrix](#) (PCTYPE *pct*, Mat *B*, Mat * *Buse*)

Definition at line 258 of file pcstuff.c.

References [CHKERRQ\(\)](#), [ierr](#), [PCBS95](#), [PCMUMPS](#), [PCSPOOLES](#), [PCSUPERLU](#), and [PCUMFPACK](#).

Referenced by [setup_pc\(\)](#).

19.14.1.7 PetscErrorCode SetPetscOptionsForPC (PC *pc*, PCType *pct0*, int *pcv*, int *pcvv*)

Definition at line 304 of file pcstuff.c.

References [CHKERRQ\(\)](#), [ierr](#), [PCBOOMERAMG](#), [PCBS95](#), [PCEUCLID](#), [PCMUMPS](#), [PCPARASAILS](#), [PCPILUT](#), [PCRASM](#), [PCSILU](#), [PCSPOOLES](#), [PCSUPERLU](#), [PCUMFPACK](#), and [set_blocked_sub_pc\(\)](#).

Referenced by [setup_pc\(\)](#).

19.15 preprocess.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "petscmat.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "syspro_impl.h"
```

Data Structures

- struct [PreprocessorsGlobalInfo_](#)

Defines

- [#define NPREPROCESS](#) 25

Typedefs

- typedef struct [PreprocessorsGlobalInfo_](#) * [PreprocessorsGlobalInfo](#)

Functions

- static PetscErrorCode [CreateGlobalInfo](#) ()
- PetscErrorCode [SysProInitialize](#) ()
- PetscErrorCode [SysProFinalize](#) ()
- PetscErrorCode [DeclarePreprocessor](#) (const char *name, PetscErrorCode(*this_preprocessor_setup)(), PetscErrorCode(*specific_setup)([NumericalProblem](#), [SalSaTransform](#)), PetscErrorCode(*specific_unset)([NumericalProblem](#)), PetscErrorCode(*global_unset)(), PetscErrorCode(*ctxcreate)([NumericalProblem](#), void **), PetscErrorCode(*ctxdelete)(void

- *), PetscErrorCode(*start_function)(const char *, int, PetscTruth, NumericalProblem, NumericalProblem *, void *, void **, PetscTruth *), PetscErrorCode(*end_function)(const char *, PetscTruth, void *, void *, NumericalProblem, NumericalProblem, NumericalSolution, NumericalSolution))
- PetscErrorCode SysProDeclareProblemMonitor (PetscErrorCode(*monitor)(NumericalProblem))
- PetscErrorCode SysProDeclareErrorTracer (PetscErrorCode(*tracer)(NumericalProblem, NumericalSolution, const char *))
- PetscErrorCode SysProGetErrorTracer (PetscErrorCode(**tracer)(NumericalProblem, NumericalSolution, const char *))
- PetscErrorCode DeclarePreprocessorIntelligentChoice (const char *name, PetscErrorCode(*picker)(NumericalProblem, const char **, const char **))
- PetscErrorCode NumericalProblemGetComm (NumericalProblem prob, MPI_Comm *comm)
- PetscErrorCode SysProDeclareFunctions (PetscErrorCode(*classstaticsetup)(const char *), PetscErrorCode(*classdynamicsetup)(const char *, NumericalProblem), PetscErrorCode(*classproblemcloner)(const char *, const char *, int, NumericalProblem, NumericalProblem), PetscErrorCode(*problemsolver)(NumericalProblem, void *, NumericalSolution *), PetscErrorCode(*problemdelete)(NumericalProblem), PetscErrorCode(*solutioncreator)(NumericalProblem, NumericalSolution *), PetscErrorCode(*solutioncopy)(NumericalProblem, NumericalSolution), PetscErrorCode(*solutiondelete)(NumericalSolution), PetscErrorCode(*ctxcloner)(const char *, const char *, void *, void **), PetscErrorCode(*ctxfree)(void *), PetscErrorCode(*solutioncontextdelete)(NumericalProblem, NumericalSolution, void *))
- static PetscErrorCode SysProGetContextFunctions (PetscErrorCode(**ctxcloner)(const char *, const char *, void *, void **), PetscErrorCode(**ctxfree)(void *))
- static PetscErrorCode SysProProblemCloneContext (const char *preprocessor, const char *type, NumericalProblem in, NumericalProblem out)
- static PetscErrorCode SysProProblemDeleteContext (NumericalProblem problem)
- static PetscErrorCode RegisterPreprocessorSetting (const char *preprocess, const char *type, int option)
- PetscErrorCode PreprocessorGetSetting (const char *preprocess, const char **type, int *option)
- PetscErrorCode RetrievePreprocessorChoice (int idx, const char **type, int *option)
- PetscErrorCode PreprocessorGetIndex (const char *name, int *prenumber)
- PetscErrorCode SystemPreprocessorGetByName (const char *name, SystemPreprocessor *pp)
- PetscErrorCode TransformGetByName (const char *name, SalsaTransform *tf)
- PetscErrorCode RegisterPreprocessorContext (const char *pre, void *ctx)
- PetscErrorCode PreprocessorGetContext (const char *pre, void **ctx)
- static PetscErrorCode PreprocessorSpecificSetup (const char *preprocess, NumericalProblem problem, PetscTruth user_choices)
- static PetscErrorCode SysproPreprocessorStartFunction (SystemPreprocessor preprocessor, const char *type, int option, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem *outproblem, void *preprocessor_context, void **transform_context, PetscTruth *success)

- static PetscErrorCode [SysProPreprocessorEndFunction](#) ([SystemPreprocessor](#) preprocessor, const char *pclassname, const char *type, PetscTruth do_not_keep_original, void *gctx, void *ctx, [NumericalProblem](#) next_problem, [NumericalProblem](#) problem, [NumericalSolution](#) next_solution, [NumericalSolution](#) *rsolution)
- static PetscErrorCode [ChooseFirstTransform](#) ([NumericalProblem](#) problem, const char *preprocess, PetscTruth user_choices, PetscTruth exhaustive, [SalsaTransform](#) transform, [SystemPreprocessor](#) preprocessor, [SalsaTransformObject](#) *transformitem, PetscTruth *moretransform, const char **type)
- PetscErrorCode [PreprocessedSolution](#) (const char *pclassname, [NumericalProblem](#) problem, void *prevctx, [NumericalSolution](#) *rsolution)
- PetscErrorCode [PreprocessedProblemSolving](#) ([NumericalProblem](#) problem, [NumericalSolution](#) *solution)

Variables

- [SystemPreprocessor](#) * [preprocessors](#) = NULL
- const char ** [currentpreprocessors](#)
- const char ** [currentchoices](#) = NULL
- int * [currentoptions](#) = NULL
- int [npreprocess](#) = 0
- int [preprocesslevel](#)
- static void ** [preprocessorcontexts](#)
- static void * [solutioncontext](#)
- static PetscErrorCode(** [unsetpreprocessor](#))()
- static [PreprocessorsGlobalInfo](#) [GlobalInfo](#) = NULL

19.15.1 Define Documentation

19.15.1.1 #define NPREPROCESS 25

Definition at line 157 of file preprocess.c.

Referenced by [DeclarePreprocessor\(\)](#), and [SysProInitialize\(\)](#).

19.15.2 Typedef Documentation

19.15.2.1 typedef struct PreprocessorsGlobalInfo_* PreprocessorsGlobalInfo

Definition at line 198 of file preprocess.c.

19.15.3 Function Documentation

19.15.3.1 static PetscErrorCode ChooseFirstTransform (NumericalProblem *problem*,
const char * *preprocess*, PetscTruth *user_choices*, PetscTruth *exhaustive*,
SalsaTransform *transform*, SystemPreprocessor *preprocessor*,
SalsaTransformObject * *transformitem*, PetscTruth * *moretransform*, const char
** *type*) [static]

Definition at line 826 of file preprocess.c.

References CHKERRQ(), PreprocessorsGlobalInfo_::computeCategory, ierr, SystemPreprocessor_::intelligence, SystemPreprocessor_::name, SystemPreprocessor_::required, SysProTraceMessage(), TransformGetNextUnmarkedItem(), and TransformObjectGetName().

Referenced by PreprocessedSolution().

19.15.3.2 static PetscErrorCode CreateGlobalInfo () [static]

Definition at line 203 of file preprocess.c.

References CHKERRQ(), and ierr.

Referenced by SysProInitialize().

19.15.3.3 PetscErrorCode DeclarePreprocessor (const char * *name*, PetscErrorCode(*)() *this_preprocessor_setup*, PetscErrorCode(*) (NumericalProblem, SalsaTransform) *specific_setup*, PetscErrorCode(*) (NumericalProblem) *specific_unset*, PetscErrorCode(*)() *global_unset*, PetscErrorCode(*) (NumericalProblem, void**) *ctxcreate*, PetscErrorCode(*) (void*) *ctxdelete*, PetscErrorCode(*) (const char*, int, PetscTruth, NumericalProblem, NumericalProblem*, void*, void**, PetscTruth*) *start_function*, PetscErrorCode(*) (const char*, PetscTruth, void*, void*, NumericalProblem, NumericalProblem, NumericalSolution, NumericalSolution) *end_function*)

Declare a preprocessor class, by specifying its various members.

The *name* argument should not contain the colon character.

Here is an explanation of the various function arguments.

this_preprocessor_setup () : this routine is called only once, inside this function. This is a good place for defining all the preprocessors in this class

specific_setup (NumericalProblem, SalsaTransform) : this is called at the start of a preprocessing stage; one could use this for computing matrix metadata.

global_unset (void) : this is called in [SysProFinalize\(\)](#).

ctx_create (NumericalProblem, void**) : create an object that can be used for the duration of the application of this preprocessor

ctxdelete (void*) : delete the context again

`start_function`: this is the function that performs the forward transform of the problem. Prototype:

```
PetscErrorCode start_function
(char          *classmember,
 int           optionvalue,
 PetscTruth    overwrite,
 NumericalProblem problem,
 NumericalProblem *transformedproblem,
 void          *globalcontext,
 void          **localcontext,
 PetscTruth    *success)
```

`end_function`: this is the backtransform. Its main task is copying or backtransforming the preprocessed solution to the original solution.

```
PetscErrorCode end_function
(char          *classmember,
 PetscTruth    overwrite,
 void          *globalcontext,
 void          *localcontext,
 NumericalProblem pproblem,
 NumericalProblem oproblem,
 NumericalSolution psolution,
 NumericalSolution osolution)
```

where `pproblem` and `psolution` are the preprocessed quantities, the end function has to unprocess them and leave the result in `oproblem`, `osolution`. Actually, `oproblem` is only for reference.

Definition at line 328 of file `preprocess.c`.

References `CHKERRQ()`, `PreprocessorsGlobalInfo::classstaticsetup`, `SystemPreprocessor_::ctxcreate`, `SystemPreprocessor_::ctxdelete`, `SystemPreprocessor_::end_function`, `SystemPreprocessor_::exhaustive`, `ierr`, `SystemPreprocessor_::name`, `NewTransform()`, `NPREPROCESS`, `npprocess`, `SystemPreprocessor_::setup`, `SystemPreprocessor_::start_function`, `SystemPreprocessor_::transform`, `SystemPreprocessor_::unset`, and `unsetpreprocessor`.

Referenced by `DeclareApproximationPreprocessor()`, `DeclareDistributionPreprocessor()`, `DeclareFlipsignPreprocessor()`, `DeclareKSPPPreprocessor()`, `DeclarePCPreprocessor()`, `DeclareScalingPreprocessor()`, `DeclareSingletonPreprocessor()`, and `main()`.

19.15.3.4 `PetscErrorCode DeclarePreprocessorIntelligentChoice (const char * name, PetscErrorCode(*)(NumericalProblem, const char **, const char **) picker)`

Install a function to pick the optimal choice for a preprocessor

Definition at line 412 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessor_::intelligence`, and `SystemPreprocessorGetByName()`.

Referenced by `DeclareScalingPreprocessor()`.

19.15.3.5 `PetscErrorCode NumericalProblemGetComm (NumericalProblem prob,
MPI_Comm * comm)`

Definition at line 424 of file preprocess.c.

References `NumericalProblem_::comm`.

Referenced by `create_solver()`.

19.15.3.6 `PetscErrorCode PreprocessedProblemSolving (NumericalProblem problem,
NumericalSolution * solution)`

Invoking this routine starts the preprocessing and ultimate solution of the numerical problem.

Definition at line 1028 of file preprocess.c.

References `CHKERRQ()`, `PreprocessorsGlobalInfo_::errortracer`, `GetFirstPreprocessor()`, `ierr`, `PreprocessedSolution()`, `preprocesslevel`, and `PreprocessorsGlobalInfo_::problemsolver`.

Referenced by `main()`, and `PreprocessedLinearSystemSolution()`.

19.15.3.7 `PetscErrorCode PreprocessedSolution (const char * pclassname,
NumericalProblem problem, void * prevctx, NumericalSolution * rsolution)`

This routine handles the application of one preprocessor. Depending on the runtime setup (see section [Usage modes](#)), one choice is applied, or a sequence of choices is applied consecutively. The forward and backward transformation of the preprocessor are done here, and if necessary, backup copies of the system are kept around.

Definition at line 875 of file preprocess.c.

References `CHKERRQ()`, `ChooseFirstTransform()`, `PreprocessorsGlobalInfo_::classdynamicsetup`, `SystemPreprocessor_::ctxcreate`, `SystemPreprocessor_::ctxdelete`, `PreprocessorsGlobalInfo_::errortracer`, `SystemPreprocessor_::exhaustive`, `ierr`, `PreprocessedSolution()`, `preprocesslevel`, `PreprocessorSpecificSetup()`, `PreprocessorsGlobalInfo_::problemsolver`, `RegisterPreprocessorContext()`, `RegisterPreprocessorSetting()`, `ReportSysProCallStackState()`, `PreprocessorsGlobalInfo_::solutioncontextdelete`, `PreprocessorsGlobalInfo_::solutiondelete`, `SuccessorPreprocessor()`, `SysProPreprocessorEndFunction()`, `SysproPreprocessorStartFunction()`, `SysProProblemCloneContext()`, `SysProTraceMessage()`, `SystemPreprocessorGetByName()`, `SystemPreprocessor_::transform`, `TransformGetNextUnmarkedItem()`, `TransformGetUserChoices()`, `TransformItemGetFirstOption()`, `TransformItemGetNextOption()`, `TransformObjectGetName()`, `TRUTH`, and `SystemPreprocessor_::unset`.

Referenced by `PreprocessedProblemSolving()`, and `PreprocessedSolution()`.

19.15.3.8 `PetscErrorCode PreprocessorGetContext (const char * pre, void ** ctx)`

Definition at line 681 of file preprocess.c.

References `CHKERRQ()`, `ierr`, `preprocessorcontexts`, `PreprocessorGetIndex()`, and `so-`

lutioncontext.

Referenced by setup_ksp(), and setup_pc().

19.15.3.9 PetscErrorCode PreprocessorGetIndex (const char * *name*, int * *prenumber*)

Definition at line 591 of file preprocess.c.

References CHKERRQ(), ierr, and npreprocess.

Referenced by PreprocessorGetContext(), RegisterPreprocessorContext(), and SystemPreprocessorGetByName().

19.15.3.10 PetscErrorCode PreprocessorGetSetting (const char * *preprocess*, const char ** *type*, int * *option*)

Definition at line 559 of file preprocess.c.

References currentchoices, currentoptions, currentpreprocessors, and preprocesslevel.

Referenced by disable_ksp().

19.15.3.11 static PetscErrorCode PreprocessorSpecificSetup (const char * *preprocess*, NumericalProblem *problem*, PetscTruth *user_choices*) [static]

Setup actions that are particular to a specific class of preprocessors, such as scalings. This performs the following actions:

- any user specified setup, for instance disqualifying preprocessors on purely logistical grounds.
- subsequently, the suitability functions ([Suitability functions](#)) are evaluated for each preprocessor and the current problem. In the current implementation this is only used to disqualify preprocessors. We'll get more sophisticated later.

Definition at line 710 of file preprocess.c.

References CHKERRQ(), ierr, SalsaTransform_::n_objects, PreprocessorApplyAprioriSelection(), PreprocessorsGlobalInfo_::problemmonitor, ReportEnabledPreprocessors(), SystemPreprocessor_::setup, SystemPreprocessorGetByName(), TestSuitabilityContext(), TransformGetByName(), TransformObjectGetName(), TransformObjectGetSuitabilityFunction(), TransformObjectMark(), and SalsaTransform_::transformobjects.

Referenced by PreprocessedSolution().

19.15.3.12 PetscErrorCode RegisterPreprocessorContext (const char * *pre*, void * *ctx*)

Definition at line 659 of file preprocess.c.

References CHKERRQ(), ierr, preprocessorcontexts, PreprocessorGetIndex(), and solutioncontext.

Referenced by `PreprocessedLinearSystemSolution()`, and `PreprocessedSolution()`.

19.15.3.13 `static PetscErrorCode RegisterPreprocessorSetting (const char * preprocess, const char * type, int option) [static]`

Definition at line 546 of file `preprocess.c`.

References `currentchoices`, `currentoptions`, `currentpreprocessors`, and `preprocesslevel`.

Referenced by `PreprocessedSolution()`.

19.15.3.14 `PetscErrorCode RetrievePreprocessorChoice (int idx, const char ** type, int * option)`

Definition at line 579 of file `preprocess.c`.

References `currentchoices`, and `currentoptions`.

Referenced by `ContinueRetrievingCurrentPreprocessors()`.

19.15.3.15 `PetscErrorCode SysProDeclareErrorTracer (PetscErrorCode(*)(NumericalProblem, NumericalSolution, const char *) tracer)`

Definition at line 391 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::errortracer`.

19.15.3.16 `PetscErrorCode SysProDeclareFunctions (PetscErrorCode(*)(const char *) classstaticsetup, PetscErrorCode(*)(const char *, NumericalProblem) classdynamicsetup, PetscErrorCode(*)(const char *, const char *, int, NumericalProblem, NumericalProblem) classproblemcloner, PetscErrorCode(*)(NumericalProblem, void *, NumericalSolution *) problemsolver, PetscErrorCode(*)(NumericalProblem) problemdelete, PetscErrorCode(*)(NumericalProblem, NumericalSolution *) solutioncreator, PetscErrorCode(*)(NumericalSolution, NumericalSolution) solutioncopy, PetscErrorCode(*)(NumericalSolution) solutiondelete, PetscErrorCode(*)(const char *, const char *, void *, void **) ctxcloner, PetscErrorCode(*)(void *) ctxfree, PetscErrorCode(*)(NumericalSolution) solutioncontextdelete)`

Install various functions

- `classstaticsetup`: this function is called on each processor as it is being created; see [DeclarePreprocessor\(\)](#).
- `classdynamicsetup`: this function is called as any invocation of a preprocessor starts; see [PreprocessedSolution\(\)](#);
- `classproblemcloner`: a function to clone the context : optional see [Tracing the preprocessors](#) for more details.

- `problemsolver` : the ultimate problem solver : required
- `problemdelete` : delete a problem object
- `solutioncreator` : creates a solution object; optional, but required a pre-processor has an endfunction.
- `solutioncopy` : guess what this does; optional
- `solutiondelete` : optional, but needed if `solutioncopy` is used
- `contextcloner` : problems can carry a context; this clones the context if a problem is copied; otherwise the pointer is simply duplicated
- `contextfree` : used to delete cloned contexts
- `solutioncontextdelete` : hm.

Definition at line 453 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::classdynamicsetup`, `PreprocessorsGlobalInfo_::classproblemcloner`, `PreprocessorsGlobalInfo_::classstaticsetup`, `PreprocessorsGlobalInfo_::clonecontext`, `PreprocessorsGlobalInfo_::freecontext`, `PreprocessorsGlobalInfo_::problemdelete`, `PreprocessorsGlobalInfo_::problemsolver`, `PreprocessorsGlobalInfo_::solutioncontextdelete`, `PreprocessorsGlobalInfo_::solutioncopy`, `PreprocessorsGlobalInfo_::solutioncreator`, and `PreprocessorsGlobalInfo_::solutiondelete`.

Referenced by `main()`.

19.15.3.17 `PetscErrorCode SysProDeclareProblemMonitor (PetscErrorCode*)(NumericalProblem) monitor)`

Definition at line 381 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::problemmonitor`.

19.15.3.18 `PetscErrorCode SysProFinalize ()`

Definition at line 245 of file `preprocess.c`.

References `CHKERRQ()`, `currentchoices`, `currentoptions`, `currentpreprocessors`, `DeregisterTransform()`, `ierr`, `SystemPreprocessor_::name`, `npreprocess`, `preprocessorcontexts`, `SystemPreprocessor_::preserved`, `SystemPreprocessor_::transform`, and `unsetpreprocessor`.

Referenced by `main()`.

19.15.3.19 `static PetscErrorCode SysProGetContextFunctions (PetscErrorCode(**)(const char *, const char *, void *, void **) ctxcloner, PetscErrorCode(**)(void *) ctxfree) [static]`

Definition at line 505 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::clonecontext`, and `PreprocessorsGlobalInfo_::freecontext`.

Referenced by `SysProProblemCloneContext()`, and `SysProProblemDeleteContext()`.

19.15.3.20 `PetscErrorCode SysProGetErrorTracer (PetscErrorCode(**)(NumericalProblem, NumericalSolution, const char *) tracer)`

Definition at line 401 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::errortracer`.

19.15.3.21 `PetscErrorCode SysProInitialize ()`

Allocate SysPro globals. See also [SysProFinalize\(\)](#).

Definition at line 220 of file `preprocess.c`.

References `CHKERRQ()`, `CreateGlobalInfo()`, `currentchoices`, `currentoptions`, `current-preprocessors`, `ierr`, `NPREPROCESS`, `preprocessorcontexts`, and `unsetpreprocessor`.

Referenced by `main()`.

19.15.3.22 `static PetscErrorCode SysProPreprocessorEndFunction (SystemPreprocessor preprocessor, const char * pclassname, const char * type, PetscTruth do_not_keep_original, void * gctx, void * ctx, NumericalProblem next_problem, NumericalProblem problem, NumericalSolution next_solution, NumericalSolution * rsolution) [static]`

Definition at line 786 of file `preprocess.c`.

References `CHKERRQ()`, `SystemPreprocessor_::end_function`, `PreprocessorsGlobalInfo_::errortracer`, `ierr`, `PreprocessorsGlobalInfo_::problemdelete`, `PreprocessorsGlobalInfo_::solutioncopy`, `PreprocessorsGlobalInfo_::solutioncreator`, `PreprocessorsGlobalInfo_::solutiondelete`, and `SysProProblemDeleteContext()`.

Referenced by `PreprocessedSolution()`.

19.15.3.23 `static PetscErrorCode SysproPreprocessorStartFunction (SystemPreprocessor preprocessor, const char * type, int option, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem * outproblem, void * preprocessor_context, void ** transform_context, PetscTruth * success) [static]`

Definition at line 761 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessor_::name`, and `SystemPreprocessor_::start_function`.

Referenced by `PreprocessedSolution()`.

19.15.3.24 `static PetscErrorCode SysProProblemCloneContext (const char * preprocessor,
const char * type, NumericalProblem in, NumericalProblem out)`
[static]

Definition at line 517 of file preprocess.c.

References CHKERRQ(), NumericalProblem_::ctx, ierr, and SysProGetContextFunctions().

Referenced by PreprocessedSolution().

19.15.3.25 `static PetscErrorCode SysProProblemDeleteContext (NumericalProblem
problem)` [static]

Definition at line 529 of file preprocess.c.

References CHKERRQ(), ierr, and SysProGetContextFunctions().

Referenced by SysProPreprocessorEndFunction().

19.15.3.26 `PetscErrorCode SystemPreprocessorGetByName (const char * name,
SystemPreprocessor * pp)`

Definition at line 612 of file preprocess.c.

References CHKERRQ(), ierr, and PreprocessorGetIndex().

Referenced by DeclarePCPreprocessor(), DeclarePreprocessorIntelligentChoice(), DeclarePreprocessorRequiredCategories(), PreprocessedSolution(), PreprocessorGetPreservedCategories(), PreprocessorSetPreservedCategories(), PreprocessorsOptionsHandling(), PreprocessorSpecificSetup(), and TransformGetByName().

19.15.3.27 `PetscErrorCode TransformGetByName (const char * name, SalsaTransform * tf
)`

Definition at line 624 of file preprocess.c.

References CHKERRQ(), ierr, SystemPreprocessorGetByName(), and SystemPreprocessor_::transform.

Referenced by NewTransformObject(), PreprocessorsOptionsHandling(), PreprocessorSpecificSetup(), ReportEnabledPreprocessors(), setup_approximation_choices(), setup_distribution_choices(), setup_flipsign_choices(), setup_ksp_choices(), setup_pc_choices(), setup_scaling_choices(), setup_singleton_choices(), SysProDefineCharAnnotation(), SysProDefineIntAnnotation(), and TransformObjectGetByName().

19.15.4 Variable Documentation

19.15.4.1 const char ** currentchoices = NULL

Definition at line 159 of file preprocess.c.

Referenced by PreprocessorGetSetting(), RegisterPreprocessorSetting(), RetrievePreprocessorChoice(), SysProFinalize(), and SysProInitialize().

19.15.4.2 int* currentoptions = NULL

Definition at line 160 of file preprocess.c.

Referenced by PreprocessorGetSetting(), RegisterPreprocessorSetting(), RetrievePreprocessorChoice(), SysProFinalize(), and SysProInitialize().

19.15.4.3 const char currentpreprocessors**

Definition at line 159 of file preprocess.c.

Referenced by PreprocessorGetSetting(), RegisterPreprocessorSetting(), SysProFinalize(), and SysProInitialize().

19.15.4.4 PreprocessorsGlobalInfo GlobalInfo = NULL [static]

Definition at line 199 of file preprocess.c.

19.15.4.5 int npreprocess = 0

Definition at line 161 of file preprocess.c.

Referenced by ContinueRetrievingAllPreprocessors(), DeclarePreprocessor(), GetNextPreprocessor(), PreprocessorGetIndex(), RetrieveAllPreprocessorValues(), SuccessorPreprocessor(), and SysProFinalize().

19.15.4.6 int preprocesslevel

Definition at line 161 of file preprocess.c.

Referenced by ContinueRetrievingCurrentPreprocessors(), PreprocessedProblemSolving(), PreprocessedSolution(), PreprocessorGetSetting(), and RegisterPreprocessorSetting().

19.15.4.7 void preprocessorcontexts [static]**

Definition at line 162 of file preprocess.c.

Referenced by PreprocessorGetContext(), RegisterPreprocessorContext(), SysProFinalize(), and SysProInitialize().

19.15.4.8 SystemPreprocessor* preprocessors = NULL

Definition at line 158 of file preprocess.c.

19.15.4.9 void * solutioncontext

Definition at line 162 of file preprocess.c.

Referenced by PreprocessorGetContext(), and RegisterPreprocessorContext().

19.15.4.10 PetscErrorCode(unsetpreprocessor)() [static]**

Definition at line 163 of file preprocess.c.

Referenced by DeclarePreprocessor(), SysProFinalize(), and SysProInitialize().

19.16 reporting.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "syspro.h"
#include "sysprotransform.h"
#include "syspro_impl.h"
```

Defines

- #define [LINELEN](#) 1500
- #define [REPOSITION](#)(a, b)
- #define [MAXLEN](#) 500

Functions

- PetscErrorCode [GetFirstPreprocessor](#) (const char **preprocess)
- PetscErrorCode [GetNextPreprocessor](#) (const char **next_one)
- PetscErrorCode [SuccessorPreprocessor](#) (const char *this_one, const char **next_one)
- PetscErrorCode [StartRetrievingCurrentPreprocessors](#) (const char **cclass, const char **type, int *opt, PetscTruth *success)
- PetscErrorCode [ContinueRetrievingCurrentPreprocessors](#) (const char **cclass, const char **atype, int *opt, PetscTruth *success)
- PetscErrorCode [StartRetrievingAllPreprocessors](#) (const char ***cclass, const char ***types, int *ntypes, PetscTruth *success)
- PetscErrorCode [InitRetrievingPreprocessors](#) ()
- PetscErrorCode [ContinueRetrievingAllPreprocessors](#) (const char **cclass, const char ***types, int *ntypes, PetscTruth *success)

- PetscErrorCode [RetrieveAllPreprocessorValues](#) (const char *cclass, const char ***types, int *ntypes)
- static PetscErrorCode [TabReportPreprocessors](#) (PetscTruth active, const char **key, const char **val, int separator)
- PetscErrorCode [TabReportAllPreprocessors](#) (const char **key, int separator)
- PetscErrorCode [TabReportActivePreprocessors](#) (const char **key, const char **val, int separator)
- PetscErrorCode [ScreenOutputTab](#) (const char *key, const char *val)
- PetscErrorCode [ScreenOutputTabLine](#) (const char *key, const char *val)
- PetscErrorCode [ReportEnabledPreprocessors](#) (const char *name)
- PetscErrorCode [ReportSysProCallStackState](#) (const char *name)

Variables

- int [npreprocess](#)
- int [preprocesslevel](#)
- static int [preprocessreadout](#)
- [SystemPreprocessor](#) * [preprocessors](#)

19.16.1 Define Documentation

19.16.1.1 #define LINELEN 1500

Definition at line 226 of file reporting.c.

Referenced by [TabReportPreprocessors\(\)](#).

19.16.1.2 #define MAXLEN 500

Referenced by [ScreenOutputTabLine\(\)](#).

19.16.1.3 #define REPOSITION(a, b)

Value:

```
ierr = PetscStrlen(a,&b); CHKERRQ(ierr); \
    if (b>LINELEN) SETERRQ(1,"string overflow")
```

Definition at line 227 of file reporting.c.

Referenced by [TabReportPreprocessors\(\)](#).

19.16.2 Function Documentation

19.16.2.1 PetscErrorCode ContinueRetrievingAllPreprocessors (const char ** *cclass*, const char * *types*, int * *ntypes*, PetscTruth * *success*)**

This routine is to be used repeatedly after an initial call to [StartRetrievingAllPreprocessors\(\)](#).

The `types` argument is allocated internally and should be deallocated by the user.

Definition at line 186 of file `reporting.c`.

References `CHKERRQ()`, `ierr`, `SalsaTransform_::n_objects`, `SystemPreprocessor_::name`, `npreprocess`, `preprocessreadout`, `SystemPreprocessor_::transform`, and `TransformObjectsGetNames()`.

Referenced by `RetrieveAllPreprocessorValues()`, `StartRetrievingAllPreprocessors()`, `SysProShowOptions()`, and `TabReportPreprocessors()`.

19.16.2.2 PetscErrorCode ContinueRetrievingCurrentPreprocessors (const char ** *cclass*, const char ** *atype*, int * *opt*, PetscTruth * *success*)

This routine is to be used repeatedly after an initial call to [StartRetrievingCurrentPreprocessors\(\)](#).

Definition at line 125 of file `reporting.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessor_::name`, `preprocesslevel`, `preprocessreadout`, and `RetrievePreprocessorChoice()`.

Referenced by `StartRetrievingCurrentPreprocessors()`, and `TabReportPreprocessors()`.

19.16.2.3 PetscErrorCode GetFirstPreprocessor (const char ** *preprocess*)

Get the name of the first declared preprocessor (in order of declaration) or null if none have been declared. Subsequent preprocessors can be retrieved with [GetNextPreprocessor\(\)](#) or [SuccessorPreprocessor\(\)](#).

Definition at line 45 of file `reporting.c`.

References `CHKERRQ()`, `GetNextPreprocessor()`, `ierr`, and `preprocessreadout`.

Referenced by `PreprocessedProblemSolving()`, and `PreprocessorsOptionsHandling()`.

19.16.2.4 PetscErrorCode GetNextPreprocessor (const char ** *next_one*)

Get the next preprocessor according to the variable `preprocessreadout`.

The result is null if there are no further preprocessors.

Definition at line 61 of file `reporting.c`.

References `SystemPreprocessor_::name`, `npreprocess`, and `preprocessreadout`.

Referenced by `GetFirstPreprocessor()`, and `PreprocessorsOptionsHandling()`.

19.16.2.5 PetscErrorCode InitRetrievingPreprocessors ()

Definition at line 169 of file reporting.c.

References preprocessreadout.

Referenced by TabReportPreprocessors().

19.16.2.6 PetscErrorCode ReportEnabledPreprocessors (const char * name)

Report preprocessor choices that are available after the specific setup has possible disabled some of the registered ones. This function uses the `sysprotrace` function, so this has to have been declared.

Definition at line 394 of file reporting.c.

References CHKERRQ(), ierr, SysProHasTrace(), SysProTraceMessage(), TransformGetByName(), and TransformReportEnabled().

Referenced by PreprocessorsOptionsHandling(), and PreprocessorSpecificSetup().

19.16.2.7 PetscErrorCode ReportSysProCallStackState (const char * name)

Report preprocessor choices that are available after the specific setup has possible disabled some of the registered ones. This function uses the `sysprotrace` function, so this has to have been declared.

Definition at line 418 of file reporting.c.

References CHKERRQ(), ierr, ScreenOutputTabLine(), SysProHasTrace(), SysProTraceMessage(), and TabReportPreprocessors().

Referenced by PreprocessedSolution().

19.16.2.8 PetscErrorCode RetrieveAllPreprocessorValues (const char * cclass, const char * types, int * ntypes)**

Definition at line 210 of file reporting.c.

References CHKERRQ(), ContinueRetrievingAllPreprocessors(), ierr, npreprocess, and preprocessreadout.

Referenced by pcoptionshandling().

19.16.2.9 PetscErrorCode ScreenOutputTab (const char * key, const char * val)

Definition at line 320 of file reporting.c.

References CHKERRQ(), ierr, SysProHasTrace(), and SysProTraceMessage().

19.16.2.10 PetscErrorCode ScreenOutputTabLine (const char * key, const char * val)

Definition at line 347 of file reporting.c.

References CHKERRQ(), ierr, MAXLEN, SysProHasTrace(), and SysProTraceMessage().
Referenced by ReportSysProCallStackState().

19.16.2.11 `PetscErrorCode StartRetrievingAllPreprocessors (const char ** cclass, const char *** types, int * ntypes, PetscTruth * success)`

This routine gives the class of the first declared preprocessor, and all possible values. To get the next preprocessor, call [ContinueRetrievingAllPreprocessors\(\)](#).

The class, types, and ntypes arguments can all be null.

The `types` argument is allocated internally and should be deallocated by the user.

Definition at line 157 of file reporting.c.

References CHKERRQ(), ContinueRetrievingAllPreprocessors(), ierr, and preprocess-readout.

Referenced by SysProShowOptions().

19.16.2.12 `PetscErrorCode StartRetrievingCurrentPreprocessors (const char ** cclass, const char ** type, int * opt, PetscTruth * success)`

This routine gives the class and current value of the first declared preprocessor. To get the next preprocessor, call [ContinueRetrievingAllPreprocessors\(\)](#).

The class, types, and ntypes arguments can all be null.

Definition at line 108 of file reporting.c.

References CHKERRQ(), ContinueRetrievingCurrentPreprocessors(), ierr, and preprocess-readout.

19.16.2.13 `PetscErrorCode SuccessorPreprocessor (const char * this_one, const char ** next_one)`

Given a preprocessor, get the name of the next one (in order of declaration) or null if there are no further ones.

The arguments are allowed to be the same.

Definition at line 78 of file reporting.c.

References CHKERRQ(), ierr, SystemPreprocessor_::name, and npreprocess.

Referenced by PreprocessedSolution().

19.16.2.14 `PetscErrorCode TabReportActivePreprocessors (const char ** key, const char ** val, int separator)`

Definition at line 309 of file reporting.c.

References CHKERRQ(), ierr, and TabReportPreprocessors().

19.16.2.15 `PetscErrorCode TabReportAllPreprocessors (const char ** key, int separator)`

Definition at line 295 of file reporting.c.

References `CHKERRQ()`, `ierr`, and `TabReportPreprocessors()`.

19.16.2.16 `static PetscErrorCode TabReportPreprocessors (PetscTruth active, const char ** key, const char ** val, int separator) [static]`

Report all defined preprocessors. Either key and val argument can be NULL. The string arguments returned need to be deallocated in the calling environment.

Definition at line 237 of file reporting.c.

References `CHKERRQ()`, `ContinueRetrievingAllPreprocessors()`, `ContinueRetrievingCurrentPreprocessors()`, `ierr`, `InitRetrievingPreprocessors()`, `LINELEN`, and `REPOSITION`.

Referenced by `ReportSysProCallStackState()`, `TabReportActivePreprocessors()`, and `TabReportAllPreprocessors()`.

19.16.3 Variable Documentation**19.16.3.1** `int npreprocess`

Definition at line 161 of file preprocess.c.

Referenced by `ContinueRetrievingAllPreprocessors()`, `DeclarePreprocessor()`, `GetNextPreprocessor()`, `PreprocessorGetIndex()`, `RetrieveAllPreprocessorValues()`, `SuccessorPreprocessor()`, and `SysProFinalize()`.

19.16.3.2 `int preprocesslevel`

Definition at line 161 of file preprocess.c.

Referenced by `ContinueRetrievingCurrentPreprocessors()`, `PreprocessedProblemSolving()`, `PreprocessedSolution()`, `PreprocessorGetSetting()`, and `RegisterPreprocessorSetting()`.

19.16.3.3 `SystemPreprocessor* preprocessors`

Definition at line 158 of file preprocess.c.

19.16.3.4 `int preprocessreadout [static]`

Definition at line 34 of file reporting.c.

Referenced by `ContinueRetrievingAllPreprocessors()`, `ContinueRetrievingCurrentPreprocessors()`, `GetFirstPreprocessor()`, `GetNextPreprocessor()`, `InitRetrievingPreprocessors()`, `RetrieveAllPreprocessorValues()`, `StartRetrievingAllPreprocessors()`, and `StartRetrievingCurrentPreprocessors()`.

19.17 scaling.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "petsc.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "petscmat.h"
```

Defines

- #define [PREPROCESSOR](#) "scaling"

Functions

- static PetscErrorCode [set_intelligent_scaling](#) ([NumericalProblem](#) theproblem, const char **type, const char **reason)
- static PetscErrorCode [scale_system](#) (const char *type, int nopt, PetscTruth overwrite, [NumericalProblem](#) inproblem, [NumericalProblem](#) *outproblem, void *gctx, void **ctx, PetscTruth *success)
- static PetscErrorCode [unscale_system](#) (const char *scaling_type, PetscTruth overwrite, void *gctx, void *ctx, [NumericalProblem](#) problem, [NumericalProblem](#) nextproblem, [NumericalSolution](#) scaled, [NumericalSolution](#) unscaled)
- static PetscErrorCode [setup_scaling_choices](#) ()
- static PetscErrorCode [specific_scaling_choices](#) ([NumericalProblem](#) theproblem, [SalsaTransform](#) scaling)
- PetscErrorCode [DeclareScalingPreprocessor](#) (void)

19.17.1 Detailed Description

Definition in file [scaling.c](#).

19.17.2 Define Documentation

19.17.2.1 #define [PREPROCESSOR](#) "scaling"

Definition at line 16 of file [scaling.c](#).

Referenced by [DeclareScalingPreprocessor\(\)](#), and [setup_scaling_choices\(\)](#).

19.17.3 Function Documentation

19.17.3.1 PetscErrorCode DeclareScalingPreprocessor (void)

Definition at line 292 of file scaling.c.

References CHKERRQ(), DeclarePreprocessor(), DeclarePreprocessorIntelligentChoice(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), scale_system(), set_intelligent_scaling(), setup_scaling_choices(), specific_scaling_choices(), and unscale_system().

Referenced by main().

```
19.17.3.2 static PetscErrorCode scale_system ( const char * type, int nopt, PetscTruth
        overwrite, NumericalProblem inproblem, NumericalProblem * outproblem,
        void * gctx, void ** ctx, PetscTruth * success ) [static]
```

Definition at line 67 of file scaling.c.

References CHKERRQ(), ierr, LinearSystemCopy(), LinearSystemDuplicate(), and LinearSystemGetParts().

Referenced by DeclareScalingPreprocessor().

```
19.17.3.3 static PetscErrorCode set_intelligent_scaling ( NumericalProblem theproblem,
        const char ** type, const char ** reason ) [static]
```

Definition at line 21 of file scaling.c.

References CHKERRQ(), ierr, SysProRetrieveQuantity(), and TRUTH.

Referenced by DeclareScalingPreprocessor().

```
19.17.3.4 static PetscErrorCode setup_scaling_choices ( ) [static]
```

This routine is called by [DeclarePreprocessor\(\)](#)

Definition at line 230 of file scaling.c.

References CHKERRQ(), ierr, NewTransformObject(), PREPROCESSOR, SysProDefineIntAnnotation(), TransformGetByName(), TransformObjectIntAnnotate(), and TransformObjectSetExplanation().

Referenced by DeclareScalingPreprocessor().

```
19.17.3.5 static PetscErrorCode specific_scaling_choices ( NumericalProblem theproblem,
        SalsaTransform scaling ) [static]
```

This is the 'specific setup' phase of the scaling preprocessor. See [Usage modes](#) for details.

This routine eliminates unsymmetric scalings if we are dealing with a symmetric system.

Definition at line 265 of file scaling.c.

References `CHKERRQ()`, `ierr`, `SysProRetrieveQuantity()`, `TransformGetObjects()`, `TransformObjectGetIntAnnotation()`, and `TransformObjectMark()`.

Referenced by `DeclareScalingPreprocessor()`.

```
19.17.3.6 static PetscErrorCode unscale_system ( const char * scaling_type,
        PetscTruth overwrite, void * gctx, void * ctx, NumericalProblem
        problem, NumericalProblem nextproblem, NumericalSolution scaled,
        NumericalSolution unscaled ) [static]
```

Definition at line 190 of file scaling.c.

References `CHKERRQ()`, `ierr`, `LinearSolutionCopyStats()`, and `LinearSolutionGetVector()`.

Referenced by `DeclareScalingPreprocessor()`.

19.18 singleton.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "petsc.h"
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "linear_impl.h"
```

Data Structures

- struct [singleton_struct](#)

Defines

- #define [PREPROCESSOR](#) "singleton"

Functions

- static PetscErrorCode [eliminate_singletons](#) (const char *type, int nopt, PetscTruth overwrite, [NumericalProblem](#) inproblem, [NumericalProblem](#) *outproblem, void *gctx, void **ctx, PetscTruth *success)

- static PetscErrorCode [back_singleton](#) (const char *singleton_type, PetscTruth overwrite, void *gctx, void *ctx, [NumericalProblem](#) compactproblem, [NumericalProblem](#) fullproblem, [NumericalSolution](#) compactvector, [NumericalSolution](#) fullvector)
- static PetscErrorCode [setup_singleton_choices](#) ()
- static PetscErrorCode [specific_singleton_choices](#) ([NumericalProblem](#) theproblem, [SalsaTransform](#) singleton)
- static PetscErrorCode [singleton_specific_unset](#) ([NumericalProblem](#) theproblem)
- PetscErrorCode [DeclareSingletonPreprocessor](#) (void)

19.18.1 Detailed Description

Definition in file [singleton.c](#).

19.18.2 Define Documentation

19.18.2.1 #define PREPROCESSOR "singleton"

Definition at line 19 of file singleton.c.

Referenced by [DeclareSingletonPreprocessor\(\)](#), [setup_singleton_choices\(\)](#), and [specific_singleton_choices\(\)](#).

19.18.3 Function Documentation

19.18.3.1 static PetscErrorCode back_singleton (const char * *singleton_type*, PetscTruth *overwrite*, void * *gctx*, void * *ctx*, [NumericalProblem](#) *compactproblem*, [NumericalProblem](#) *fullproblem*, [NumericalSolution](#) *compactvector*, [NumericalSolution](#) *fullvector*) [static]

Definition at line 175 of file singleton.c.

References [CHKERRQ\(\)](#), [singleton_struct::extractor](#), [ierr](#), [LinearSolutionCopyStats\(\)](#), [LinearSolutionGetVector\(\)](#), [LinearSolutionSetVector\(\)](#), [LinearSystemGetParts\(\)](#), and [singleton_struct::t](#).

Referenced by [DeclareSingletonPreprocessor\(\)](#).

19.18.3.2 PetscErrorCode DeclareSingletonPreprocessor (void)

Definition at line 304 of file singleton.c.

References [back_singleton\(\)](#), [CHKERRQ\(\)](#), [DeclarePreprocessor\(\)](#), [eliminate_singletons\(\)](#), [ierr](#), [PREPROCESSOR](#), [PreprocessorSetPreservedCategories\(\)](#), [setup_singleton_choices\(\)](#), [singleton_specific_unset\(\)](#), and [specific_singleton_choices\(\)](#).

19.18.3.3 `static PetscErrorCode eliminate_singletons (const char * type, int nopt, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem * outproblem, void * gctx, void ** ctx, PetscTruth * success) [static]`

Definition at line 24 of file singleton.c.

References CHKERRQ(), singleton_struct::extractor, ierr, LinearSystemDuplicatePointers(), LinearSystemGetContext(), LinearSystemGetParts(), LinearSystemSetContext(), LinearSystemSetParts(), singleton_struct::n, SysProRetrieveQuantity(), and singleton_struct::t.

Referenced by DeclareSingletonPreprocessor().

19.18.3.4 `static PetscErrorCode setup_singleton_choices () [static]`

This routine is only called when the singleton preprocessor is created by [DeclarePreprocessor\(\)](#) inside [DeclareSingletonPreprocessor\(\)](#)

Definition at line 227 of file singleton.c.

References CHKERRQ(), ierr, NewTransformObject(), PREPROCESSOR, TransformGetByName(), and TransformObjectSetExplanation().

Referenced by DeclareSingletonPreprocessor().

19.18.3.5 `static PetscErrorCode singleton_specific_unset (NumericalProblem theproblem) [static]`

Definition at line 291 of file singleton.c.

References CHKERRQ(), ierr, and SysProRemoveQuantity().

Referenced by DeclareSingletonPreprocessor().

19.18.3.6 `static PetscErrorCode specific_singleton_choices (NumericalProblem theproblem, SalsaTransform singleton) [static]`

This is the 'specific setup' phase of the singleton preprocessor. See [Usage modes](#) for details.

It disables either the identity or the elimination routine, to leave only the one applicable to this particular system.

Maybe if we'd ever want to prove how effective singleton elimination is, we could leave identity in place for systems with singletons.

Definition at line 258 of file singleton.c.

References CHKERRQ(), ierr, PREPROCESSOR, SysProComputeQuantity(), TransformObjectGetByName(), and TransformObjectMark().

Referenced by DeclareSingletonPreprocessor().

19.19 **suit.c File Reference**

```
#include <stdlib.h>
#include <stdio.h>
#include "syspro.h"
#include "sysprolinear.h"
#include "linear_impl.h"
#include "sysprosuit.h"
#include "anamod.h"
#include "linksp.h"
#include "petscmat.h"
#include "petscpc.h"
#include "petscksp.h"
```

Functions

- PetscErrorCode [onlyforsymmetricproblem](#) ([NumericalProblem](#) problem, void *ctx, [SuitabilityValue](#) *v)

19.19.1 Function Documentation

19.19.1.1 PetscErrorCode [onlyforsymmetricproblem](#) ([NumericalProblem](#) *problem*, void **ctx*, [SuitabilityValue](#) * *v*)

19.19.2 Suitability functions for the linear problem

Definition at line 18 of file `suit.c`.

References `CHKERRQ()`, and `ierr`.

Referenced by `setup_ksp_choices()`.

19.20 **syspro.h File Reference**

```
#include "petscksp.h"
#include "petscmat.h"
```

Defines

- #define [TRANSFORMCOOKIE](#) 2008
- #define [CHECKVALIDTRANSFORM](#)(x) {if (!(x)) {printf("Null [SalsaTransform](#)"); return 1;} else if ((x)->cookie!=TRANSFORMCOOKIE) {printf("Invalid [SalsaTransform](#)"); return 1;}}
- #define [CHECKVALIDTRANSFORM0](#)(x) {if (!(x)) {printf("Null [SalsaTransform](#)"); return 1;} else if ((x)->cookie!=TRANSFORMCOOKIE) {printf("Invalid [SalsaTransform](#)"); return 1;}}
- #define [TRANSFORMOBJECTCOOKIE](#) 2009
- #define [CHECKVALIDTRANSFORMOBJECT](#)(x) {if (!(x)) {printf("Null TransformObject"); return 1;} else if ((x)->cookie!=TRANSFORMOBJECTCOOKIE) {printf("Invalid TransformObject"); return 1;}}
- #define [TRUTH](#)(x) ((x) ? PETSC_TRUE : PETSC_FALSE)

Typedefs

- typedef struct [SystemPreprocessor_](#) * [SystemPreprocessor](#)
- typedef struct [NumericalProblem_](#) * [NumericalProblem](#)
- typedef struct [NumericalSolution_](#) * [NumericalSolution](#)
- typedef PetscReal [SuitabilityValue](#)
- typedef struct [SalsaTransform_](#) * [SalsaTransform](#)
- typedef struct [SalsaTransformObject_](#) * [SalsaTransformObject](#)

Functions

- PetscErrorCode [SysProInitialize](#) ()
- PetscErrorCode [SysProFinalize](#) ()
- PetscErrorCode [DeclarePreprocessor](#) (const char *name, PetscErrorCode(*global_setup)(), PetscErrorCode(*specific_setup)([NumericalProblem](#), [SalsaTransform](#)), PetscErrorCode(*specific_unset)([NumericalProblem](#)), PetscErrorCode(*global_unset)(), PetscErrorCode(*ctxcreate)([NumericalProblem](#), void **), PetscErrorCode(*ctxdelete)(void **), PetscErrorCode(*start_function)(const char *, int, PetscTruth, [NumericalProblem](#), [NumericalProblem](#) *, void *, void **, PetscTruth *), PetscErrorCode(*end_function)(const char *, PetscTruth, void *, void *, [NumericalProblem](#), [NumericalProblem](#), [NumericalSolution](#), [NumericalSolution](#)))
- PetscErrorCode [DeclarePreprocessorIntelligentChoice](#) (const char *name, PetscErrorCode(*picker)([NumericalProblem](#), const char **, const char **))
- PetscErrorCode [PreprocessorsOptionsHandling](#) ()
- PetscErrorCode [SysProDeclareFunctions](#) (PetscErrorCode(*classstaticsetup)(const char *), PetscErrorCode(*classdynamicsetup)(const char *, [NumericalProblem](#)), PetscErrorCode(*classproblemcloner)(const char *, const char *, int, [NumericalProblem](#), [NumericalProblem](#)), PetscErrorCode(*solver)([NumericalProblem](#), void

- * [NumericalSolution](#) *), PetscErrorCode(*problemdelete)([NumericalProblem](#)), PetscErrorCode(*solutioncreator)([NumericalSolution](#) *), PetscErrorCode(*solutioncopy)([NumericalSolution](#), [NumericalSolution](#)), PetscErrorCode(*solutiondelete)([NumericalSolution](#)), PetscErrorCode(*ctxcloner)(const char *, const char *, void *, void **), PetscErrorCode(*ctxfree)(void *), PetscErrorCode(*solutioncontextdelete)([NumericalSolution](#) *), PetscErrorCode(*)
- PetscErrorCode [ProcessPreprocessorOptions](#) (char *processor, void *ctx)
- PetscErrorCode [PreprocessorGetIndex](#) (const char *, int *)
- PetscErrorCode [SystemPreprocessorGetByName](#) (const char *, [SystemPreprocessor](#) *)
- PetscErrorCode [PreprocessorGetSetting](#) (const char *, const char **, int *)
- PetscErrorCode [RetrievePreprocessorChoice](#) (int, const char **, int *)
- PetscErrorCode [GetFirstPreprocessor](#) (const char **preprocess)
- PetscErrorCode [GetNextPreprocessor](#) (const char **next_one)
- PetscErrorCode [SuccessorPreprocessor](#) (const char *, const char **)
- PetscErrorCode [InitRetrievingPreprocessors](#) ()
- PetscErrorCode [StartRetrievingCurrentPreprocessors](#) (const char **, const char **, int *, PetscTruth *)
- PetscErrorCode [ContinueRetrievingCurrentPreprocessors](#) (const char **, const char **, int *, PetscTruth *)
- PetscErrorCode [StartRetrievingAllPreprocessors](#) (const char **, const char ***, int *, PetscTruth *)
- PetscErrorCode [ContinueRetrievingAllPreprocessors](#) (const char **, const char ***, int *, PetscTruth *)
- PetscErrorCode [RetrieveAllPreprocessorValues](#) (const char *, const char ***, int *)
- PetscErrorCode [SysProShowOptions](#) (MPI_Comm comm)
- PetscErrorCode [RegisterPreprocessorContext](#) (const char *, void *ctx)
- PetscErrorCode [PreprocessorGetContext](#) (const char *, void **ctx)
- PetscErrorCode [PreprocessedSolution](#) (const char *, [NumericalProblem](#), void *, [NumericalSolution](#) *)
- PetscErrorCode [PreprocessedProblemSolving](#) ([NumericalProblem](#), [NumericalSolution](#) *)
- PetscErrorCode [PreprocessorSetPreservedCategories](#) (const char *, const char *)
- PetscErrorCode [PreprocessorGetPreservedCategories](#) (const char *, const char **)
- PetscErrorCode [SysProComputeQuantity](#) ([NumericalProblem](#), const char *, const char *, void *, int *, PetscTruth *)
- PetscErrorCode [SysProRetrieveQuantity](#) ([NumericalProblem](#), const char *, const char *, void *, int *, PetscTruth *)
- PetscErrorCode [SysProRemoveQuantity](#) ([NumericalProblem](#), const char *, const char *, PetscTruth *)
- PetscErrorCode [SysProFreeQuantities](#) ([NumericalProblem](#))
- PetscErrorCode [SysProDefaultTrace](#) (void *, const char *, va_list)

- PetscErrorCode [SysProDeclareTraceFunction](#) (PetscErrorCode(*fn)(void *, const char *, va_list))
- PetscErrorCode [SysProDeclareTraceContext](#) (void *ctx)
- PetscErrorCode [SysProTraceMessage](#) (const char *fmt,...)
- PetscErrorCode [SysProHasTrace](#) (PetscTruth *flg)
- PetscErrorCode [SysProDeclareProblemMonitor](#) (PetscErrorCode*)(NumericalProblem))
- PetscErrorCode [SysProDeclareErrorTracer](#) (PetscErrorCode*)(NumericalProblem, NumericalSolution, const char *)
- PetscErrorCode [SysProGetErrorTracer](#) (PetscErrorCode*)(NumericalProblem, NumericalSolution, const char *)
- PetscErrorCode [TabReportAllPreprocessors](#) (const char **key, int)
- PetscErrorCode [TabReportActivePreprocessors](#) (const char **key, const char **val, int)
- PetscErrorCode [ReportEnabledPreprocessors](#) (const char *)
- PetscErrorCode [ReportSysProCallStackState](#) (const char *)
- PetscErrorCode [ScreenOutputTab](#) (const char *, const char *)
- PetscErrorCode [ScreenOutputTabLine](#) (const char *, const char *)
- PetscErrorCode [NumericalProblemGetComm](#) (NumericalProblem, MPI_Comm *)
- PetscErrorCode [TestSuitabilityContext](#) (SalsaTransform, void *)

19.20.1 Define Documentation

19.20.1.1 **#define CHECKVALIDTRANSFORM(x)** { if (!x) { printf("Null SalsaTransform"); return 1;} else if ((x)->cookie!=TRANSFORMCOOKIE) { printf("Invalid SalsaTransform"); return 1;}; }

Definition at line 8 of file syspro.h.

Referenced by [DeregisterTransform\(\)](#), [SetSuitabilityContextTester\(\)](#), [TransformCharAnnotationGetIndex\(\)](#), [TransformGetName\(\)](#), [TransformGetNextUnmarkedItem\(\)](#), [TransformGetNUnmarked\(\)](#), [TransformGetObjects\(\)](#), [TransformGetUserChoices\(\)](#), [TransformIntAnnotationGetIndex\(\)](#), [TransformItemDescribeLong\(\)](#), [TransformItemOptionMark\(\)](#), [TransformObjectsGetNames\(\)](#), [TransformObjectsMarkAll\(\)](#), [TransformObjectsUnmarkAll\(\)](#), [TransformObjectsUseOnly\(\)](#), and [TransformSetUserChoices\(\)](#).

19.20.1.2 **#define CHECKVALIDTRANSFORM0(x)** { if (!x) { printf("Null SalsaTransform"); return 1;} else if ((x)->cookie!=TRANSFORMCOOKIE) { printf("Invalid SalsaTransform"); return 1;}; }

Definition at line 10 of file syspro.h.

Referenced by [TestSuitabilityContext\(\)](#).


```
19.20.1.3 #define CHECKVALIDTRANSFORMOBJECT( x ) { if (!(x)) { printf("Null
TransformObject"); return 1;} else if ((x)->cookie!=TRANSFORMOBJECTCOOKIE)
{ printf("Invalid TransformObject"); return 1;} }
```

Definition at line 12 of file syspro.h.

Referenced by FreeTransformObject(), PreprocessorSaveAprioriSelection(), TransformGetNextUnmarkedItem(), TransformItemOptionsUseOnly(), TransformObjectAddOption(), TransformObjectAddOptionExplanation(), TransformObjectCharAnnotate(), TransformObjectDefineOption(), TransformObjectGetByName(), TransformObjectGetIntAnnotation(), TransformObjectGetMark(), TransformObjectGetName(), TransformObjectGetSuitabilityFunction(), TransformObjectGetTransformName(), TransformObjectIntAnnotate(), TransformObjectMark(), TransformObjectSetExplanation(), TransformObjectSetSuitabilityFunction(), TransformObjectsMarkAll(), TransformObjectsUnmarkAll(), and TransformObjectUnmark().

```
19.20.1.4 #define TRANSFORMCOOKIE 2008
```

Definition at line 7 of file syspro.h.

Referenced by NewTransform().

```
19.20.1.5 #define TRANSFORMOBJECTCOOKIE 2009
```

Definition at line 11 of file syspro.h.

Referenced by NewTransformObject().

```
19.20.1.6 #define TRUTH( x ) ( (x) ? PETSC_TRUE : PETSC_FALSE )
```

Definition at line 13 of file syspro.h.

Referenced by is_gmres_method(), PreprocessedSolution(), PreprocessorsOptionsHandling(), set_intelligent_scaling(), setup_pc(), TransformGetNextUnmarkedItem(), and TransformObjectGetIntAnnotation().

19.20.2 Typedef Documentation

```
19.20.2.1 typedef struct NumericalProblem_* NumericalProblem
```

Definition at line 20 of file syspro.h.

```
19.20.2.2 typedef struct NumericalSolution_* NumericalSolution
```

Definition at line 21 of file syspro.h.

19.20.2.3 typedef struct SalsaTransform_* SalsaTransform

Definition at line 24 of file syspro.h.

19.20.2.4 typedef struct SalsaTransformObject_* SalsaTransformObject

Definition at line 25 of file syspro.h.

19.20.2.5 typedef PetscReal SuitabilityValue

Definition at line 22 of file syspro.h.

19.20.2.6 typedef struct SystemPreprocessor_* SystemPreprocessor

Definition at line 19 of file syspro.h.

19.20.3 Function Documentation**19.20.3.1 PetscErrorCode ContinueRetrievingAllPreprocessors (const char ** *cclass*, const char *** *types*, int * *ntypes*, PetscTruth * *success*)**

This routine is to be used repeatedly after an initial call to [StartRetrievingAllPreprocessors\(\)](#).

The *types* argument is allocated internally and should be deallocated by the user.

Definition at line 186 of file reporting.c.

References [CHKERRQ\(\)](#), [ierr](#), [SalsaTransform_::n_objects](#), [SystemPreprocessor_::name](#), [npreprocess](#), [preprocessreadout](#), [SystemPreprocessor_::transform](#), and [TransformObjectsGetNames\(\)](#).

Referenced by [RetrieveAllPreprocessorValues\(\)](#), [StartRetrievingAllPreprocessors\(\)](#), [SysProShowOptions\(\)](#), and [TabReportPreprocessors\(\)](#).

19.20.3.2 PetscErrorCode ContinueRetrievingCurrentPreprocessors (const char ** *cclass*, const char ** *atype*, int * *opt*, PetscTruth * *success*)

This routine is to be used repeatedly after an initial call to [StartRetrievingCurrentPreprocessors\(\)](#).

Definition at line 125 of file reporting.c.

References [CHKERRQ\(\)](#), [ierr](#), [SystemPreprocessor_::name](#), [preprocesslevel](#), [preprocessreadout](#), and [RetrievePreprocessorChoice\(\)](#).

Referenced by [StartRetrievingCurrentPreprocessors\(\)](#), and [TabReportPreprocessors\(\)](#).

19.20.3.3 PetscErrorCode DeclarePreprocessor (const char * name, PetscErrorCode(*)() *this_preprocessor_setup*, PetscErrorCode(*) (NumericalProblem, SalsaTransform) *specific_setup*, PetscErrorCode(*) (NumericalProblem) *specific_unset*, PetscErrorCode(*)() *global_unset*, PetscErrorCode(*) (NumericalProblem, void **) *ctxcreate*, PetscErrorCode(*) (void *) *ctxdelete*, PetscErrorCode(*) (const char *, int, PetscTruth, NumericalProblem, NumericalProblem *, void *, void **, PetscTruth *) *start_function*, PetscErrorCode(*) (const char *, PetscTruth, void *, void *, NumericalProblem, NumericalProblem, NumericalSolution, NumericalSolution) *end_function*)

Declare a preprocessor class, by specifying its various members.

The name argument should not contain the colon character.

Here is an explanation of the various function arguments.

this_preprocessor_setup () : this routine is called only once, inside this function. This is a good place for defining all the preprocessors in this class

specific_setup (NumericalProblem, SalsaTransform) : this is called at the start of a preprocessing stage; one could use this for computing matrix metadata.

global_unset (void) : this is called in [SysProFinalize\(\)](#).

ctx_create (NumericalProblem, void**) : create an object that can be used for the duration of the application of this preprocessor

ctxdelete (void*) : delete the context again

start_function : this is the function that performs the forward transform of the problem. Prototype:

```
PetscErrorCode start_function
(char                *classmember,
 int                optionvalue,
 PetscTruth         overwrite,
 NumericalProblem   problem,
 NumericalProblem   *transformedproblem,
 void               *globalcontext,
 void               **localcontext,
 PetscTruth         *success)
```

end_function : this is the backtransform. Its main task is copying or backtransforming the preprocessed solution to the original solution.

```
PetscErrorCode end_function
(char                *classmember,
 PetscTruth         overwrite,
 void               *globalcontext,
 void               *localcontext,
 NumericalProblem   pproblem,
 NumericalProblem   oproblem,
 NumericalSolution  psolution,
 NumericalSolution  osolution)
```

where `pproblem` and `psolution` are the preprocessed quantities, the end function has to unprocess them and leave the result in `oproblem`, `osolution`. Actually, `oproblem` is only for reference.

Definition at line 328 of file `preprocess.c`.

References `CHKERRQ()`, `PreprocessorsGlobalInfo_::classstaticsetup`, `SystemPreprocessor_::ctxcreate`, `SystemPreprocessor_::ctxdelete`, `SystemPreprocessor_::end_function`, `SystemPreprocessor_::exhaustive`, `ierr`, `SystemPreprocessor_::name`, `NewTransform()`, `NPREPROCESS`, `npreprocess`, `SystemPreprocessor_::setup`, `SystemPreprocessor_::start_function`, `SystemPreprocessor_::transform`, `SystemPreprocessor_::unset`, and `unsetpreprocessor`.

Referenced by `DeclareApproximationPreprocessor()`, `DeclareDistributionPreprocessor()`, `DeclareFlipsignPreprocessor()`, `DeclareKSPPPreprocessor()`, `DeclarePCPreprocessor()`, `DeclareScalingPreprocessor()`, `DeclareSingletonPreprocessor()`, and `main()`.

19.20.3.4 PetscErrorCode DeclarePreprocessorIntelligentChoice (const char * *name*, PetscErrorCode(*)*(NumericalProblem, const char **, const char **)* *picker*)

Install a function to pick the optimal choice for a preprocessor

Definition at line 412 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessor_::intelligence`, and `SystemPreprocessorGetByName()`.

Referenced by `DeclareScalingPreprocessor()`.

19.20.3.5 PetscErrorCode GetFirstPreprocessor (const char ** *preprocess*)

Get the name of the first declared preprocessor (in order of declaration) or null if none have been declared. Subsequent preprocessors can be retrieved with [GetNextPreprocessor\(\)](#) or [SuccessorPreprocessor\(\)](#).

Definition at line 45 of file `reporting.c`.

References `CHKERRQ()`, `GetNextPreprocessor()`, `ierr`, and `preprocessreadout`.

Referenced by `PreprocessedProblemSolving()`, and `PreprocessorsOptionsHandling()`.

19.20.3.6 PetscErrorCode GetNextPreprocessor (const char ** *next_one*)

Get the next preprocessor according to the variable `preprocessreadout`.

The result is null if there are no further preprocessors.

Definition at line 61 of file `reporting.c`.

References `SystemPreprocessor_::name`, `npreprocess`, and `preprocessreadout`.

Referenced by `GetFirstPreprocessor()`, and `PreprocessorsOptionsHandling()`.

19.20.3.7 PetscErrorCode InitRetrievingPreprocessors ()

Definition at line 169 of file reporting.c.

References preprocessreadout.

Referenced by TabReportPreprocessors().

19.20.3.8 PetscErrorCode NumericalProblemGetComm (NumericalProblem , MPI_Comm *)

Definition at line 424 of file preprocess.c.

References NumericalProblem_::comm.

Referenced by create_solver().

19.20.3.9 PetscErrorCode PreprocessedProblemSolving (NumericalProblem *problem*, NumericalSolution * *solution*)

Invoking this routine starts the preprocessing and ultimate solution of the numerical problem.

Definition at line 1028 of file preprocess.c.

References CHKERRQ(), PreprocessorsGlobalInfo_::errortracer, GetFirstPreprocessor(), ierr, PreprocessedSolution(), preprocesslevel, and PreprocessorsGlobalInfo_::problemsolver.

Referenced by main(), and PreprocessedLinearSystemSolution().

19.20.3.10 PetscErrorCode PreprocessedSolution (const char * *pclassname*, NumericalProblem *problem*, void * *prevctx*, NumericalSolution * *rsolution*)

This routine handles the application of one preprocessor. Depending on the runtime setup (see section [Usage modes](#)), one choice is applied, or a sequence of choices is applied consecutively. The forward and backward transformation of the preprocessor are done here, and if necessary, backup copies of the system are kept around.

Definition at line 875 of file preprocess.c.

References CHKERRQ(), ChooseFirstTransform(), PreprocessorsGlobalInfo_::classdynamicsetup, SystemPreprocessor_::ctxcreate, SystemPreprocessor_::ctxdelete, PreprocessorsGlobalInfo_::errortracer, SystemPreprocessor_::exhaustive, ierr, PreprocessedSolution(), preprocesslevel, PreprocessorSpecificSetup(), PreprocessorsGlobalInfo_::problemsolver, RegisterPreprocessorContext(), RegisterPreprocessorSetting(), ReportSysProCallStackState(), PreprocessorsGlobalInfo_::solutioncontextdelete, PreprocessorsGlobalInfo_::solutiondelete, SuccessorPreprocessor(), SysProPreprocessorEndFunction(), SysproPreprocessorStartFunction(), SysProProblemCloneContext(), SysProTraceMessage(), SystemPreprocessorGetByName(), SystemPreprocessor_::transform, TransformGetNextUnmarkedItem(), TransformGetUserChoices(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformObjectGetName(), TRUTH, and SystemPreprocessor_::unset.

Referenced by `PreprocessedProblemSolving()`, and `PreprocessedSolution()`.

19.20.3.11 `PetscErrorCode PreprocessorGetContext (const char *, void ** ctx)`

Definition at line 681 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, `preprocessorcontexts`, `PreprocessorGetIndex()`, and `solutioncontext`.

Referenced by `setup_ksp()`, and `setup_pc()`.

19.20.3.12 `PetscErrorCode PreprocessorGetIndex (const char *, int *)`

Definition at line 591 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, and `npreprocess`.

Referenced by `PreprocessorGetContext()`, `RegisterPreprocessorContext()`, and `SystemPreprocessorGetByName()`.

19.20.3.13 `PetscErrorCode PreprocessorGetPreservedCategories (const char *, const char **)`

Definition at line 55 of file `compute.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessor_::preserved`, and `SystemPreprocessorGetByName()`.

19.20.3.14 `PetscErrorCode PreprocessorGetSetting (const char *, const char **, int *)`

Definition at line 559 of file `preprocess.c`.

References `currentchoices`, `currentoptions`, `currentpreprocessors`, and `preprocesslevel`.

Referenced by `disable_ksp()`.

19.20.3.15 `PetscErrorCode PreprocessorSetPreservedCategories (const char *, const char *)`

Definition at line 33 of file `compute.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessor_::preserved`, and `SystemPreprocessorGetByName()`.

Referenced by `DeclareApproximationPreprocessor()`, `DeclareDistributionPreprocessor()`, `DeclareFlipsignPreprocessor()`, `DeclareKSPPreprocessor()`, `DeclarePCPreprocessor()`, `DeclareScalingPreprocessor()`, and `DeclareSingletonPreprocessor()`.

19.20.3.16 `PetscErrorCode PreprocessorsOptionsHandling ()`

Process commandline options that control the behaviour of SysPro. For more information see [Command line options handling](#).

Definition at line 72 of file options.c.

References CHKERRQ(), SystemPreprocessor_::exhaustive, GetFirstPreprocessor(), GetNextPreprocessor(), ierr, SystemPreprocessor_::optionshandling, PreprocessorSaveA prioriSelection(), ReportEnabledPreprocessors(), SystemPreprocessorGetByName(), TransformGetByName(), TransformGetNextUnmarkedItem(), TransformGetNUnmarked(), TransformItemOptionsUseOnly(), TransformObjectGetName(), TransformObjectsUseOnly(), TransformSetUserChoices(), TRUTH, and TYPELEN.

Referenced by main().

19.20.3.17 PetscErrorCode ProcessPreprocessorOptions (char * processor, void * ctx)

19.20.3.18 PetscErrorCode RegisterPreprocessorContext (const char * , void * ctx)

Definition at line 659 of file preprocess.c.

References CHKERRQ(), ierr, preprocessorcontexts, PreprocessorGetIndex(), and solutioncontext.

Referenced by PreprocessedLinearSystemSolution(), and PreprocessedSolution().

19.20.3.19 PetscErrorCode ReportEnabledPreprocessors (const char * name)

Report preprocessor choices that are available after the specific setup has possible disabled some of the registered ones. This function uses the `sysprotrace` function, so this has to have been declared.

Definition at line 394 of file reporting.c.

References CHKERRQ(), ierr, SysProHasTrace(), SysProTraceMessage(), TransformGetByName(), and TransformReportEnabled().

Referenced by PreprocessorsOptionsHandling(), and PreprocessorSpecificSetup().

19.20.3.20 PetscErrorCode ReportSysProCallStackState (const char * name)

Report preprocessor choices that are available after the specific setup has possible disabled some of the registered ones. This function uses the `sysprotrace` function, so this has to have been declared.

Definition at line 418 of file reporting.c.

References CHKERRQ(), ierr, ScreenOutputTabLine(), SysProHasTrace(), SysProTraceMessage(), and TabReportPreprocessors().

Referenced by PreprocessedSolution().

19.20.3.21 PetscErrorCode RetrieveAllPreprocessorValues (const char * , const char ** , int *)

Definition at line 210 of file reporting.c.

References CHKERRQ(), ContinueRetrievingAllPreprocessors(), ierr, npreprocess, and preprocessreadout.

Referenced by pcoptionshandling().

19.20.3.22 PetscErrorCode RetrievePreprocessorChoice (int , const char **, int *)

Definition at line 579 of file preprocess.c.

References currentchoices, and currentoptions.

Referenced by ContinueRetrievingCurrentPreprocessors().

19.20.3.23 PetscErrorCode ScreenOutputTab (const char * , const char *)

Definition at line 320 of file reporting.c.

References CHKERRQ(), ierr, SysProHasTrace(), and SysProTraceMessage().

19.20.3.24 PetscErrorCode ScreenOutputTabLine (const char * , const char *)

Definition at line 347 of file reporting.c.

References CHKERRQ(), ierr, MAXLEN, SysProHasTrace(), and SysProTraceMessage().

Referenced by ReportSysProCallStackState().

19.20.3.25 PetscErrorCode StartRetrievingAllPreprocessors (const char ** *cclass*, const char *** *types*, int * *ntypes*, PetscTruth * *success*)

This routine gives the class of the first declared preprocessor, and all possible values. To get the next preprocessor, call [ContinueRetrievingAllPreprocessors\(\)](#).

The class, types, and ntypes arguments can all be null.

The `types` argument is allocated internally and should be deallocated by the user.

Definition at line 157 of file reporting.c.

References CHKERRQ(), ContinueRetrievingAllPreprocessors(), ierr, and preprocess-readout.

Referenced by SysProShowOptions().

19.20.3.26 PetscErrorCode StartRetrievingCurrentPreprocessors (const char ** *cclass*, const char ** *type*, int * *opt*, PetscTruth * *success*)

This routine gives the class and current value of the first declared preprocessor. To get the next preprocessor, call [ContinueRetrievingAllPreprocessors\(\)](#).

The class, types, and ntypes arguments can all be null.

Definition at line 108 of file reporting.c.

References CHKERRQ(), ContinueRetrievingCurrentPreprocessors(), ierr, and preprocessreadout.

19.20.3.27 `PetscErrorCode SuccessorPreprocessor (const char * this_one, const char ** next_one)`

Given a preprocessor, get the name of the next one (in order of declaration) or null if there are no further ones.

The arguments are allowed to be the same.

Definition at line 78 of file reporting.c.

References CHKERRQ(), ierr, SystemPreprocessor_::name, and npreprocess.

Referenced by PreprocessedSolution().

19.20.3.28 `PetscErrorCode SysProComputeQuantity (NumericalProblem theproblem, const char * cat, const char * cmp, void * res, int * reslen, PetscTruth * flg)`

anamod SysPro-AnaMod interface

The SysPro linear package has a few routines to facilitate integration with AnaMod

- `SysProComputeQuantity()` : to compute a quantity using AnaMod and store it as the metadata of a linear system
- `SysProRetrieveQuantity()` : to get an already computed quantity
- `SysProFreeQuantities()` : to destroy the metadata object
- `SysProRemoveQuantity()` : to invalidate/free selected quantities

This routine is used in SysPro to compute quantities. See also `SysProRetrieveQuantity()`.

Definition at line 23 of file syspro_anamod.c.

References CHKERRQ(), ierr, LinearSystemGetMetadata(), and LinearSystemGetParts().

Referenced by flipsign(), MatSymmetricPart(), sans_partition(), specific_flipsign_choices(), and specific_singleton_choices().

19.20.3.29 `PetscErrorCode SysProDeclareErrorTracer (PetscErrorCode(*) (NumericalProblem, NumericalSolution, const char *))`

Definition at line 391 of file preprocess.c.

References PreprocessorsGlobalInfo_::errortracer.

```

19.20.3.30 PetscErrorCode SysProDeclareFunctions ( PetscErrorCode (*)(const char *)
    classstaticsetup, PetscErrorCode (*)(const char *, NumericalProblem)
    classdynamicsetup, PetscErrorCode (*)(const char *, const char *,
    int, NumericalProblem, NumericalProblem) classproblemcloner,
    PetscErrorCode (*)(NumericalProblem, void *, NumericalSolution *)
    problemsolver, PetscErrorCode (*)(NumericalProblem) problemdelete,
    PetscErrorCode (*)(NumericalProblem, NumericalSolution *) solutioncreator,
    PetscErrorCode (*)(NumericalSolution, NumericalSolution) solutioncopy,
    PetscErrorCode (*)(NumericalSolution) solutiondelete, PetscErrorCode (*)(const
    char *, const char *, void *, void **) ctxcloner, PetscErrorCode (*)(void *) ctxfree,
    PetscErrorCode (*)(NumericalSolution) solutioncontextdelete )

```

Install various functions

- `classstaticsetup` : this function is called on each processor as it is being created; see [DeclarePreprocessor\(\)](#).
- `classdynamicsetup` : this function is called as any invocation of a preprocessor starts; see [PreprocessedSolution\(\)](#);
- `classproblemcloner` : a function to clone the context : optional see [Tracing the preprocessors](#) for more details.
- `problemsolver` : the ultimate problem solver : required
- `problemdelete` : delete a problem object
- `solutioncreator` : creates a solution object; optional, but required a preprocessor has an endfunction.
- `solutioncopy` : guess what this does; optional
- `solutiondelete` : optional, but needed if `solutioncopy` is used
- `contextcloner` : problems can carry a context; this clones the context if a problem is copied; otherwise the pointer is simply duplicated
- `contextfree` : used to delete cloned contexts
- `solutioncontextdelete` : hm.

Definition at line 453 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::classdynamicsetup`, `PreprocessorsGlobalInfo_::classproblemcloner`, `PreprocessorsGlobalInfo_::classstaticsetup`, `PreprocessorsGlobalInfo_::clonecontext`, `PreprocessorsGlobalInfo_::freecontext`, `PreprocessorsGlobalInfo_::problemdelete`, `PreprocessorsGlobalInfo_::problemsolver`, `PreprocessorsGlobalInfo_::solutioncontextdelete`, `PreprocessorsGlobalInfo_::solutioncopy`, `PreprocessorsGlobalInfo_::solutioncreator`, and `PreprocessorsGlobalInfo_::solutiondelete`.

Referenced by `main()`.

19.20.3.31 `PetscErrorCode SysProDeclareProblemMonitor (PetscErrorCode*)(NumericalProblem))`

Definition at line 381 of file preprocess.c.

References `PreprocessorsGlobalInfo_::problemmonitor`.

19.20.3.32 `PetscErrorCode SysProDeclareTraceContext (void * ctx)`

Definition at line 77 of file tracing.c.

References `sysprotracectx`.

19.20.3.33 `PetscErrorCode SysProDeclareTraceFunction (PetscErrorCode*)(void *, const char *, va_list) fn)`

Specify a trace function.

The trace function has a prototype

```
PetscErrorCode tracefunction(void*,char*,va_list)
```

which means that it has an arbitrary number of arguments, much like `printf`. The first argument is a context, which can be set by [SysProDeclareTraceContext\(\)](#).

Here is an example of how you would write a trace function:

```
#include <stdarg.h>
PetscErrorCode tracefunction(void *ctx,char *fmt,va_list argp)
{
    char *prefix = (char*)ctx;
    PetscFunctionBegin;
    printf("%s ",prefix);
    vprintf(fmt, argp);
    PetscFunctionReturn(0);
}
```

Consult `string.h` (probably in `/usr/include`) to see which "v" versions of `printf` are available.

There is a default trace function [SysProDefaultTrace\(\)](#).

You can undeclare a trace function by passing `NULL`.

See also [SysProTraceMessage\(\)](#).

Definition at line 64 of file tracing.c.

References `sysprotrace`.

Referenced by `main()`.

19.20.3.34 `PetscErrorCode SysProDefaultTrace (void *, const char *, va_list)`

Definition at line 22 of file tracing.c.

Referenced by `main()`.

19.20.3.35 `PetscErrorCode SysProFinalize ()`

Definition at line 245 of file `preprocess.c`.

References `CHKERRQ()`, `currentchoices`, `currentoptions`, `currentpreprocessors`, `DeregisterTransform()`, `ierr`, `SystemPreprocessor_::name`, `npreprocess`, `preprocessorcontexts`, `SystemPreprocessor_::preserved`, `SystemPreprocessor_::transform`, and `unsetpreprocessor`.

Referenced by `main()`.

19.20.3.36 `PetscErrorCode SysProFreeQuantities (NumericalProblem)`

Definition at line 96 of file `syspro_anamod.c`.

References `CHKERRQ()`, `ierr`, and `LinearSystemGetMetadata()`.

19.20.3.37 `PetscErrorCode SysProGetErrorTracer (PetscErrorCode(*) (NumericalProblem, NumericalSolution, const char *))`

Definition at line 401 of file `preprocess.c`.

References `PreprocessorsGlobalInfo_::errortracer`.

19.20.3.38 `PetscErrorCode SysProHasTrace (PetscTruth * flg)`

Test whether a trace function has been declared; see [SysProDeclareTraceFunction\(\)](#). Normally you would use [SysProTraceMessage\(\)](#) which performs this test internally, but this function can be useful if a large amount of processing has to be performed to construct the trace message to begin with.

Definition at line 109 of file `tracing.c`.

References `sysprotrace`.

Referenced by `ReportEnabledPreprocessors()`, `ReportSysProCallStackState()`, `ScreenOutputTab()`, and `ScreenOutputTabLine()`.

19.20.3.39 `PetscErrorCode SysProInitialize ()`

Allocate SysPro globals. See also [SysProFinalize\(\)](#).

Definition at line 220 of file `preprocess.c`.

References `CHKERRQ()`, `CreateGlobalInfo()`, `currentchoices`, `currentoptions`, `currentpreprocessors`, `ierr`, `NPREPROCESS`, `preprocessorcontexts`, and `unsetpreprocessor`.

Referenced by `main()`.

19.20.3.40 `PetscErrorCode SysProRemoveQuantity (NumericalProblem theproblem, const char * cat, const char * cmp, PetscTruth * flg)`

This routine is used to invalidate and free computed quantities. See also [SysProRetrieveQuantity\(\)](#), [SysProComputeQuantity\(\)](#).

Definition at line 80 of file `syspro_anamod.c`.

References `CHKERRQ()`, `ierr`, and `LinearSystemGetMetadata()`.

Referenced by `singleton_specific_unset()`.

19.20.3.41 `PetscErrorCode SysProRetrieveQuantity (NumericalProblem theproblem, const char * cat, const char * cmp, void * res, int * reslen, PetscTruth * flg)`

This routine is used in SysPro to retrieve already computed quantities. Reports failure if the quantity has not already been computed. See also [SysProComputeQuantity\(\)](#).

Definition at line 52 of file `syspro_anamod.c`.

References `CHKERRQ()`, `ierr`, and `LinearSystemGetParts()`.

Referenced by `disable_pcs()`, `eliminate_singletons()`, `MatSymmetricPart()`, `set_intelligent_scaling()`, `specific_approximation_choices()`, and `specific_scaling_choices()`.

19.20.3.42 `PetscErrorCode SysProShowOptions (MPI.Comm comm)`

Display all available options.

Definition at line 45 of file `options.c`.

References `CHKERRQ()`, `ContinueRetrievingAllPreprocessors()`, `ierr`, and `StartRetrievingAllPreprocessors()`.

19.20.3.43 `PetscErrorCode SysProTraceMessage (const char * fmt, ...)`

This function prints a trace message if a trace function has been declared; see [SysProDeclareTraceFunction\(\)](#).

Definition at line 89 of file `tracing.c`.

References `CHKERRQ()`, `ierr`, `sysprotrace`, and `sysprotracectx`.

Referenced by `adder()`, `ChooseFirstTransform()`, `PreprocessedSolution()`, `ReportEnabledPreprocessors()`, `ReportSysProCallStackState()`, `ScreenOutputTab()`, `ScreenOutputTabLine()`, and `solvebycopy()`.

19.20.3.44 `PetscErrorCode SystemPreprocessorGetByName (const char * , SystemPreprocessor *)`

Definition at line 612 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, and `PreprocessorGetIndex()`.

Referenced by `DeclarePCPreprocessor()`, `DeclarePreprocessorIntelligentChoice()`, `DeclarePreprocessorRequiredCategories()`, `PreprocessedSolution()`, `PreprocessorGetPreservedCategories()`, `PreprocessorSetPreservedCategories()`, `PreprocessorsOptionsHandling()`, `PreprocessorSpecificSetup()`, and `TransformGetByName()`.

19.20.3.45 `PetscErrorCode TabReportActivePreprocessors (const char ** key, const char ** val, int)`

Definition at line 309 of file `reporting.c`.

References `CHKERRQ()`, `ierr`, and `TabReportPreprocessors()`.

19.20.3.46 `PetscErrorCode TabReportAllPreprocessors (const char ** key, int)`

Definition at line 295 of file `reporting.c`.

References `CHKERRQ()`, `ierr`, and `TabReportPreprocessors()`.

19.20.3.47 `PetscErrorCode TestSuitabilityContext (SalsaTransform , void *)`

Definition at line 894 of file `transform.c`.

References `CHECKVALIDTRANSFORM0`, `CHKERRQ()`, `ierr`, and `SalsaTransform_::suitabilityctxtester`.

Referenced by `PreprocessorSpecificSetup()`, and `SalsaTransformIntegrityTest()`.

19.21 syspro_anamod.c File Reference

```
#include <stdlib.h>
#include "anamod.h"
#include "syspro.h"
#include "sysprolinear.h"
```

Functions

- `PetscErrorCode SysProComputeQuantity (NumericalProblem theproblem, const char *cat, const char *cmp, void *res, int *reslen, PetscTruth *flg)`
- `PetscErrorCode SysProRetrieveQuantity (NumericalProblem theproblem, const char *cat, const char *cmp, void *res, int *reslen, PetscTruth *flg)`
- `PetscErrorCode SysProRemoveQuantity (NumericalProblem theproblem, const char *cat, const char *cmp, PetscTruth *flg)`
- `PetscErrorCode SysProFreeQuantities (NumericalProblem theproblem)`

19.21.1 Function Documentation

19.21.1.1 **PetscErrorCode SysProComputeQuantity (NumericalProblem *theproblem*, const char * *cat*, const char * *cmp*, void * *res*, int * *reslen*, PetscTruth * *flg*)**

anamod SysPro-AnaMod interface

The SysPro linear package has a few routines to facilitate integration with AnaMod

- [SysProComputeQuantity\(\)](#) : to compute a quantity using AnaMod and store it as the metadata of a linear system
- [SysProRetrieveQuantity\(\)](#) : to get an already computed quantity
- [SysProFreeQuantities\(\)](#) : to destroy the metadata object
- [SysProRemoveQuantity\(\)](#) : to invalidate/free selected quantities

This routine is used in SysPro to compute quantities. See also [SysProRetrieveQuantity\(\)](#).

Definition at line 23 of file syspro_anamod.c.

References [CHKERRQ\(\)](#), [ierr](#), [LinearSystemGetMetadata\(\)](#), and [LinearSystemGetParts\(\)](#).

Referenced by [flipsign\(\)](#), [MatSymmetricPart\(\)](#), [sans_partition\(\)](#), [specific_flipsign_choices\(\)](#), and [specific_singleton_choices\(\)](#).

19.21.1.2 **PetscErrorCode SysProFreeQuantities (NumericalProblem *theproblem*)**

Definition at line 96 of file syspro_anamod.c.

References [CHKERRQ\(\)](#), [ierr](#), and [LinearSystemGetMetadata\(\)](#).

19.21.1.3 **PetscErrorCode SysProRemoveQuantity (NumericalProblem *theproblem*, const char * *cat*, const char * *cmp*, PetscTruth * *flg*)**

This routine is used to invalidate and free computed quantities. See also [SysProRetrieveQuantity\(\)](#), [SysProComputeQuantity\(\)](#).

Definition at line 80 of file syspro_anamod.c.

References [CHKERRQ\(\)](#), [ierr](#), and [LinearSystemGetMetadata\(\)](#).

Referenced by [singleton_specific_unset\(\)](#).

19.21.1.4 **PetscErrorCode SysProRetrieveQuantity (NumericalProblem *theproblem*, const char * *cat*, const char * *cmp*, void * *res*, int * *reslen*, PetscTruth * *flg*)**

This routine is used in SysPro to retrieve already computed quantities. Reports failure if the quantity has not already been computed. See also [SysProComputeQuantity\(\)](#).

Definition at line 52 of file syspro_anamod.c.

References [CHKERRQ\(\)](#), [ierr](#), and [LinearSystemGetParts\(\)](#).

Referenced by `disable_pcs()`, `eliminate_singletons()`, `MatSymmetricPart()`, `set_intelligent_scaling()`, `specific_approximation_choices()`, and `specific_scaling_choices()`.

19.22 syspro_impl.h File Reference

```
#include "petsc.h"
#include "syspro.h"
```

Data Structures

- struct [NumericalProblem_](#)
- struct [SystemPreprocessor_](#)
- struct [SalsaTransform_](#)

Defines

- #define [SYSPROCHECKVALID](#)(i, c, s) {if (!i) SETERRQ1(1,"Null pointer for <%s>",s); if (i->cookie==0) SETERRQ1(1,"Not a valid <%s>; maybe object has already been freed",s); if (i->cookie!=c) SETERRQ1(1,"Not a valid <%s>",s);}
- #define [SYSPROCHECKVALIDa](#)(i, c, s, a) {if (!i) SETERRQ2(1,"Null pointer for <%s>, argument %d",s,a); if (i->cookie==0) SETERRQ2(1,"Not a valid <%s>, argument %d; maybe object has already been freed",s,a); if (i->cookie!=c) SETERRQ2(1,"Not a valid <%s>, argument %d",s,a);}
- #define [NUMERICALPROBLEMHEADER](#) MPI_Comm comm; void *ctx;

19.22.1 Define Documentation

19.22.1.1 #define [NUMERICALPROBLEMHEADER](#) MPI_Comm comm; void *ctx;

Definition at line 10 of file `syspro_impl.h`.

19.22.1.2 #define [SYSPROCHECKVALID](#)(i, c, s) {if (!i) SETERRQ1(1,"Null pointer for <%s>",s); if (i->cookie==0) SETERRQ1(1,"Not a valid <%s>; maybe object has already been freed",s); if (i->cookie!=c) SETERRQ1(1,"Not a valid <%s>",s);}

Definition at line 7 of file `syspro_impl.h`.

19.22.1.3 #define [SYSPROCHECKVALIDa](#)(i, c, s, a) {if (!i) SETERRQ2(1,"Null pointer for <%s>, argument %d",s,a); if (i->cookie==0) SETERRQ2(1,"Not a valid <%s>, argument %d; maybe object has already been freed",s,a); if (i->cookie!=c) SETERRQ2(1,"Not a valid <%s>, argument %d",s,a);}

Definition at line 8 of file `syspro_impl.h`.

19.23 sysprolinear.h File Reference

```
#include "petscmat.h"
#include "petscksp.h"
#include "syspro.h"
#include "nmd.h"
```

Typedefs

- typedef struct [LinearSystem_](#) * [LinearSystem](#)
- typedef struct [LinearSolution_](#) * [LinearSolution](#)
- typedef struct [Diagnostics_](#) * [Diagnostics](#)

Functions

- PetscErrorCode [CreateLinearSystem](#) (MPI_Comm, [LinearSystem](#) *)
- PetscErrorCode [LinearSystemDelete](#) ([LinearSystem](#))
- PetscErrorCode [LinearDeleteNumericalProblem](#) ([NumericalProblem](#))
- PetscErrorCode [LinearSystemSetParts](#) ([LinearSystem](#), Mat, Mat, Vec, Vec, Vec)
- PetscErrorCode [LinearSystemInheritParts](#) ([LinearSystem](#), Mat, Mat, Vec, Vec, Vec)
- PetscErrorCode [LinearSystemGetParts](#) ([LinearSystem](#), Mat *, Mat *, Vec *, Vec *, Vec *)
- PetscErrorCode [LinearSystemGetTmpVector](#) ([LinearSystem](#), Vec *)
- PetscErrorCode [LinearSystemSetContext](#) ([LinearSystem](#), void *ctx)
- PetscErrorCode [LinearSystemGetContext](#) ([LinearSystem](#), void **ctx)
- PetscErrorCode [LinearSystemSetKnownSolution](#) ([LinearSystem](#), PetscTruth)
- PetscErrorCode [LinearSystemGetKnownSolution](#) ([LinearSystem](#), PetscTruth *)
- PetscErrorCode [LinearSystemSetMetadata](#) ([LinearSystem](#), NMD_metadata)
- PetscErrorCode [LinearSystemGetMetadata](#) ([LinearSystem](#), NMD_metadata *)
- PetscErrorCode [LinearSystemDuplicatePointers](#) ([LinearSystem](#), [LinearSystem](#) *)
- PetscErrorCode [LinearSystemDuplicate](#) ([LinearSystem](#), [LinearSystem](#) *)
- PetscErrorCode [LinearSystemCopy](#) ([LinearSystem](#), [LinearSystem](#))
- PetscErrorCode [CreateLinearSolution](#) ([LinearSolution](#) *)
- PetscErrorCode [LinearCreateNumericalSolution](#) ([NumericalProblem](#), [NumericalSolution](#) *)
- PetscErrorCode [LinearSolutionDelete](#) ([LinearSolution](#))
- PetscErrorCode [LinearSolutionCopy](#) ([LinearSolution](#), [LinearSolution](#))
- PetscErrorCode [LinearSolutionCopyStats](#) ([LinearSolution](#), [LinearSolution](#))
- PetscErrorCode [LinearCopyNumericalSolution](#) ([NumericalSolution](#), [NumericalSolution](#))

- PetscErrorCode [LinearDeleteNumericalSolution](#) ([NumericalSolution](#))
- PetscErrorCode [LinearDeleteNumericalSolutionContext](#) ([NumericalSolution](#))
- PetscErrorCode [CreateDefaultLinearSolution](#) ([NumericalProblem](#), [NumericalSolution](#) *)
- PetscErrorCode [LinearSolutionSetVector](#) ([LinearSolution](#), [Vec](#))
- PetscErrorCode [LinearSolutionGetVector](#) ([LinearSolution](#), [Vec](#) *)
- PetscErrorCode [LinearSolutionGetStatistics](#) ([LinearSolution](#), [NMD_metadata](#) *)
- PetscErrorCode [LinearSolutionSetTimes](#) ([LinearSolution](#), [PetscLogDouble](#), [PetscLogDouble](#), [PetscLogDouble](#))
- PetscErrorCode [LinearSolutionAddToPreprocessTime](#) ([LinearSolution](#), [PetscLogDouble](#))
- PetscErrorCode [LinearSolutionGetTimes](#) ([LinearSolution](#), [PetscLogDouble](#) *, [PetscLogDouble](#) *, [PetscLogDouble](#) *)
- PetscErrorCode [LinearSolutionSetContext](#) ([LinearSolution](#), [void *ctx](#))
- PetscErrorCode [LinearSolutionGetContext](#) ([LinearSolution](#), [void **ctx](#))
- PetscErrorCode [LinearSystemTrueDistance](#) ([LinearSystem](#), [LinearSolution](#), [PetscReal](#) *)
- PetscErrorCode [LinearSystemTrueDistancePrint](#) ([NumericalProblem](#), [NumericalSolution](#), [char](#) *)
- PetscErrorCode [LinearSolutionCreateStatistics](#) ([LinearSolution](#) sol)
- PetscErrorCode [PreprocessedLinearSystemSolution](#) ([LinearSystem](#), [LinearSolution](#) *)
- PetscErrorCode [delete_diagnostics](#) ([Diagnostics](#))
- PetscErrorCode [make_diagnostics](#) ([char](#) *, [char](#) *, [Diagnostics](#) *)
- PetscErrorCode [DeclareSingletonPreprocessor](#) ([void](#))
- PetscErrorCode [DeclareFlipsignPreprocessor](#) ([void](#))
- PetscErrorCode [DeclareApproximationPreprocessor](#) ([void](#))
- PetscErrorCode [DeclareDummyRowPreprocessor](#) ([void](#))
- PetscErrorCode [DeclareDistributionPreprocessor](#) ([void](#))
- PetscErrorCode [DeclareScalingPreprocessor](#) ([void](#))
- PetscErrorCode [DeclarePCPreprocessor](#) ([void](#))
- PetscErrorCode [DeclareKSPPreprocessor](#) ([void](#))

19.23.1 Typedef Documentation

19.23.1.1 typedef struct [Diagnostics](#)_* [Diagnostics](#)

Definition at line 11 of file [sysprolinear.h](#).

19.23.1.2 typedef struct [LinearSolution](#)_* [LinearSolution](#)

Definition at line 10 of file [sysprolinear.h](#).

19.23.1.3 typedef struct LinearSystem_* LinearSystem

Definition at line 9 of file sysprolinear.h.

19.23.2 Function Documentation

19.23.2.1 PetscErrorCode CreateDefaultLinearSolution (NumericalProblem , NumericalSolution *)

Definition at line 528 of file linear.c.

References CHKERRQ(), CreateLinearSolution(), ierr, LinearSolutionSetVector(), LinearSystemGetParts(), and SYSPROCHECKVALIDLINSYS.

19.23.2.2 PetscErrorCode CreateLinearSolution (LinearSolution *)

Definition at line 411 of file linear.c.

References CHKERRQ(), LinearSolution_::cookie, ierr, LINSOLCOOKIE, and LinearSolution_::statistics.

Referenced by CreateDefaultLinearSolution(), and LinearCreateNumericalSolution().

19.23.2.3 PetscErrorCode CreateLinearSystem (MPI_Comm comm, LinearSystem * system)

Allocate the structure for a linear system

Definition at line 74 of file linear.c.

References CHKERRQ(), LinearSystem_::cookie, ierr, LINSYSCOOKIE, and LinearSystem_::partsoriginal.

Referenced by LinearSystemDuplicate(), LinearSystemDuplicatePointers(), and main().

19.23.2.4 PetscErrorCode DeclareApproximationPreprocessor (void)

Definition at line 280 of file approximating.c.

References approximate_system(), CHKERRQ(), DeclarePreprocessor(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_approximation_choices(), specific_approximation_choices(), and unapproximate_system().

19.23.2.5 PetscErrorCode DeclareDistributionPreprocessor (void)

Definition at line 298 of file distribution.c.

References CHKERRQ(), DeclarePreprocessor(), distribute_system(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_distribution_choices(), specific_distribution_choices(), and undistribute_system().

19.23.2.6 PetscErrorCode DeclareDummyRowPreprocessor (void)**19.23.2.7 PetscErrorCode DeclareFlipsignPreprocessor (void)**

Definition at line 168 of file flipsign.c.

References back_flipsign(), CHKERRQ(), DeclarePreprocessor(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_flipsign_choices(), and specific_flipsign_choices().

19.23.2.8 PetscErrorCode DeclareKSPPreprocessor (void)

Definition at line 368 of file ksp.c.

References CHKERRQ(), DeclarePreprocessor(), disable_ksp(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_ksp(), setup_ksp_choices(), unset_ksp(), and unset_ksp().

19.23.2.9 PetscErrorCode DeclarePCPreprocessor (void)

Definition at line 392 of file pc.c.

References CHKERRQ(), create_solver(), DeclarePreprocessor(), destroy_solver(), disable_pcs(), ierr, SystemPreprocessor::optionshandling, pcoptionshandling(), PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_pc(), setup_pc_choices(), SystemPreprocessorGetByName(), and unset_pc().

19.23.2.10 PetscErrorCode DeclareScalingPreprocessor (void)

Definition at line 292 of file scaling.c.

References CHKERRQ(), DeclarePreprocessor(), DeclarePreprocessorIntelligentChoice(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), scale_system(), set_intelligent_scaling(), setup_scaling_choices(), specific_scaling_choices(), and unscale_system().

Referenced by main().

19.23.2.11 PetscErrorCode DeclareSingletonPreprocessor (void)

Definition at line 304 of file singleton.c.

References back_singleton(), CHKERRQ(), DeclarePreprocessor(), eliminate_singletons(), ierr, PREPROCESSOR, PreprocessorSetPreservedCategories(), setup_singleton_choices(), singleton_specific_unset(), and specific_singleton_choices().

19.23.2.12 PetscErrorCode delete_diagnostics (Diagnostics)

**19.23.2.13 PetscErrorCode LinearCopyNumericalSolution (NumericalSolution *old*,
NumericalSolution *nnew*)**

This routine is essentially [LinearSolutionCopy\(\)](#), except that it does casts of the arguments so that it can be used as the `solutioncopy` member of [SysProDeclareFunctions\(\)](#)

Definition at line 515 of file `linear.c`.

References [CHKERRQ\(\)](#), `ierr`, and [LinearSolutionCopy\(\)](#).

**19.23.2.14 PetscErrorCode LinearCreateNumericalSolution (NumericalProblem *prob*,
NumericalSolution * *sol*)**

Shell routine around [CreateLinearSolution\(\)](#) to save you some type casting.

If the first argument is not NULL, its matrix is extracted and used to create the vector of the solution object.

Definition at line 432 of file `linear.c`.

References [CHKERRQ\(\)](#), [CreateLinearSolution\(\)](#), `ierr`, [LinearSolutionSetVector\(\)](#), and [LinearSystemGetParts\(\)](#).

Referenced by `main()`, and [solvelinear\(\)](#).

19.23.2.15 PetscErrorCode LinearDeleteNumericalProblem (NumericalProblem *sys*)

This is like [LinearSystemDelete\(\)](#), except that the argument has been cast so that this routine can be used as the `problemdelete` argument of [SysProDeclareFunctions\(\)](#).

Definition at line 122 of file `linear.c`.

References [CHKERRQ\(\)](#), `ierr`, and [LinearSystemDelete\(\)](#).

Referenced by `main()`.

19.23.2.16 PetscErrorCode LinearDeleteNumericalSolution (NumericalSolution *sol*)

This is like [LinearSolutionDelete\(\)](#), except that the argument has been cast so that this routine can be used as the `solutiondelete` argument of [SysProDeclareFunctions\(\)](#).

Definition at line 477 of file `linear.c`.

References [CHKERRQ\(\)](#), `ierr`, and [LinearSolutionDelete\(\)](#).

Referenced by `main()`.

19.23.2.17 PetscErrorCode LinearDeleteNumericalSolutionContext (NumericalSolution)

Definition at line 650 of file `linear.c`.

References `LinearSolution_::ctx`, and `SYSPROCHECKVALIDLINSOL`.

19.23.2.18 `PetscErrorCode LinearSolutionAddToPreprocessTime (LinearSolution , PetscLogDouble)`

19.23.2.19 `PetscErrorCode LinearSolutionCopy (LinearSolution old, LinearSolution new)`

Copy one linear solution object into another. This clearly only works if their vectors are similarly layed out.

The context pointer is blindly copied. We may have to think about this a bit more.

See also [LinearCopyNumericalSolution\(\)](#).

Definition at line 496 of file linear.c.

References `CHKERRQ()`, `LinearSolution_::ctx`, `ierr`, `LinearSolution_::Out`, `LinearSolution_::statistics`, and `SYSPROCHECKVALIDLINSOLa`.

Referenced by `back_flipsign()`, `LinearCopyNumericalSolution()`, `unapproximate_system()`, `unset_ksp()`, and `unset_pc()`.

19.23.2.20 `PetscErrorCode LinearSolutionCopyStats (LinearSolution , LinearSolution)`

Definition at line 611 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolution_::statistics`, and `SYSPROCHECKVALIDLINSOLa`.

Referenced by `back_singleton()`, `undistribute_system()`, and `unscale_system()`.

19.23.2.21 `PetscErrorCode LinearSolutionCreateStatistics (LinearSolution sol)`

Definition at line 573 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolution_::statistics`, and `SYSPROCHECKVALIDLINSOL`.

19.23.2.22 `PetscErrorCode LinearSolutionDelete (LinearSolution sol)`

Delete a linear solution.

This does not affect the context stored in the solution. That needs a special purpose routine.

See also [LinearDeleteNumericalSolution\(\)](#).

Definition at line 459 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolution_::Out`, `LinearSolution_::statistics`, and `SYSPROCHECKVALIDLINSOL`.

Referenced by `LinearDeleteNumericalSolution()`.

19.23.2.23 `PetscErrorCode LinearSolutionGetContext (LinearSolution , void ** ctx)`

Definition at line 640 of file linear.c.

References `LinearSolution_::ctx`, and `SYSPROCHECKVALIDLINSOL`.

19.23.2.24 `PetscErrorCode LinearSolutionGetStatistics (LinearSolution , NMD_metadata *)`

Definition at line 601 of file linear.c.

References `LinearSolution_::statistics`, and `SYSPROCHECKVALIDLINSOL`.

19.23.2.25 `PetscErrorCode LinearSolutionGetTimes (LinearSolution , PetscLogDouble * , PetscLogDouble * , PetscLogDouble *)`**19.23.2.26** `PetscErrorCode LinearSolutionGetVector (LinearSolution , Vec *)`

Definition at line 557 of file linear.c.

References `LinearSolution_::Out`, and `SYSPROCHECKVALIDLINSOL`.

Referenced by `back_singleton()`, `LinearSystemTrueDistance()`, `LinearSystemTrueDistancePrint()`, `main()`, `undistribute_system()`, and `unscale_system()`.

19.23.2.27 `PetscErrorCode LinearSolutionSetContext (LinearSolution , void * ctx)`

Definition at line 630 of file linear.c.

References `LinearSolution_::ctx`, and `SYSPROCHECKVALIDLINSOL`.

19.23.2.28 `PetscErrorCode LinearSolutionSetTimes (LinearSolution , PetscLogDouble , PetscLogDouble , PetscLogDouble)`**19.23.2.29** `PetscErrorCode LinearSolutionSetVector (LinearSolution , Vec)`

Definition at line 547 of file linear.c.

References `LinearSolution_::Out`, and `SYSPROCHECKVALIDLINSOL`.

Referenced by `back_singleton()`, `CreateDefaultLinearSolution()`, `LinearCreateNumericalSolution()`, and `solvelinear()`.

19.23.2.30 `PetscErrorCode LinearSystemCopy (LinearSystem old, LinearSystem new)`

Copy the values of the components of an old linear system into a new. The new system has to have been created with [LinearSystemDuplicate\(\)](#) because this routine assumes that the data structures are already in place.

Definition at line 368 of file linear.c.

References `LinearSystem_::A`, `ALLPARTSNEW`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::known_solution`, `LinearSystem_::metadata`, `LinearSystem_::`

::partsoriginal, LinearSystem_::Rhs, LinearSystem_::Sol, and SYSPROCHECKVALIDLINSYSa.

Referenced by `scale_system()`.

19.23.2.31 `PetscErrorCode LinearSystemDelete (LinearSystem)`

Definition at line 89 of file `linear.c`.

References `LinearSystem_::A`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, `SYSPROCHECKVALIDLINSYS`, and `LinearSystem_::Tmp`.

Referenced by `LinearDeleteNumericalProblem()`.

19.23.2.32 `PetscErrorCode LinearSystemDuplicate (LinearSystem problem, LinearSystem * newproblem)`

Allocate a new linear system, and create copies in it of the data structure, but not the values, of the components of the old system.

See also [LinearSystemCopy\(\)](#).

Definition at line 323 of file `linear.c`.

References `LinearSystem_::A`, `ALLPARTSNEW`, `LinearSystem_::B`, `CHKERRQ()`, `CreateLinearSystem()`, `NumericalProblem_::ctx`, `LinearSystem_::ctx`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::known_solution`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `scale_system()`.

19.23.2.33 `PetscErrorCode LinearSystemDuplicatePointers (LinearSystem problem, LinearSystem * newproblem)`

Allocate a new linear system and give it the components of the old by pointer duplication.

Definition at line 294 of file `linear.c`.

References `LinearSystem_::A`, `LinearSystem_::B`, `CHKERRQ()`, `CreateLinearSystem()`, `NumericalProblem_::ctx`, `LinearSystem_::ctx`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::known_solution`, `LinearSystem_::metadata`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `approximate_system()`, `distribute_system()`, `eliminate_singletons()`, `flip-sign()`, `setup_ksp()`, and `setup_pc()`.

19.23.2.34 `PetscErrorCode LinearSystemGetContext (LinearSystem , void ** ctx)`

Definition at line 227 of file `linear.c`.

References `LinearSystem_::ctx`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `eliminate_singletons()`.

19.23.2.35 `PetscErrorCode LinearSystemGetKnownSolution (LinearSystem , PetscTruth *)`

Definition at line 247 of file `linear.c`.

References `LinearSystem_::known_solution`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `LinearSystemTrueDistancePrint()`.

19.23.2.36 `PetscErrorCode LinearSystemGetMetadata (LinearSystem , NMD_metadata *)`

Definition at line 267 of file `linear.c`.

References `LinearSystem_::metadata`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `SysProComputeQuantity()`, `SysProFreeQuantities()`, and `SysProRemoveQuantity()`.

19.23.2.37 `PetscErrorCode LinearSystemGetParts (LinearSystem system, Mat * A, Mat * B, Vec * Rhs, Vec * Sol, Vec * Init)`

Get the matrices and vectors of the system

Definition at line 202 of file `linear.c`.

References `LinearSystem_::A`, `LinearSystem_::B`, `LinearSystem_::Init`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `approximate_system()`, `back_singleton()`, `CreateDefaultLinearSolution()`, `distribute_system()`, `eliminate_singletons()`, `flipsign()`, `LinearCreateNumericalSolution()`, `LinearSystemTrueDistance()`, `LinearSystemTrueDistancePrint()`, `MatGustafssonMod()`, `MatSymmetricPart()`, `sans_partition()`, `scale_system()`, `setup_pc()`, `solvelinear()`, `specific_approximation_choices()`, `SysProComputeQuantity()`, `SysProRetrieveQuantity()`, and `unset_pc()`.

19.23.2.38 `PetscErrorCode LinearSystemGetTmpVector (LinearSystem , Vec *)`

Definition at line 277 of file `linear.c`.

References `CHKERRQ()`, `ierr`, `LinearSystem_::Rhs`, `SYSPROCHECKVALIDLINSYS`, and `LinearSystem_::Tmp`.

Referenced by `LinearSystemTrueDistance()`, and `LinearSystemTrueDistancePrint()`.

19.23.2.39 `PetscErrorCode LinearSystemInheritParts (LinearSystem system, Mat A, Mat B, Vec Rhs, Vec Sol, Vec Init)`

Declare the matrices and vectors for a linear system. Unlike in [LinearSystemSetParts\(\)](#), here the parts are marked as not original, so they will not be deleted in `DeleteLinearSystem()`.

Definition at line 175 of file linear.c.

References `LinearSystem_::A`, `ALLPARTSNEW`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

19.23.2.40 `PetscErrorCode LinearSystemSetContext (LinearSystem , void * ctx)`

Definition at line 217 of file linear.c.

References `LinearSystem_::ctx`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `eliminate_singletons()`.

19.23.2.41 `PetscErrorCode LinearSystemSetKnownSolution (LinearSystem , PetscTruth)`

Definition at line 237 of file linear.c.

References `LinearSystem_::known_solution`, and `SYSPROCHECKVALIDLINSYS`.

19.23.2.42 `PetscErrorCode LinearSystemSetMetadata (LinearSystem , NMD.metadata)`

Definition at line 257 of file linear.c.

References `LinearSystem_::metadata`, and `SYSPROCHECKVALIDLINSYS`.

19.23.2.43 `PetscErrorCode LinearSystemSetParts (LinearSystem system, Mat A, Mat B, Vec Rhs, Vec Sol, Vec Init)`

Declare the matrices and vectors for a linear system.

Arguments:

- `system`
- `A` : the matrix
- `B` : operator to construct the preconditioner from; if `NULL`, (or identical to `A`), `A` will be used
- `rhs` : right hand side
- `sol` : storage for the computed solution
- `init` : (optional) nontrivial starting vector for iterative solution

Definition at line 145 of file linear.c.

References `LinearSystem_::A`, `LinearSystem_::B`, `CHKERRQ()`, `ierr`, `LinearSystem_::Init`, `LinearSystem_::partsoriginal`, `LinearSystem_::Rhs`, `LinearSystem_::Sol`, and `SYSPROCHECKVALIDLINSYS`.

Referenced by `distribute_system()`, `eliminate_singletons()`, `flipsign()`, `main()`, `MatGustafssonMod()`, `MatSymmetricPart()`, and `setup_pc()`.

19.23.2.44 `PetscErrorCode LinearSystemTrueDistance (LinearSystem , LinearSolution , PetscReal *)`

Definition at line 664 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolutionGetVector()`, `LinearSystemGetParts()`, and `LinearSystemGetTmpVector()`.

Referenced by `LinearSystemTrueDistancePrint()`.

19.23.2.45 `PetscErrorCode LinearSystemTrueDistancePrint (NumericalProblem , NumericalSolution , char *)`

Definition at line 684 of file linear.c.

References `CHKERRQ()`, `ierr`, `LinearSolutionGetVector()`, `LinearSystemGetKnownSolution()`, `LinearSystemGetParts()`, `LinearSystemGetTmpVector()`, `LinearSystemTrueDistance()`, `SYSPROCHECKVALIDLINSOL`, and `SYSPROCHECKVALIDLINSYS`.

19.23.2.46 `PetscErrorCode make_diagnostics (char * , char * , Diagnostics *)`

19.23.2.47 `PetscErrorCode PreprocessedLinearSystemSolution (LinearSystem , LinearSolution *)`

Definition at line 717 of file linear.c.

References `CHKERRQ()`, `ierr`, `PreprocessedProblemSolving()`, `RegisterPreprocessorContext()`, and `SYSPROCHECKVALIDLINSYS`.

19.24 sysprosuit.h File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include "syspro.h"
#include "sysprolinear.h"
```

Functions

- `PetscErrorCode` [onlyforsymmetricproblem](#) (`NumericalProblem`, `void *`, `Suitability-Value *`)

19.24.1 Function Documentation

19.24.1.1 PetscErrorCode onlyforsymmetricproblem (NumericalProblem *problem*, void * *ctx*, SuitabilityValue * *v*)

19.24.2 Suitability functions for the linear problem

Definition at line 18 of file suit.c.

References CHKERRQ(), and ierr.

Referenced by setup_ksp_choices().

19.25 sysprotransform.h File Reference

```
#include "syspro.h"
```

```
#include "petsc.h"
```

Functions

- PetscErrorCode [NewTransform](#) (const char *, [SalsaTransform](#) *)
- PetscErrorCode [DeregisterTransform](#) ([SalsaTransform](#))
- PetscErrorCode [TransformGetName](#) ([SalsaTransform](#), const char **)
- PetscErrorCode [TransformGetByName](#) (const char *, [SalsaTransform](#) *)
- PetscErrorCode [NewTransformObject](#) (const char *, const char *, [SalsaTransformObject](#) *)
- PetscErrorCode [FreeTransformObject](#) ([SalsaTransformObject](#) tf)
- PetscErrorCode [TransformObjectGetByName](#) (const char *, const char *, [SalsaTransformObject](#) *)
- PetscErrorCode [TransformGetObjects](#) ([SalsaTransform](#), int *, [SalsaTransformObject](#) **)
- PetscErrorCode [TransformObjectGetName](#) ([SalsaTransformObject](#), const char **)
- PetscErrorCode [TransformObjectGetTransformName](#) ([SalsaTransformObject](#), char **)
- PetscErrorCode [TransformObjectsGetNames](#) ([SalsaTransform](#), const char ***)
- PetscErrorCode [TransformObjectSetExplanation](#) ([SalsaTransformObject](#), const char *)
- PetscErrorCode [TransformObjectSetSuitabilityFunction](#) ([SalsaTransformObject](#), void *, PetscErrorCode (*)(NumericalProblem, void *, SuitabilityValue *))
- PetscErrorCode [SetSuitabilityContextTester](#) ([SalsaTransform](#), PetscErrorCode (*)(void *))
- PetscErrorCode [TransformObjectGetSuitabilityFunction](#) ([SalsaTransformObject](#), void **, PetscErrorCode (*)(NumericalProblem, void *, SuitabilityValue *))
- PetscErrorCode [TransformObjectAddOptionExplanation](#) ([SalsaTransformObject](#), int, const char *)

- PetscErrorCode [TransformItemGetFirstOption](#) (const char *, const char *, int *, PetscTruth *)
- PetscErrorCode [TransformItemGetNextOption](#) (const char *, const char *, int *, PetscTruth *)
- PetscErrorCode [TransformReportTeXTable](#) (SalsaTransform, FILE *)
- PetscErrorCode [TransformReportEnabled](#) (SalsaTransform, const char **)
- PetscErrorCode [TransformItemDescribeShort](#) (SalsaTransform, char *, int, char **)
- PetscErrorCode [TransformItemDescribeLong](#) (SalsaTransform, char *, int, char **)
- PetscErrorCode [TransformObjectMark](#) (SalsaTransformObject tf)
- PetscErrorCode [TransformObjectUnmark](#) (SalsaTransformObject tf)
- PetscErrorCode [TransformObjectsMarkAll](#) (SalsaTransform tf)
- PetscErrorCode [TransformObjectsUnmarkAll](#) (SalsaTransform tf)
- PetscErrorCode [TransformObjectGetMark](#) (SalsaTransformObject, int *)
- PetscErrorCode [TransformItemOptionMark](#) (SalsaTransform, const char *, int)
- PetscErrorCode [TransformGetNUnmarked](#) (SalsaTransform, int *)
- PetscErrorCode [TransformObjectsUseOnly](#) (SalsaTransform, const char *)
- PetscErrorCode [TransformItemOptionsUseOnly](#) (SalsaTransformObject, const char *)
- PetscErrorCode [TransformGetNItems](#) (SalsaTransform, int *n)
- PetscErrorCode [TransformGetNextUnmarkedItem](#) (SalsaTransform, const char *, SalsaTransformObject *, PetscTruth *)
- PetscErrorCode [PreprocessorSaveAprioriSelection](#) (SystemPreprocessor)
- PetscErrorCode [PreprocessorApplyAprioriSelection](#) (SystemPreprocessor)
- PetscErrorCode [SysProDefineCharAnnotation](#) (const char *, const char *)
- PetscErrorCode [TransformCharAnnotationGetIndex](#) (SalsaTransform, const char *, int *, PetscTruth *)
- PetscErrorCode [TransformObjectCharAnnotate](#) (SalsaTransformObject, const char *, const char *)
- PetscErrorCode [TransformObjectIntAnnotate](#) (SalsaTransformObject, const char *, int)
- PetscErrorCode [TransformObjectGetIntAnnotation](#) (SalsaTransformObject, const char *, int *, PetscTruth *)
- PetscErrorCode [SysProDefineIntAnnotation](#) (const char *, const char *)
- PetscErrorCode [TransformIntAnnotationGetIndex](#) (SalsaTransform, const char *, int *, PetscTruth *)
- PetscErrorCode [TransformItemIntAnnotate](#) (SalsaTransform, int, int)
- PetscErrorCode [TransformItemGetIntAnnotation](#) (SalsaTransform, int idx, char *an, int *v, PetscTruth *f)
- PetscErrorCode [TransformObjectDefineOption](#) (SalsaTransformObject, const char *)
- PetscErrorCode [TransformObjectAddOption](#) (SalsaTransformObject, int)

- PetscErrorCode [TransformItemCharAnnotationGetIndex](#) ([SalsaTransform](#), char *, int *)
- PetscErrorCode [TransformItemGetCharAnnotation](#) ([SalsaTransform](#), int idx, char *an, char **v, PetscTruth *)
- PetscErrorCode [TransformCurrentItemDefineOption](#) ([SalsaTransform](#), char *, char *)
- PetscErrorCode [TransformItemDefineOption](#) ([SalsaTransform](#), int, char *, char *)
- PetscErrorCode [TransformItemGetOptions](#) ([SalsaTransform](#), int it, int *nopt)
- PetscErrorCode [TransformItemGetOptionI](#) ([SalsaTransform](#), int it, int iopt, int *v)
- PetscErrorCode [TransformSetUserChoices](#) ([SalsaTransform](#), PetscTruth)
- PetscErrorCode [TransformGetUserChoices](#) ([SalsaTransform](#), PetscTruth *)
- PetscErrorCode [SalsaTransformIntegrityTest](#) ([SalsaTransform](#) tf)

19.25.1 Function Documentation

19.25.1.1 PetscErrorCode DeregisterTransform ([SalsaTransform](#))

Definition at line 63 of file transform.c.

References [SalsaTransform_::annotations_c](#), [SalsaTransform_::annotations_i](#), [SalsaTransform_::aprioriselection](#), [CHECKVALIDTRANSFORM](#), [CHKERRQ\(\)](#), [FreeTransformObject\(\)](#), [ierr](#), [SalsaTransform_::n_objects](#), and [SalsaTransform_::transformobjects](#).

Referenced by [SysProFinalize\(\)](#).

19.25.1.2 PetscErrorCode FreeTransformObject ([SalsaTransformObject tf](#))

Definition at line 127 of file transform.c.

References [SalsaTransformObject_::annotate_c](#), [SalsaTransformObject_::annotate_i](#), [CHECKVALIDTRANSFORMOBJECT](#), [CHKERRQ\(\)](#), [ierr](#), [SalsaTransformObject_::n_options](#), [SalsaTransformObject_::name](#), [SalsaTransformObject_::optionexplanation](#), [SalsaTransformObject_::options](#), and [SalsaTransformObject_::options_marked](#).

Referenced by [DeregisterTransform\(\)](#).

19.25.1.3 PetscErrorCode NewTransform (const char * *name*, [SalsaTransform](#) * *tf*)

Define a new class of preprocessors, for instance scaling or permutation.

Definition at line 45 of file transform.c.

References [SalsaTransform_::alloc_objects](#), [SalsaTransform_::aprioriselection](#), [CHKERRQ\(\)](#), [SalsaTransform_::cookie](#), [ierr](#), [SalsaTransform_::n_objects](#), [SalsaTransform_::name](#), [TFINC](#), [TRANSFORMCOOKIE](#), and [SalsaTransform_::transformobjects](#).

Referenced by [DeclarePreprocessor\(\)](#).

19.25.1.4 PetscErrorCode NewTransformObject (const char * *transform*, const char * *name*, SalsaTransformObject * *to*)

Create a transform object specified by *name* for the preprocessor class *transform*. The *to* parameter can be NULL if no further specifications of the object are needed, in which case this only registers the name.

Definition at line 109 of file transform.c.

References SalsaTransform_::alloc_objects, CHKERRQ(), SalsaTransformObject_::cookie, ierr, SalsaTransform_::n_objects, SalsaTransformObject_::name, SalsaTransformObject_::transform, TransformGetByName(), TRANSFORMOBJECTCOOKIE, and SalsaTransform_::transformobjects.

Referenced by declareadders(), setup_approximation_choices(), setup_distribution_choices(), setup_flipsign_choices(), setup_ksp_choices(), setup_pc_choices(), setup_scaling_choices(), and setup_singleton_choices().

19.25.1.5 PetscErrorCode PreprocessorApplyAprioriSelection (SystemPreprocessor)

Definition at line 475 of file transform.c.

References SalsaTransform_::aprioriselection, SalsaTransformObject_::marked, SalsaTransform_::n_objects, SystemPreprocessor_::transform, and SalsaTransform_::transformobjects.

Referenced by PreprocessorSpecificSetup().

19.25.1.6 PetscErrorCode PreprocessorSaveAprioriSelection (SystemPreprocessor)

Definition at line 461 of file transform.c.

References SalsaTransform_::aprioriselection, CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransform_::n_objects, SystemPreprocessor_::transform, and SalsaTransform_::transformobjects.

Referenced by PreprocessorsOptionsHandling().

19.25.1.7 PetscErrorCode SalsaTransformIntegrityTest (SalsaTransform *tf*)

Definition at line 907 of file transform.c.

References CHKERRQ(), ierr, SalsaTransform_::n_objects, SalsaTransform_::suitabilityctxtester, TestSuitabilityContext(), TransformObjectGetSuitabilityFunction(), and SalsaTransform_::transformobjects.

19.25.1.8 PetscErrorCode SetSuitabilityContextTester (SalsaTransform , PetscErrorCode(*)(void *))

Definition at line 884 of file transform.c.

References CHECKVALIDTRANSFORM, and SalsaTransform_::suitabilityctxtester.

Referenced by `setup_ksp_choices()`.

19.25.1.9 `PetscErrorCode SysProDefineCharAnnotation (const char * transform, const char * ann)`

Define a character string annotation for a transform. The index of this annotation can be retrieved with [TransformCharAnnotationGetIndex\(\)](#). The actual annotation can be found with [TransformItemGetCharAnnotation\(\)](#).

Definition at line 276 of file `transform.c`.

References `SalsaTransform_::annotations_c`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_annotate_c`, `TFINC`, and `TransformGetByName()`.

Referenced by `setup_ksp_choices()`.

19.25.1.10 `PetscErrorCode SysProDefineIntAnnotation (const char * transform, const char * ann)`

Define a integer string annotation for a transform. The index of this annotation can be retrieved with [TransformIntAnnotationGetIndex\(\)](#). The actual annotation can be found with [TransformItemGetIntAnnotation\(\)](#).

Definition at line 332 of file `transform.c`.

References `SalsaTransform_::annotations_i`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_annotate_i`, `TFINC`, and `TransformGetByName()`.

Referenced by `setup_distribution_choices()`, `setup_ksp_choices()`, `setup_pc_choices()`, and `setup_scaling_choices()`.

19.25.1.11 `PetscErrorCode TransformCharAnnotationGetIndex (SalsaTransform , const char * , int * , PetscTruth *)`

Definition at line 311 of file `transform.c`.

References `SalsaTransform_::annotations_c`, `CHECKVALIDTRANSFORM`, `CHKERRQ()`, `ierr`, and `SalsaTransform_::n_annotate_c`.

Referenced by `TransformObjectCharAnnotate()`.

19.25.1.12 `PetscErrorCode TransformCurrentItemDefineOption (SalsaTransform , char * , char *)`

19.25.1.13 `PetscErrorCode TransformGetByName (const char * , SalsaTransform *)`

Definition at line 624 of file `preprocess.c`.

References `CHKERRQ()`, `ierr`, `SystemPreprocessorGetByName()`, and `SystemPreprocessor_::transform`.

Referenced by `NewTransformObject()`, `PreprocessorsOptionsHandling()`, `Preprocessor-`

SpecificSetup(), ReportEnabledPreprocessors(), setup_approximation_choices(), setup_distribution_choices(), setup_flipsign_choices(), setup_ksp_choices(), setup_pc_choices(), setup_scaling_choices(), setup_singleton_choices(), SysProDefineCharAnnotation(), SysProDefineIntAnnotation(), and TransformObjectGetByName().

19.25.1.14 PetscErrorCode TransformGetName (SalsaTransform , const char **)

Definition at line 81 of file transform.c.

References CHECKVALIDTRANSFORM, and SalsaTransform_::name.

19.25.1.15 PetscErrorCode TransformGetNextUnmarkedItem (SalsaTransform *tf*, const char * *old*, SalsaTransformObject * *snew*, PetscTruth * *f*)

Find the next unmarked value; if `old` is NULL, the first first unmarked value is given, otherwise the first one after a match with `old`.

Definition at line 527 of file transform.c.

References CHECKVALIDTRANSFORM, CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransform_::n_objects, SalsaTransformObject_::name, SalsaTransform_::transformobjects, and TRUTH.

Referenced by ChooseFirstTransform(), PreprocessedSolution(), and PreprocessorsOptionsHandling().

19.25.1.16 PetscErrorCode TransformGetNItems (SalsaTransform , int * *n*)

19.25.1.17 PetscErrorCode TransformGetNUnmarked (SalsaTransform , int *)

Definition at line 448 of file transform.c.

References CHECKVALIDTRANSFORM, SalsaTransformObject_::marked, SalsaTransform_::n_objects, and SalsaTransform_::transformobjects.

Referenced by PreprocessorsOptionsHandling().

19.25.1.18 PetscErrorCode TransformGetObjects (SalsaTransform , int * , SalsaTransformObject **)

Definition at line 92 of file transform.c.

References CHECKVALIDTRANSFORM, SalsaTransform_::n_objects, and SalsaTransform_::transformobjects.

Referenced by disable_ksp(), specific_distribution_choices(), and specific_scaling_choices().

19.25.1.19 `PetscErrorCode TransformGetUserChoices (SalsaTransform tf, PetscTruth * ch)`

Query whether the user has ordained which choice(s) to take for a specific transform. The values of these choices are implicitly given by disabling some transforms.

See also [TransformSetUserChoices\(\)](#), [TransformObjectsUseOnly\(\)](#).

Definition at line 874 of file transform.c.

References CHECKVALIDTRANSFORM, and SalsaTransform_::userchoices.

Referenced by PreprocessedSolution().

19.25.1.20 `PetscErrorCode TransformIntAnnotationGetIndex (SalsaTransform , const char * , int * , PetscTruth *)`

Definition at line 365 of file transform.c.

References SalsaTransform_::annotations_i, CHECKVALIDTRANSFORM, CHKERRQ(), ierr, and SalsaTransform_::n_annotate_i.

Referenced by TransformObjectIntAnnotate().

19.25.1.21 `PetscErrorCode TransformItemCharAnnotationGetIndex (SalsaTransform , char * , int *)`**19.25.1.22** `PetscErrorCode TransformItemDefineOption (SalsaTransform , int , char * , char *)`**19.25.1.23** `PetscErrorCode TransformItemDescribeLong (SalsaTransform , char * , int , char **)`

Definition at line 821 of file transform.c.

References CHECKVALIDTRANSFORM, CHKERRQ(), SalsaTransformObject_::explanation, ierr, SalsaTransform_::name, SalsaTransformObject_::options, and TransformObjectGetByName().

19.25.1.24 `PetscErrorCode TransformItemDescribeShort (SalsaTransform , char * , int , char **)`

Definition at line 802 of file transform.c.

References CHKERRQ(), ierr, SalsaTransformObject_::n_options, SalsaTransformObject_::name, SalsaTransform_::name, and TransformObjectGetByName().

19.25.1.25 `PetscErrorCode TransformItemGetCharAnnotation (SalsaTransform , int idx, char * an, char ** v, PetscTruth *)`

19.25.1.26 `PetscErrorCode TransformItemGetFirstOption (const char * , const char * , int * , PetscTruth *)`

Definition at line 630 of file transform.c.

References `CHKERRQ()`, `ierr`, `SalsaTransformObject_::n_options`, `SalsaTransformObject_::options`, `SalsaTransformObject_::options_marked`, and `TransformObjectGetByName()`.

Referenced by `PreprocessedSolution()`.

19.25.1.27 `PetscErrorCode TransformItemGetIntAnnotation (SalsaTransform , int idx, char * an, int * v, PetscTruth * f)`

19.25.1.28 `PetscErrorCode TransformItemGetNextOption (const char * , const char * , int * , PetscTruth *)`

Definition at line 654 of file transform.c.

References `CHKERRQ()`, `ierr`, `SalsaTransformObject_::n_options`, `SalsaTransformObject_::options`, `SalsaTransformObject_::options_marked`, and `TransformObjectGetByName()`.

Referenced by `PreprocessedSolution()`.

19.25.1.29 `PetscErrorCode TransformItemGetNOptions (SalsaTransform , int it, int * nopt)`

19.25.1.30 `PetscErrorCode TransformItemGetOptionI (SalsaTransform , int it, int iopt, int * v)`

19.25.1.31 `PetscErrorCode TransformItemIntAnnotate (SalsaTransform , int , int)`

19.25.1.32 `PetscErrorCode TransformItemOptionMark (SalsaTransform , const char * , int)`

Definition at line 678 of file transform.c.

References `CHECKVALIDTRANSFORM`, `CHKERRQ()`, `ierr`, `SalsaTransformObject_::marked`, `SalsaTransformObject_::n_options`, `SalsaTransform_::name`, `SalsaTransformObject_::options`, `SalsaTransformObject_::options_marked`, and `TransformObjectGetByName()`.

19.25.1.33 `PetscErrorCode TransformItemOptionsUseOnly (SalsaTransformObject , const char *)`

Definition at line 611 of file transform.c.

References `CHECKVALIDTRANSFORMOBJECT`, `CHKERRQ()`, `ierr`, `SalsaTransformObject_::n_options`, and `TransformObjectAddOption()`.

Referenced by `PreprocessorsOptionsHandling()`.

19.25.1.34 PetscErrorCode TransformObjectAddOption (SalsaTransformObject , int)

Definition at line 571 of file transform.c.

References SalsaTransformObject_::alloc_options, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransformObject_::n_options, SalsaTransformObject_::name, SalsaTransformObject_::optionexplanation, SalsaTransformObject_::options, SalsaTransformObject_::options_marked, and TFINC.

Referenced by declareadders(), setup_ksp_choices(), setup_pc_choices(), and TransformItemOptionsUseOnly().

19.25.1.35 PetscErrorCode TransformObjectAddOptionExplanation (SalsaTransformObject , int , const char *)

Definition at line 594 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::n_options, SalsaTransformObject_::optionexplanation, and SalsaTransformObject_::options.

Referenced by setup_pc_choices().

19.25.1.36 PetscErrorCode TransformObjectCharAnnotate (SalsaTransformObject , const char * , const char *)

Definition at line 694 of file transform.c.

References SalsaTransformObject_::alloc_annotate_c, SalsaTransformObject_::annotate_c, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, TFINC, SalsaTransformObject_::transform, and TransformCharAnnotationGetIndex().

19.25.1.37 PetscErrorCode TransformObjectDefineOption (SalsaTransformObject , const char *)

Definition at line 561 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, and SalsaTransformObject_::option.

Referenced by declareadders(), setup_ksp_choices(), and setup_pc_choices().

19.25.1.38 PetscErrorCode TransformObjectGetByName (const char * , const char * , SalsaTransformObject *)

Definition at line 233 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransform_::n_objects, SalsaTransformObject_::name, TransformGetByName(), and SalsaTransform_::transformobjects.

Referenced by disable_ksp(), disable_pcs(), is_gmres_method(), pcoptionshandling(), setup_ksp(), specific_approximation_choices(), specific_flipsign_choices(), specific_singleton_

choices(), TransformItemDescribeLong(), TransformItemDescribeShort(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformItemOptionMark(), TransformObjectsUseOnly(), and unset_ksp().

19.25.1.39 `PetscErrorCode TransformObjectGetIntAnnotation (SalsaTransformObject ,
const char * , int * , PetscTruth *)`

Definition at line 738 of file transform.c.

References SalsaTransformObject_::annotate_i, SalsaTransform_::annotations_i, CHECKVALIDTRANSFORMOBJECT, SalsaTransform_::n_annotate_i, SalsaTransformObject_::transform, and TRUTH.

Referenced by disable_ksp(), is_gmres_method(), pcoptionshandling(), set_ksp_options(), specific_distribution_choices(), and specific_scaling_choices().

19.25.1.40 `PetscErrorCode TransformObjectGetMark (SalsaTransformObject , int *)`

Definition at line 438 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, and SalsaTransformObject_::marked.

Referenced by TransformReportEnabled().

19.25.1.41 `PetscErrorCode TransformObjectGetName (SalsaTransformObject , const char
**)`

Definition at line 148 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, and SalsaTransformObject_::name.

Referenced by ChooseFirstTransform(), disable_ksp(), PreprocessedSolution(), PreprocessorsOptionsHandling(), PreprocessorSpecificSetup(), and set_ksp_options().

19.25.1.42 `PetscErrorCode TransformObjectGetSuitabilityFunction (SalsaTransformObject
tf, void ** scctx, PetscErrorCode(**)(NumericalProblem, void *,
SuitabilityValue *) f)`

Retrieve the suitability function and context; see [Suitability functions](#). Both arguments can be null.

See also [TransformObjectSetSuitabilityFunction\(\)](#).

Definition at line 210 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::suitabilityctx, and SalsaTransformObject_::suitabilityfunction.

Referenced by PreprocessorSpecificSetup(), SalsaTransformIntegrityTest(), and unset_ksp().

19.25.1.43 `PetscErrorCode TransformObjectGetTransformName (SalsaTransformObject , char **)`

Definition at line 222 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransform_::name, and SalsaTransformObject_::transform.

19.25.1.44 `PetscErrorCode TransformObjectIntAnnotate (SalsaTransformObject , const char * , int)`

Definition at line 716 of file transform.c.

References SalsaTransformObject_::alloc_annotate_i, SalsaTransformObject_::annotate_i, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, TFINC, SalsaTransformObject_::transform, and TransformIntAnnotationGetIndex().

Referenced by setup_distribution_choices(), setup_ksp_choices(), setup_pc_choices(), and setup_scaling_choices().

19.25.1.45 `PetscErrorCode TransformObjectMark (SalsaTransformObject tf)`

Definition at line 382 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransformObject_::n_options, and SalsaTransformObject_::options_marked.

Referenced by disable_ksp(), disable_pcs(), pcoptionshandling(), PreprocessorSpecific-Setup(), specific_approximation_choices(), specific_distribution_choices(), specific_flipsign_choices(), specific_scaling_choices(), specific_singleton_choices(), TransformObjects-MarkAll(), and TransformObjectsUseOnly().

19.25.1.46 `PetscErrorCode TransformObjectSetExplanation (SalsaTransformObject , const char *)`

Definition at line 159 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, and SalsaTransformObject_::explanation.

Referenced by setup_approximation_choices(), setup_distribution_choices(), setup_flipsign_choices(), setup_ksp_choices(), setup_pc_choices(), setup_scaling_choices(), and setup_singleton_choices().

19.25.1.47 `PetscErrorCode TransformObjectSetSuitabilityFunction (SalsaTransformObject tf, void * ctx, PetscErrorCode (*)(NumericalProblem, void *, SuitabilityValue *) f)`

Set the suitability function; see [Suitability functions](#).

See also [TransformObjectGetSuitabilityFunction\(\)](#).

Definition at line 192 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::suitabilityctx, and SalsaTransformObject_::suitabilityfunction.

Referenced by setup_ksp_choices().

19.25.1.48 `PetscErrorCode TransformObjectsGetNames (SalsaTransform tf, const char *** names)`

Get the names of all declared transformobjects. An array is allocated for the names, which needs to be PetscFree()'d.

Definition at line 255 of file transform.c.

References CHECKVALIDTRANSFORM, CHKERRQ(), ierr, SalsaTransform_::n_objects, SalsaTransformObject_::name, and SalsaTransform_::transformobjects.

Referenced by ContinueRetrievingAllPreprocessors(), and TransformReportEnabled().

19.25.1.49 `PetscErrorCode TransformObjectsMarkAll (SalsaTransform tf)`

Definition at line 408 of file transform.c.

References CHECKVALIDTRANSFORM, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransform_::n_objects, TransformObjectMark(), and SalsaTransform_::transformobjects.

Referenced by TransformObjectsUseOnly().

19.25.1.50 `PetscErrorCode TransformObjectsUnmarkAll (SalsaTransform tf)`

Definition at line 423 of file transform.c.

References CHECKVALIDTRANSFORM, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransform_::n_objects, SalsaTransform_::transformobjects, and TransformObjectUnmark().

Referenced by disable_ksp(), and TransformObjectsUseOnly().

19.25.1.51 `PetscErrorCode TransformObjectsUseOnly (SalsaTransform tf, const char * list)`

Mark a list of names as to be used.

Cases:

- "name1, name2, name3" : all other names are marked as not to be used
- "not, name1, name2" : all names will be used, except for the ones listed

Definition at line 494 of file transform.c.

References CHECKVALIDTRANSFORM, CHKERRQ(), ierr, SalsaTransform_::name,

TransformObjectGetByName(), TransformObjectMark(), TransformObjectsMarkAll(), TransformObjectsUnmarkAll(), and TransformObjectUnmark().

Referenced by PreprocessorsOptionsHandling().

19.25.1.52 PetscErrorCode TransformObjectUnmark (SalsaTransformObject *tf*)

Definition at line 395 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransformObject_::n_options, and SalsaTransformObject_::options_marked.

Referenced by TransformObjectsUnmarkAll(), and TransformObjectsUseOnly().

19.25.1.53 PetscErrorCode TransformReportEnabled (SalsaTransform , const char **)

Definition at line 779 of file transform.c.

References CHKERRQ(), ierr, SalsaTransform_::n_objects, TransformObjectGetMark(), SalsaTransform_::transformobjects, and TransformObjectsGetNames().

Referenced by ReportEnabledPreprocessors().

19.25.1.54 PetscErrorCode TransformReportTeXTable (SalsaTransform , FILE *)

Definition at line 756 of file transform.c.

References SalsaTransformObject_::explanation, SalsaTransform_::n_objects, SalsaTransformObject_::n_options, SalsaTransformObject_::name, SalsaTransformObject_::options, and SalsaTransform_::transformobjects.

19.25.1.55 PetscErrorCode TransformSetUserChoices (SalsaTransform *tf*, PetscTruth *ch*)

Declare that the user has ordained which choice(s) to take for a specific transform. The values of these choices are implicitly given by disabling some transforms.

See also [TransformGetUserChoices\(\)](#), [TransformObjectsUseOnly\(\)](#).

Definition at line 858 of file transform.c.

References CHECKVALIDTRANSFORM, and SalsaTransform_::userchoices.

Referenced by PreprocessorsOptionsHandling().

19.26 testmat.c File Reference

Functions

- [CHKERRQ](#) (*ierr*)
- [for](#) (*i=0; i < n; i++*)

Variables

- `ierr = MatCreateSeqAIJ(MPI_COMM_SELF,n,n,3,0,&A)`

19.26.1 Function Documentation

19.26.1.1 CHKERRQ (ierr)

Referenced by `adder()`, `approximate_system()`, `back_flipsign()`, `back_singleton()`, `ChooseFirstTransform()`, `ContinueRetrievingAllPreprocessors()`, `ContinueRetrievingCurrentPreprocessors()`, `copy()`, `create_solver()`, `CreateDefaultLinearSolution()`, `CreateGlobalInfo()`, `CreateLinearSolution()`, `CreateLinearSystem()`, `declareadders()`, `DeclareApproximationPreprocessor()`, `DeclareDistributionPreprocessor()`, `DeclareFlipsignPreprocessor()`, `DeclareKSPPreprocessor()`, `DeclarePCPreprocessor()`, `DeclarePreprocessor()`, `DeclarePreprocessorIntelligentChoice()`, `DeclarePreprocessorRequiredCategories()`, `DeclareScalingPreprocessor()`, `DeclareSingletonPreprocessor()`, `delintctx()`, `delprob()`, `delsol()`, `DeregisterTransform()`, `destroy_solver()`, `destroysolution()`, `disable_ksp()`, `disable_pcs()`, `distribute_system()`, `eliminate_singletons()`, `flipsign()`, `for()`, `FreeTransformObject()`, `get_pc_stats_function()`, `GetFirstPreprocessor()`, `is_gmres_method()`, `LinearCopyNumericalSolution()`, `LinearCreateNumericalSolution()`, `LinearDeleteNumericalProblem()`, `LinearDeleteNumericalSolution()`, `LinearSolutionCopy()`, `LinearSolutionCopyStats()`, `LinearSolutionCreateStatistics()`, `LinearSolutionDelete()`, `LinearSystemCopy()`, `LinearSystemDelete()`, `LinearSystemDuplicate()`, `LinearSystemDuplicatePointers()`, `LinearSystemGetTmpVector()`, `LinearSystemInheritParts()`, `LinearSystemSetParts()`, `LinearSystemTrueDistance()`, `LinearSystemTrueDistancePrint()`, `main()`, `makeintctx()`, `makesol()`, `MatGustafssonMod()`, `MatSymmetricPart()`, `MonitorAdjustMaxit()`, `NewTransform()`, `NewTransformObject()`, `onlyforsymmetricproblem()`, `pc_short_string()`, `pc_string()`, `pcoptionshandling()`, `PreprocessedLinearSystemSolution()`, `PreprocessedProblemSolving()`, `PreprocessedSolution()`, `PreprocessorGetContext()`, `PreprocessorGetIndex()`, `PreprocessorGetPreservedCategories()`, `PreprocessorSetPreservedCategories()`, `PreprocessorsOptionsHandling()`, `PreprocessorSpecificSetup()`, `RegisterPreprocessorContext()`, `ReportEnabledPreprocessors()`, `ReportSysProCallStackState()`, `RetrieveAllPreprocessorValues()`, `SalsaTransformIntegrityTest()`, `sans_partition()`, `scale_system()`, `ScreenOutputTab()`, `ScreenOutputTabLine()`, `set_blocked_sub_pc()`, `set_intelligent_scaling()`, `set_ksp_options()`, `set_preconditioner_base_matrix()`, `SetPetscOptionsForPC()`, `setup_approximation_choices()`, `setup_distribution_choices()`, `setup_flipsign_choices()`, `setup_ksp()`, `setup_ksp_choices()`, `setup_pc()`, `setup_pc_choices()`, `setup_scaling_choices()`, `setup_singleton_choices()`, `singleton_specific_unset()`, `solvebycopy()`, `solvelinear()`, `specific_approximation_choices()`, `specific_distribution_choices()`, `specific_flipsign_choices()`, `specific_scaling_choices()`, `specific_singleton_choices()`, `StartRetrievingAllPreprocessors()`, `StartRetrievingCurrentPreprocessors()`, `SuccessorPreprocessor()`, `SysProComputeQuantity()`, `SysProDefineCharAnnotation()`, `SysProDefineIntAnnotation()`, `SysProFinalize()`, `SysProFreeQuantities()`, `SysProInitialize()`, `SysProLinearInstallCustomKSPMonitor()`, `SysProPreprocessorEndFunction()`, `SysproPreprocessorStartFunction()`, `SysProProblemCloneContext()`, `SysProProblemDeleteContext()`, `SysProRemoveQuantity()`, `SysProRetrieveQuantity()`, `SysProShowOptions()`, `SysProTraceMessage()`,

SystemPreprocessorGetByName(), TabReportActivePreprocessors(), TabReportAllPreprocessors(), TabReportPreprocessors(), TestSuitabilityContext(), TransformCharAnnotationGetIndex(), TransformGetByName(), TransformIntAnnotationGetIndex(), TransformItemDescribeLong(), TransformItemDescribeShort(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformItemOptionMark(), TransformItemOptionsUseOnly(), TransformObjectAddOption(), TransformObjectCharAnnotate(), TransformObjectGetByName(), TransformObjectIntAnnotate(), TransformObjectsGetNames(), TransformObjectsMarkAll(), TransformObjectsUnmarkAll(), TransformObjectsUseOnly(), TransformReportEnabled(), unapproximate_system(), undistribute_system(), unscale_system(), unset_ksp(), unset_ksp(), and unset_pc().

19.26.1.2 for ()

Definition at line 6 of file testmat.c.

References CHKERRQ(), and ierr.

19.26.2 Variable Documentation

19.26.2.1 ierr = MatCreateSeqAIJ(MPI_COMM_SELF,n,n,3,0,&A)

Definition at line 4 of file testmat.c.

Referenced by adder(), approximate_system(), back_flipsign(), back_singleton(), ChooseFirstTransform(), ContinueRetrievingAllPreprocessors(), ContinueRetrievingCurrentPreprocessors(), copy(), create_solver(), CreateDefaultLinearSolution(), CreateGlobalInfo(), CreateLinearSolution(), CreateLinearSystem(), declareadders(), DeclareApproximationPreprocessor(), DeclareDistributionPreprocessor(), DeclareFlipsignPreprocessor(), DeclareKSPPreprocessor(), DeclarePCPreprocessor(), DeclarePreprocessor(), DeclarePreprocessorIntelligentChoice(), DeclarePreprocessorRequiredCategories(), DeclareScalingPreprocessor(), DeclareSingletonPreprocessor(), delintctx(), delprob(), delsol(), DeregisterTransform(), destroy_solver(), destroysolution(), disable_ksp(), disable_pcs(), distribute_system(), eliminate_singletons(), flipsign(), for(), FreeTransformObject(), get_pc_stats_function(), GetFirstPreprocessor(), is_gmres_method(), LinearCopyNumericalSolution(), LinearCreateNumericalSolution(), LinearDeleteNumericalProblem(), LinearDeleteNumericalSolution(), LinearSolutionCopy(), LinearSolutionCopyStats(), LinearSolutionCreateStatistics(), LinearSolutionDelete(), LinearSystemCopy(), LinearSystemDelete(), LinearSystemDuplicate(), LinearSystemDuplicatePointers(), LinearSystemGetTmpVector(), LinearSystemInheritParts(), LinearSystemSetParts(), LinearSystemTrueDistance(), LinearSystemTrueDistancePrint(), main(), makeintctx(), makesol(), MatGustafssonMod(), MatSymmetricPart(), MonitorAdjustMaxit(), NewTransform(), NewTransformObject(), onluforsymmetricproblem(), pc_short_string(), pc_string(), pcoptionshandling(), PreprocessedLinearSystemSolution(), PreprocessedProblemSolving(), PreprocessedSolution(), PreprocessorGetContext(), PreprocessorGetIndex(), PreprocessorGetPreservedCategories(), PreprocessorSetPreservedCategories(), PreprocessorsOptionsHandling(), PreprocessorSpecificSetup(), RegisterPreprocessorContext(), ReportEnabledPreprocessors(), Re-

portSysProCallStackState(), RetrieveAllPreprocessorValues(), SalsaTransformIntegrityTest(), sans_partition(), scale_system(), ScreenOutputTab(), ScreenOutputTabLine(), set_blocked_sub_pc(), set_intelligent_scaling(), set_ksp_options(), set_preconditioner_base_matrix(), SetPetscOptionsForPC(), setup_approximation_choices(), setup_distribution_choices(), setup_flipsign_choices(), setup_ksp(), setup_ksp_choices(), setup_pc(), setup_pc_choices(), setup_scaling_choices(), setup_singleton_choices(), singleton_specific_unset(), solve-bycopy(), solvelinear(), specific_approximation_choices(), specific_distribution_choices(), specific_flipsign_choices(), specific_scaling_choices(), specific_singleton_choices(), StartRetrievingAllPreprocessors(), StartRetrievingCurrentPreprocessors(), SuccessorPreprocessor(), SysProComputeQuantity(), SysProDefineCharAnnotation(), SysProDefineIntAnnotation(), SysProFinalize(), SysProFreeQuantities(), SysProInitialize(), SysProLinearInstallCustomKSPMonitor(), SysProPreprocessorEndFunction(), SysproPreprocessorStartFunction(), SysProProblemCloneContext(), SysProProblemDeleteContext(), SysProRemoveQuantity(), SysProRetrieveQuantity(), SysProShowOptions(), SysProTraceMessage(), SystemPreprocessorGetByName(), TabReportActivePreprocessors(), TabReportAllPreprocessors(), TabReportPreprocessors(), TestSuitabilityContext(), TransformCharAnnotationGetIndex(), TransformGetByName(), TransformIntAnnotationGetIndex(), TransformItemDescribeLong(), TransformItemDescribeShort(), TransformItemGetFirstOption(), TransformItemGetNextOption(), TransformItemOptionMark(), TransformItemOptionsUseOnly(), TransformObjectAddOption(), TransformObjectCharAnnotate(), TransformObjectGetByName(), TransformObjectIntAnnotate(), TransformObjectsGetNames(), TransformObjectsMarkAll(), TransformObjectsUnmarkAll(), TransformObjectsUseOnly(), TransformReportEnabled(), unapproximate_system(), undistribute_system(), unscale_system(), unset_ksp(), unset_ksp(), and unset_pc().

19.27 testmat16.c File Reference

Functions

- [CHKERRQ \(ierr\)](#)
- [for \(i=0;i< n;i++\)](#)

Variables

- [ierr](#) = MatCreateSeqAIJ(MPI_COMM_SELF,n,n,3,0,&A)

19.27.1 Function Documentation

19.27.1.1 CHKERRQ (ierr)

19.27.1.2 for ()

Definition at line 6 of file testmat16.c.

References CHKERRQ(), and ierr.

19.27.2 Variable Documentation

19.27.2.1 ierr = MatCreateSeqAIJ(MPI_COMM_SELF,n,n,3,0,&A)

Definition at line 4 of file testmat16.c.

19.28 tracing.c File Reference

```
#include <stdlib.h>
#include <string.h>
#include <stdarg.h>
#include "syspro.h"
```

Functions

- PetscErrorCode [SysProDefaultTrace](#) (void *ctx, const char *fmt, va_list argp)
- PetscErrorCode [SysProDeclareTraceFunction](#) (PetscErrorCode(*fn)(void *, const char *, va_list))
- PetscErrorCode [SysProDeclareTraceContext](#) (void *ctx)
- PetscErrorCode [SysProTraceMessage](#) (const char *fmt,...)
- PetscErrorCode [SysProHasTrace](#) (PetscTruth *flg)

Variables

- static PetscErrorCode(* [sysprotrace](#))(void *, const char *fmt, va_list) = NULL
- static size_t [sysprotracectx](#) = (size_t)NULL

19.28.1 Function Documentation

19.28.1.1 PetscErrorCode SysProDeclareTraceContext (void * ctx)

Definition at line 77 of file tracing.c.

References sysprotracectx.

19.28.1.2 `PetscErrorCode SysProDeclareTraceFunction (PetscErrorCode*)(void *, const char *, va_list) fn`

Specify a trace function.

The trace function has a prototype

```
PetscErrorCode tracefunction(void*,char*,va_list)
```

which means that it has an arbitrary number of arguments, much like `printf`. The first argument is a context, which can be set by [SysProDeclareTraceContext\(\)](#).

Here is an example of how you would write a trace function:

```
#include <stdarg.h>
PetscErrorCode tracefunction(void *ctx,char *fmt,va_list argp)
{
    char *prefix = (char*)ctx;
    PetscFunctionBegin;
    printf("%s ",prefix);
    vprintf(fmt, argp);
    PetscFunctionReturn(0);
}
```

Consult `string.h` (probably in `/usr/include`) to see which "v" versions of `printf` are available.

There is a default trace function [SysProDefaultTrace\(\)](#).

You can undeclare a trace function by passing `NULL`.

See also [SysProTraceMessage\(\)](#).

Definition at line 64 of file `tracing.c`.

References `sysprotrace`.

Referenced by `main()`.

19.28.1.3 `PetscErrorCode SysProDefaultTrace (void * ctx, const char * fmt, va_list argp)`

Definition at line 22 of file `tracing.c`.

Referenced by `main()`.

19.28.1.4 `PetscErrorCode SysProHasTrace (PetscTruth * flg)`

Test whether a trace function has been declared; see [SysProDeclareTraceFunction\(\)](#). Normally you would use [SysProTraceMessage\(\)](#) which performs this test internally, but this function can be useful if a large amount of processing has to be performed to construct the trace message to begin with.

Definition at line 109 of file `tracing.c`.

References `sysprotrace`.

Referenced by `ReportEnabledPreprocessors()`, `ReportSysProCallStackState()`, `ScreenOutputTab()`, and `ScreenOutputTabLine()`.

19.28.1.5 `PetscErrorCode SysProTraceMessage (const char * fmt, ...)`

This function prints a trace message if a trace function has been declared; see [SysProDeclareTraceFunction\(\)](#).

Definition at line 89 of file `tracing.c`.

References `CHKERRQ()`, `ierr`, `sysprotrace`, and `sysprotracectx`.

Referenced by `adder()`, `ChooseFirstTransform()`, `PreprocessedSolution()`, `ReportEnabledPreprocessors()`, `ReportSysProCallStackState()`, `ScreenOutputTab()`, `ScreenOutputTabLine()`, and `solvebycopy()`.

19.28.2 Variable Documentation

19.28.2.1 `PetscErrorCode(* sysprotrace)(void *, const char *fmt, va_list) = NULL` [static]

Definition at line 17 of file `tracing.c`.

Referenced by `SysProDeclareTraceFunction()`, `SysProHasTrace()`, and `SysProTraceMessage()`.

19.28.2.2 `size_t sysprotracectx = (size_t)NULL` [static]

Definition at line 18 of file `tracing.c`.

Referenced by `SysProDeclareTraceContext()`, and `SysProTraceMessage()`.

19.29 transform.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "petsc.h"
#include "sysprotransform.h"
#include "syspro_impl.h"
```

Data Structures

- struct [SalsaTransformObject_](#)

Defines

- #define [TFINC](#) 20
- #define [STRDUP](#)(a) ((a) ? strdup(a) : NULL)

Functions

- PetscErrorCode [NewTransform](#) (const char *name, [SalsaTransform](#) *tf)
- PetscErrorCode [DeregisterTransform](#) ([SalsaTransform](#) tf)
- PetscErrorCode [TransformGetName](#) ([SalsaTransform](#) tf, const char **name)
- PetscErrorCode [TransformGetObjects](#) ([SalsaTransform](#) tf, int *n, [SalsaTransformObject](#) **objs)
- PetscErrorCode [NewTransformObject](#) (const char *transform, const char *name, [SalsaTransformObject](#) *to)
- PetscErrorCode [FreeTransformObject](#) ([SalsaTransformObject](#) tf)
- PetscErrorCode [TransformObjectGetName](#) ([SalsaTransformObject](#) tf, const char **name)
- PetscErrorCode [TransformObjectSetExplanation](#) ([SalsaTransformObject](#) tf, const char *x)
- PetscErrorCode [TransformObjectSetSuitabilityFunction](#) ([SalsaTransformObject](#) tf, void *sctx, PetscErrorCode(*)(NumericalProblem, void *, [SuitabilityValue](#) *))
- PetscErrorCode [TransformObjectGetSuitabilityFunction](#) ([SalsaTransformObject](#) tf, void **sctx, PetscErrorCode(**f)(NumericalProblem, void *, [SuitabilityValue](#) *))
- PetscErrorCode [TransformObjectGetTransformName](#) ([SalsaTransformObject](#) tf, char **name)
- PetscErrorCode [TransformObjectGetByName](#) (const char *trans, const char *name, [SalsaTransformObject](#) *tf)
- PetscErrorCode [TransformObjectsGetNames](#) ([SalsaTransform](#) tf, const char ***names)
- PetscErrorCode [SysProDefineCharAnnotation](#) (const char *transform, const char *ann)
- PetscErrorCode [TransformCharAnnotationGetIndex](#) ([SalsaTransform](#) tf, const char *ann, int *idx, PetscTruth *flg)
- PetscErrorCode [SysProDefineIntAnnotation](#) (const char *transform, const char *ann)
- PetscErrorCode [TransformIntAnnotationGetIndex](#) ([SalsaTransform](#) tf, const char *ann, int *idx, PetscTruth *flg)
- PetscErrorCode [TransformObjectMark](#) ([SalsaTransformObject](#) tf)
- PetscErrorCode [TransformObjectUnmark](#) ([SalsaTransformObject](#) tf)
- PetscErrorCode [TransformObjectsMarkAll](#) ([SalsaTransform](#) tf)
- PetscErrorCode [TransformObjectsUnmarkAll](#) ([SalsaTransform](#) tf)
- PetscErrorCode [TransformObjectGetMark](#) ([SalsaTransformObject](#) tf, int *m)
- PetscErrorCode [TransformGetNUnmarked](#) ([SalsaTransform](#) tf, int *n)
- PetscErrorCode [PreprocessorSaveAprioriSelection](#) ([SystemPreprocessor](#) pp)

- PetscErrorCode [PreprocessorApplyAprioriSelection](#) ([SystemPreprocessor](#) pp)
- PetscErrorCode [TransformObjectsUseOnly](#) ([SalsaTransform](#) tf, const char *list)
- PetscErrorCode [TransformGetNextUnmarkedItem](#) ([SalsaTransform](#) tf, const char *old, [SalsaTransformObject](#) *snew, PetscTruth *f)
- PetscErrorCode [TransformObjectDefineOption](#) ([SalsaTransformObject](#) tf, const char *opt)
- PetscErrorCode [TransformObjectAddOption](#) ([SalsaTransformObject](#) tf, int v)
- PetscErrorCode [TransformObjectAddOptionExplanation](#) ([SalsaTransformObject](#) tf, int opt, const char *ex)
- PetscErrorCode [TransformItemOptionsUseOnly](#) ([SalsaTransformObject](#) tf, const char *opt)
- PetscErrorCode [TransformItemGetFirstOption](#) (const char *tf, const char *it, int *v, PetscTruth *f)
- PetscErrorCode [TransformItemGetNextOption](#) (const char *tf, const char *it, int *v, PetscTruth *f)
- PetscErrorCode [TransformItemOptionMark](#) ([SalsaTransform](#) tf, const char *it, int o)
- PetscErrorCode [TransformObjectCharAnnotate](#) ([SalsaTransformObject](#) tf, const char *an, const char *v)
- PetscErrorCode [TransformObjectIntAnnotate](#) ([SalsaTransformObject](#) tf, const char *an, int v)
- PetscErrorCode [TransformObjectGetIntAnnotation](#) ([SalsaTransformObject](#) tf, const char *an, int *v, PetscTruth *f)
- PetscErrorCode [TransformReportTeXTable](#) ([SalsaTransform](#) tf, FILE *f)
- PetscErrorCode [TransformReportEnabled](#) ([SalsaTransform](#) tf, const char **rs)
- PetscErrorCode [TransformItemDescribeShort](#) ([SalsaTransform](#) tf, char *it, int opt, char **s)
- PetscErrorCode [TransformItemDescribeLong](#) ([SalsaTransform](#) tf, char *it, int opt, char **s)
- PetscErrorCode [TransformSetUserChoices](#) ([SalsaTransform](#) tf, PetscTruth ch)
- PetscErrorCode [TransformGetUserChoices](#) ([SalsaTransform](#) tf, PetscTruth *ch)
- PetscErrorCode [SetSuitabilityContextTester](#) ([SalsaTransform](#) tf, PetscErrorCode(*)(void *))
- PetscErrorCode [TestSuitabilityContext](#) ([SalsaTransform](#) tf, void *ctx)
- PetscErrorCode [SalsaTransformIntegrityTest](#) ([SalsaTransform](#) tf)

19.29.1 Define Documentation

19.29.1.1 #define STRDUP(a) ((a) ? strdup(a) : NULL)

Definition at line 556 of file transform.c.

19.29.1.2 `#define TFINC 20`

Definition at line 22 of file transform.c.

Referenced by `NewTransform()`, `SysProDefineCharAnnotation()`, `SysProDefineIntAnnotation()`, `TransformObjectAddOption()`, `TransformObjectCharAnnotate()`, and `TransformObjectIntAnnotate()`.

19.29.2 Function Documentation

19.29.2.1 `PetscErrorCode DeregisterTransform (SalsaTransform tf)`

Definition at line 63 of file transform.c.

References `SalsaTransform_::annotations_c`, `SalsaTransform_::annotations_i`, `SalsaTransform_::aprioriselection`, `CHECKVALIDTRANSFORM`, `CHKERRQ()`, `FreeTransformObject()`, `ierr`, `SalsaTransform_::n_objects`, and `SalsaTransform_::transformobjects`.

Referenced by `SysProFinalize()`.

19.29.2.2 `PetscErrorCode FreeTransformObject (SalsaTransformObject tf)`

Definition at line 127 of file transform.c.

References `SalsaTransformObject_::annotate_c`, `SalsaTransformObject_::annotate_i`, `CHECKVALIDTRANSFORMOBJECT`, `CHKERRQ()`, `ierr`, `SalsaTransformObject_::n_options`, `SalsaTransformObject_::name`, `SalsaTransformObject_::optionexplanation`, `SalsaTransformObject_::options`, and `SalsaTransformObject_::options_marked`.

Referenced by `DeregisterTransform()`.

19.29.2.3 `PetscErrorCode NewTransform (const char * name, SalsaTransform * tf)`

Define a new class of preprocessors, for instance scaling or permutation.

Definition at line 45 of file transform.c.

References `SalsaTransform_::alloc_objects`, `SalsaTransform_::aprioriselection`, `CHKERRQ()`, `SalsaTransform_::cookie`, `ierr`, `SalsaTransform_::n_objects`, `SalsaTransform_::name`, `TFINC`, `TRANSFORMCOOKIE`, and `SalsaTransform_::transformobjects`.

Referenced by `DeclarePreprocessor()`.

19.29.2.4 `PetscErrorCode NewTransformObject (const char * transform, const char * name, SalsaTransformObject * to)`

Create a transform object specified by `name` for the preprocessor class `transform`. The `to` parameter can be NULL if no further specifications of the object are needed, in which case this only registers the name.

Definition at line 109 of file transform.c.

References `SalsaTransform_::alloc_objects`, `CHKERRQ()`, `SalsaTransformObject_::cookie`, `ierr`, `SalsaTransform_::n_objects`, `SalsaTransformObject_::name`, `SalsaTransformObject_::transform`, `TransformGetByName()`, `TRANSFORMOBJECTCOOKIE`, and `SalsaTransform_::transformobjects`.

Referenced by `declareadders()`, `setup_approximation_choices()`, `setup_distribution_choices()`, `setup_flipsign_choices()`, `setup_ksp_choices()`, `setup_pc_choices()`, `setup_scaling_choices()`, and `setup_singleton_choices()`.

19.29.2.5 PetscErrorCode PreprocessorApplyAprioriSelection (*SystemPreprocessor pp*)

Definition at line 475 of file `transform.c`.

References `SalsaTransform_::aprioriselection`, `SalsaTransformObject_::marked`, `SalsaTransform_::n_objects`, `SystemPreprocessor_::transform`, and `SalsaTransform_::transformobjects`.

Referenced by `PreprocessorSpecificSetup()`.

19.29.2.6 PetscErrorCode PreprocessorSaveAprioriSelection (*SystemPreprocessor pp*)

Definition at line 461 of file `transform.c`.

References `SalsaTransform_::aprioriselection`, `CHECKVALIDTRANSFORMOBJECT`, `SalsaTransformObject_::marked`, `SalsaTransform_::n_objects`, `SystemPreprocessor_::transform`, and `SalsaTransform_::transformobjects`.

Referenced by `PreprocessorsOptionsHandling()`.

19.29.2.7 PetscErrorCode SalsaTransformIntegrityTest (*SalsaTransform tf*)

Definition at line 907 of file `transform.c`.

References `CHKERRQ()`, `ierr`, `SalsaTransform_::n_objects`, `SalsaTransform_::suitabilityctxtester`, `TestSuitabilityContext()`, `TransformObjectGetSuitabilityFunction()`, and `SalsaTransform_::transformobjects`.

19.29.2.8 PetscErrorCode SetSuitabilityContextTester (*SalsaTransform tf*, PetscErrorCode(*)(void *) f)

Definition at line 884 of file `transform.c`.

References `CHECKVALIDTRANSFORM`, and `SalsaTransform_::suitabilityctxtester`.

Referenced by `setup_ksp_choices()`.

19.29.2.9 PetscErrorCode SysProDefineCharAnnotation (*const char * transform*, *const char * ann*)

Define a character string annotation for a transform. The index of this annotation can be retrieved with [TransformCharAnnotationGetIndex\(\)](#). The actual annotation can be found with [TransformItemGetCharAnnotation\(\)](#).

Definition at line 276 of file transform.c.

References `SalsaTransform_::annotations_c`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_annotate_c`, `TFINC`, and `TransformGetByName()`.

Referenced by `setup_ksp_choices()`.

19.29.2.10 `PetscErrorCode SysProDefineIntAnnotation (const char * transform, const char * ann)`

Define a integer string annotation for a transform. The index of this annotation can be retrieved with [TransformIntAnnotationGetIndex\(\)](#). The actual annotation can be found with [TransformItemGetIntAnnotation\(\)](#).

Definition at line 332 of file transform.c.

References `SalsaTransform_::annotations_i`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_annotate_i`, `TFINC`, and `TransformGetByName()`.

Referenced by `setup_distribution_choices()`, `setup_ksp_choices()`, `setup_pc_choices()`, and `setup_scaling_choices()`.

19.29.2.11 `PetscErrorCode TestSuitabilityContext (SalsaTransform tf, void * ctx)`

Definition at line 894 of file transform.c.

References `CHECKVALIDTRANSFORM0`, `CHKERRQ()`, `ierr`, and `SalsaTransform_::suitabilityctxtester`.

Referenced by `PreprocessorSpecificSetup()`, and `SalsaTransformIntegrityTest()`.

19.29.2.12 `PetscErrorCode TransformCharAnnotationGetIndex (SalsaTransform tf, const char * ann, int * idx, PetscTruth * flg)`

Definition at line 311 of file transform.c.

References `SalsaTransform_::annotations_c`, `CHECKVALIDTRANSFORM`, `CHKERRQ()`, `ierr`, and `SalsaTransform_::n_annotate_c`.

Referenced by `TransformObjectCharAnnotate()`.

19.29.2.13 `PetscErrorCode TransformGetName (SalsaTransform tf, const char ** name)`

Definition at line 81 of file transform.c.

References `CHECKVALIDTRANSFORM`, and `SalsaTransform_::name`.

19.29.2.14 `PetscErrorCode TransformGetNextUnmarkedItem (SalsaTransform tf, const char * old, SalsaTransformObject * snew, PetscTruth * f)`

Find the next unmarked value; if `old` is NULL, the first first unmarked value is given, otherwise the first one after a match with `old`.

Definition at line 527 of file transform.c.

References CHECKVALIDTRANSFORM, CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransform_::n_objects, SalsaTransformObject_::name, SalsaTransform_::transformobjects, and TRUTH.

Referenced by ChooseFirstTransform(), PreprocessedSolution(), and PreprocessorsOptionsHandling().

19.29.2.15 PetscErrorCode TransformGetNUnmarked (SalsaTransform *tf*, int * *n*)

Definition at line 448 of file transform.c.

References CHECKVALIDTRANSFORM, SalsaTransformObject_::marked, SalsaTransform_::n_objects, and SalsaTransform_::transformobjects.

Referenced by PreprocessorsOptionsHandling().

19.29.2.16 PetscErrorCode TransformGetObjects (SalsaTransform *tf*, int * *n*, SalsaTransformObject ** *objs*)

Definition at line 92 of file transform.c.

References CHECKVALIDTRANSFORM, SalsaTransform_::n_objects, and SalsaTransform_::transformobjects.

Referenced by disable_ksp(), specific_distribution_choices(), and specific_scaling_choices().

19.29.2.17 PetscErrorCode TransformGetUserChoices (SalsaTransform *tf*, PetscTruth * *ch*)

Query whether the user has ordained which choice(s) to take for a specific transform. The values of these choices are implicitly given by disabling some transforms.

See also [TransformSetUserChoices\(\)](#), [TransformObjectsUseOnly\(\)](#).

Definition at line 874 of file transform.c.

References CHECKVALIDTRANSFORM, and SalsaTransform_::userchoices.

Referenced by PreprocessedSolution().

19.29.2.18 PetscErrorCode TransformIntAnnotationGetIndex (SalsaTransform *tf*, const char * *ann*, int * *idx*, PetscTruth * *flg*)

Definition at line 365 of file transform.c.

References SalsaTransform_::annotations_i, CHECKVALIDTRANSFORM, CHKERRQ(), ierr, and SalsaTransform_::n_annotate_i.

Referenced by TransformObjectIntAnnotate().

19.29.2.19 `PetscErrorCode TransformItemDescribeLong (SalsaTransform tf, char * it, int opt, char ** s)`

Definition at line 821 of file transform.c.

References CHECKVALIDTRANSFORM, CHKERRQ(), SalsaTransformObject_::explanation, ierr, SalsaTransform_::name, SalsaTransformObject_::options, and TransformObjectGetByName().

19.29.2.20 `PetscErrorCode TransformItemDescribeShort (SalsaTransform tf, char * it, int opt, char ** s)`

Definition at line 802 of file transform.c.

References CHKERRQ(), ierr, SalsaTransformObject_::n_options, SalsaTransformObject_::name, SalsaTransform_::name, and TransformObjectGetByName().

19.29.2.21 `PetscErrorCode TransformItemGetFirstOption (const char * tf, const char * it, int * v, PetscTruth * f)`

Definition at line 630 of file transform.c.

References CHKERRQ(), ierr, SalsaTransformObject_::n_options, SalsaTransformObject_::options, SalsaTransformObject_::options_marked, and TransformObjectGetByName().

Referenced by PreprocessedSolution().

19.29.2.22 `PetscErrorCode TransformItemGetNextOption (const char * tf, const char * it, int * v, PetscTruth * f)`

Definition at line 654 of file transform.c.

References CHKERRQ(), ierr, SalsaTransformObject_::n_options, SalsaTransformObject_::options, SalsaTransformObject_::options_marked, and TransformObjectGetByName().

Referenced by PreprocessedSolution().

19.29.2.23 `PetscErrorCode TransformItemOptionMark (SalsaTransform tf, const char * it, int o)`

Definition at line 678 of file transform.c.

References CHECKVALIDTRANSFORM, CHKERRQ(), ierr, SalsaTransformObject_::marked, SalsaTransformObject_::n_options, SalsaTransform_::name, SalsaTransformObject_::options, SalsaTransformObject_::options_marked, and TransformObjectGetByName().

19.29.2.24 `PetscErrorCode TransformItemOptionsUseOnly (SalsaTransformObject tf, const char * opt)`

Definition at line 611 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransformObject_::n_options, and TransformObjectAddOption().

Referenced by PreprocessorsOptionsHandling().

19.29.2.25 PetscErrorCode TransformObjectAddOption (SalsaTransformObject *tf*, int *v*)

Definition at line 571 of file transform.c.

References SalsaTransformObject_::alloc_options, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransformObject_::n_options, SalsaTransformObject_::name, SalsaTransformObject_::optionexplanation, SalsaTransformObject_::options, SalsaTransformObject_::options_marked, and TFINC.

Referenced by declareadders(), setup_ksp_choices(), setup_pc_choices(), and TransformItemOptionsUseOnly().

19.29.2.26 PetscErrorCode TransformObjectAddOptionExplanation (SalsaTransformObject *tf*, int *opt*, const char * *ex*)

Definition at line 594 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::n_options, SalsaTransformObject_::optionexplanation, and SalsaTransformObject_::options.

Referenced by setup_pc_choices().

19.29.2.27 PetscErrorCode TransformObjectCharAnnotate (SalsaTransformObject *tf*, const char * *an*, const char * *v*)

Definition at line 694 of file transform.c.

References SalsaTransformObject_::alloc_annotate_c, SalsaTransformObject_::annotate_c, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, TFINC, SalsaTransformObject_::transform, and TransformCharAnnotationGetIndex().

19.29.2.28 PetscErrorCode TransformObjectDefineOption (SalsaTransformObject *tf*, const char * *opt*)

Definition at line 561 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, and SalsaTransformObject_::option.

Referenced by declareadders(), setup_ksp_choices(), and setup_pc_choices().

19.29.2.29 PetscErrorCode TransformObjectGetByName (const char * *trans*, const char * *name*, SalsaTransformObject * *tf*)

Definition at line 233 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, SalsaTransform_::n_objects, SalsaTransformObject_::name, TransformGetByName(), and SalsaTransform_

::transformobjects.

Referenced by `disable_ksp()`, `disable_pcs()`, `is_gmres_method()`, `pcoptionshandling()`, `setup_ksp()`, `specific_approximation_choices()`, `specific_flipsign_choices()`, `specific_singleton_choices()`, `TransformItemDescribeLong()`, `TransformItemDescribeShort()`, `TransformItemGetFirstOption()`, `TransformItemGetNextOption()`, `TransformItemOptionMark()`, `TransformObjectsUseOnly()`, and `unset_ksp()`.

19.29.2.30 `PetscErrorCode TransformObjectGetIntAnnotation (SalsaTransformObject tf, const char * an, int * v, PetscTruth * f)`

Definition at line 738 of file `transform.c`.

References `SalsaTransformObject::annotate_i`, `SalsaTransform::annotations_i`, `CHECKVALIDTRANSFORMOBJECT`, `SalsaTransform::n_annotate_i`, `SalsaTransformObject::transform`, and `TRUTH`.

Referenced by `disable_ksp()`, `is_gmres_method()`, `pcoptionshandling()`, `set_ksp_options()`, `specific_distribution_choices()`, and `specific_scaling_choices()`.

19.29.2.31 `PetscErrorCode TransformObjectGetMark (SalsaTransformObject tf, int * m)`

Definition at line 438 of file `transform.c`.

References `CHECKVALIDTRANSFORMOBJECT`, and `SalsaTransformObject::marked`.

Referenced by `TransformReportEnabled()`.

19.29.2.32 `PetscErrorCode TransformObjectGetName (SalsaTransformObject tf, const char ** name)`

Definition at line 148 of file `transform.c`.

References `CHECKVALIDTRANSFORMOBJECT`, and `SalsaTransformObject::name`.

Referenced by `ChooseFirstTransform()`, `disable_ksp()`, `PreprocessedSolution()`, `PreprocessorsOptionsHandling()`, `PreprocessorSpecificSetup()`, and `set_ksp_options()`.

19.29.2.33 `PetscErrorCode TransformObjectGetSuitabilityFunction (SalsaTransformObject tf, void ** sctx, PetscErrorCode(**)(NumericalProblem, void *, SuitabilityValue *) f)`

Retrieve the suitability function and context; see [Suitability functions](#). Both arguments can be null.

See also [TransformObjectSetSuitabilityFunction\(\)](#).

Definition at line 210 of file `transform.c`.

References `CHECKVALIDTRANSFORMOBJECT`, `SalsaTransformObject::suitabilityctx`, and `SalsaTransformObject::suitabilityfunction`.

Referenced by PreprocessorSpecificSetup(), SalsaTransformIntegrityTest(), and unset_ksp().

19.29.2.34 `PetscErrorCode TransformObjectGetTransformName (SalsaTransformObject tf, char ** name)`

Definition at line 222 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransform_::name, and SalsaTransformObject_::transform.

19.29.2.35 `PetscErrorCode TransformObjectIntAnnotate (SalsaTransformObject tf, const char * an, int v)`

Definition at line 716 of file transform.c.

References SalsaTransformObject_::alloc_annotate_i, SalsaTransformObject_::annotate_i, CHECKVALIDTRANSFORMOBJECT, CHKERRQ(), ierr, TFINC, SalsaTransformObject_::transform, and TransformIntAnnotationGetIndex().

Referenced by setup_distribution_choices(), setup_ksp_choices(), setup_pc_choices(), and setup_scaling_choices().

19.29.2.36 `PetscErrorCode TransformObjectMark (SalsaTransformObject tf)`

Definition at line 382 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransformObject_::n_options, and SalsaTransformObject_::options_marked.

Referenced by disable_ksp(), disable_pcs(), pcoptionshandling(), PreprocessorSpecificSetup(), specific_approximation_choices(), specific_distribution_choices(), specific_flipsign_choices(), specific_scaling_choices(), specific_singleton_choices(), TransformObjectsMarkAll(), and TransformObjectsUseOnly().

19.29.2.37 `PetscErrorCode TransformObjectSetExplanation (SalsaTransformObject tf, const char * x)`

Definition at line 159 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, and SalsaTransformObject_::explanation.

Referenced by setup_approximation_choices(), setup_distribution_choices(), setup_flipsign_choices(), setup_ksp_choices(), setup_pc_choices(), setup_scaling_choices(), and setup_singleton_choices().

19.29.2.38 `PetscErrorCode TransformObjectSetSuitabilityFunction (SalsaTransformObject tf, void * ctx, PetscErrorCode(*)(NumericalProblem, void *, SuitabilityValue *) f)`

Set the suitability function; see [Suitability functions](#).

See also [TransformObjectGetSuitabilityFunction\(\)](#).

Definition at line 192 of file transform.c.

References `CHECKVALIDTRANSFORMOBJECT`, `SalsaTransformObject_::suitabilityctx`, and `SalsaTransformObject_::suitabilityfunction`.

Referenced by `setup_ksp_choices()`.

19.29.2.39 `PetscErrorCode TransformObjectsGetNames (SalsaTransform tf, const char *** names)`

Get the names of all declared transformobjects. An array is allocated for the names, which needs to be `PetscFree()`'d.

Definition at line 255 of file transform.c.

References `CHECKVALIDTRANSFORM`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_objects`, `SalsaTransformObject_::name`, and `SalsaTransform_::transformobjects`.

Referenced by `ContinueRetrievingAllPreprocessors()`, and `TransformReportEnabled()`.

19.29.2.40 `PetscErrorCode TransformObjectsMarkAll (SalsaTransform tf)`

Definition at line 408 of file transform.c.

References `CHECKVALIDTRANSFORM`, `CHECKVALIDTRANSFORMOBJECT`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_objects`, `TransformObjectMark()`, and `SalsaTransform_::transformobjects`.

Referenced by `TransformObjectsUseOnly()`.

19.29.2.41 `PetscErrorCode TransformObjectsUnmarkAll (SalsaTransform tf)`

Definition at line 423 of file transform.c.

References `CHECKVALIDTRANSFORM`, `CHECKVALIDTRANSFORMOBJECT`, `CHKERRQ()`, `ierr`, `SalsaTransform_::n_objects`, `SalsaTransform_::transformobjects`, and `TransformObjectUnmark()`.

Referenced by `disable_ksp()`, and `TransformObjectsUseOnly()`.

19.29.2.42 `PetscErrorCode TransformObjectsUseOnly (SalsaTransform tf, const char * list)`

Mark a list of names as to be used.

Cases:

- `"name1, name2, name3"` : all other names are marked as not to be used
- `"not, name1, name2"` : all names will be used, except for the ones listed

Definition at line 494 of file transform.c.

References CHECKVALIDTRANSFORM, CHKERRQ(), ierr, SalsaTransform_::name, TransformObjectGetByName(), TransformObjectMark(), TransformObjectsMarkAll(), TransformObjectsUnmarkAll(), and TransformObjectUnmark().

Referenced by PreprocessorsOptionsHandling().

19.29.2.43 PetscErrorCode TransformObjectUnmark (SalsaTransformObject *tf*)

Definition at line 395 of file transform.c.

References CHECKVALIDTRANSFORMOBJECT, SalsaTransformObject_::marked, SalsaTransformObject_::n_options, and SalsaTransformObject_::options_marked.

Referenced by TransformObjectsUnmarkAll(), and TransformObjectsUseOnly().

19.29.2.44 PetscErrorCode TransformReportEnabled (SalsaTransform *tf*, const char ** *rs*)

Definition at line 779 of file transform.c.

References CHKERRQ(), ierr, SalsaTransform_::n_objects, TransformObjectGetMark(), SalsaTransform_::transformobjects, and TransformObjectsGetNames().

Referenced by ReportEnabledPreprocessors().

19.29.2.45 PetscErrorCode TransformReportTeXTable (SalsaTransform *tf*, FILE * *f*)

Definition at line 756 of file transform.c.

References SalsaTransformObject_::explanation, SalsaTransform_::n_objects, SalsaTransformObject_::n_options, SalsaTransformObject_::name, SalsaTransformObject_::options, and SalsaTransform_::transformobjects.

19.29.2.46 PetscErrorCode TransformSetUserChoices (SalsaTransform *tf*, PetscTruth *ch*)

Declare that the user has ordained which choice(s) to take for a specific transform. The values of these choices are implicitly given by disabling some transforms.

See also [TransformGetUserChoices\(\)](#), [TransformObjectsUseOnly\(\)](#).

Definition at line 858 of file transform.c.

References CHECKVALIDTRANSFORM, and SalsaTransform_::userchoices.

Referenced by PreprocessorsOptionsHandling().

19.30 u1.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
```

Functions

- static PetscErrorCode [copy](#) ([NumericalProblem](#) problem, void *dum, [NumericalSolution](#) *rsol)
- int [main](#) (int argc, char **argv)

19.30.1 Function Documentation

19.30.1.1 static PetscErrorCode [copy](#) ([NumericalProblem](#) *problem*, void * *dum*, [NumericalSolution](#) * *rsol*) [static]

Definition at line 7 of file u1.c.

References [CHKERRQ\(\)](#), and [ierr](#).

Referenced by [main\(\)](#).

19.30.1.2 int [main](#) (int *argc*, char ** *argv*)

Definition at line 17 of file u1.c.

References [CHKERRQ\(\)](#), [copy\(\)](#), [ierr](#), [SysProDeclareFunctions\(\)](#), [SysProFinalize\(\)](#), and [SysProInitialize\(\)](#).

19.31 u12.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "sysprolinear.h"
#include "testmat.c"
```

Functions

- static PetscErrorCode [solvelinear](#) ([NumericalProblem](#) problem, void *dum, [NumericalSolution](#) *rsol)
- int [main](#) (int argc, char **argv)

19.31.1 Function Documentation

19.31.1.1 int [main](#) (int *argc*, char ** *argv*)

Definition at line 28 of file u12.c.

References CHKERRQ(), CreateLinearSystem(), ierr, LinearSystemSetParts(), PreprocessedProblemSolving(), solvelinear(), SysProDeclareFunctions(), SysProFinalize(), and SysProInitialize().

19.31.1.2 static PetscErrorCode solvelinear (NumericalProblem *problem*, void * *dum*, NumericalSolution * *rsol*) [static]

Definition at line 13 of file u12.c.

References CHKERRQ(), ierr, and LinearSystemGetParts().

Referenced by main().

19.32 u13.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "testmat.c"
```

Functions

- static PetscErrorCode [create_solver](#) (NumericalProblem prob, void **ctx)
- static PetscErrorCode [destroy_solver](#) (void *ctx)
- static PetscErrorCode [setup_pc_choices](#) ()
- static PetscErrorCode [setup_pc](#) (const char *type, int pcv, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem *outproblem, void *gctx, void **ctx, PetscTruth *success)
- static PetscErrorCode [solvelinear](#) (NumericalProblem problem, void *dum, NumericalSolution *rsol)
- static PetscErrorCode [destroysolution](#) (NumericalSolution sol)
- int [main](#) (int argc, char **argv)

19.32.1 Function Documentation

19.32.1.1 static PetscErrorCode create_solver (NumericalProblem *prob*, void ** *ctx*) [static]

Create a solver and install a monitor that dynamically increases the maximum number of iterations.

Definition at line 20 of file u13.c.

References CHKERRQ(), ierr, and NumericalProblemGetComm().

Referenced by main().

19.32.1.2 static PetscErrorCode destroy_solver (void * ctx) [static]

Definition at line 32 of file u13.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.32.1.3 static PetscErrorCode destroysolution (NumericalSolution sol) [static]

Definition at line 124 of file u13.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.32.1.4 int main (int argc, char ** argv)

Definition at line 134 of file u13.c.

References CHKERRQ(), create_solver(), CreateLinearSystem(), DeclarePreprocessor(), destroy_solver(), destroysolution(), ierr, LinearSystemSetParts(), Preprocessed-ProblemSolving(), PreprocessorsOptionsHandling(), setup_pc(), setup_pc_choices(), solve-linear(), SysProDeclareFunctions(), SysProDeclareTraceFunction(), SysProDefaultTrace(), SysProFinalize(), and SysProInitialize().

19.32.1.5 static PetscErrorCode setup_pc (const char * type, int pcv, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem * outproblem, void * gctx, void ** ctx, PetscTruth * success) [static]

Definition at line 56 of file u13.c.

References CHKERRQ(), ierr, and LinearSystemGetParts().

Referenced by main().

19.32.1.6 static PetscErrorCode setup_pc_choices () [static]

Definition at line 43 of file u13.c.

References CHKERRQ(), ierr, and NewTransformObject().

Referenced by main().

19.32.1.7 static PetscErrorCode solvelinear (NumericalProblem problem, void * dum, NumericalSolution * rsol) [static]

Definition at line 102 of file u13.c.

References CHKERRQ(), ierr, and LinearSystemGetParts().

Referenced by main().

19.33 u14.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "testmat.c"
```

Functions

- static PetscErrorCode [create_solver](#) ([NumericalProblem](#) prob, void **ctx)
- static PetscErrorCode [destroy_solver](#) (void *ctx)
- static PetscErrorCode [setup_pc_choices](#) ()
- static PetscErrorCode [setup_pc](#) (const char *type, int pcv, PetscTruth overwrite, [NumericalProblem](#) inproblem, [NumericalProblem](#) *outproblem, void *gctx, void **ctx, PetscTruth *success)
- static PetscErrorCode [unset_pc](#) (const char *type, PetscTruth overwrite, void *ctx, void *gctx, [NumericalProblem](#) thisproblem, [NumericalProblem](#) upproblem, [NumericalSolution](#) old, [NumericalSolution](#) nnew)
- static PetscErrorCode [solvelinear](#) ([NumericalProblem](#) problem, void *dum, [NumericalSolution](#) *rsol)
- int [main](#) (int argc, char **argv)

19.33.1 Function Documentation

19.33.1.1 static PetscErrorCode [create_solver](#) ([NumericalProblem](#) *prob*, void ** *ctx*)
[static]

Create a solver and install a monitor that dynamically increases the maximum number of iterations.

Definition at line 20 of file u14.c.

References CHKERRQ(), ierr, and [NumericalProblemGetComm](#)().

Referenced by [main](#)().

19.33.1.2 static PetscErrorCode destroy_solver (void * ctx) [static]

Definition at line 32 of file u14.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.33.1.3 int main (int argc, char ** argv)

Definition at line 128 of file u14.c.

References CHKERRQ(), create_solver(), CreateLinearSystem(), DeclarePreprocessor(), DeclareScalingPreprocessor(), destroy_solver(), ierr, LinearCreateNumericalSolution(), LinearDeleteNumericalProblem(), LinearDeleteNumericalSolution(), LinearSolutionGetVector(), LinearSystemSetParts(), PreprocessedProblemSolving(), PreprocessorsOptionsHandling(), setup_pc(), setup_pc_choices(), solvelinear(), SysProDeclareFunctions(), SysProDeclareTraceFunction(), SysProDefaultTrace(), SysProFinalize(), and SysProInitialize().

19.33.1.4 static PetscErrorCode setup_pc (const char * type, int pcv, PetscTruth overwrite, NumericalProblem inproblem, NumericalProblem * outproblem, void * gctx, void ** ctx, PetscTruth * success) [static]

Definition at line 56 of file u14.c.

References CHKERRQ(), ierr, and LinearSystemGetParts().

Referenced by main().

19.33.1.5 static PetscErrorCode setup_pc_choices () [static]

Definition at line 43 of file u14.c.

References CHKERRQ(), ierr, and NewTransformObject().

Referenced by main().

19.33.1.6 static PetscErrorCode solvelinear (NumericalProblem problem, void * dum, NumericalSolution * rsol) [static]

Definition at line 107 of file u14.c.

References CHKERRQ(), ierr, LinearCreateNumericalSolution(), LinearSolutionSetVector(), and LinearSystemGetParts().

Referenced by main().

19.33.1.7 static PetscErrorCode unset_pc (const char * *type*, PetscTruth *overwrite*, void * *ctx*, void * *gctx*, NumericalProblem *thisproblem*, NumericalProblem *upproblem*, NumericalSolution *old*, NumericalSolution *nnew*) [static]

Definition at line 84 of file u14.c.

References CHKERRQ(), ierr, and LinearSolutionCopy().

19.34 u15.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "anamodsalsamodules.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "anamod.h"
#include "nmd.h"
#include "u1516main.c"
```

Defines

- #define MATMAKE "testmat.c"

19.34.1 Define Documentation

19.34.1.1 #define MATMAKE "testmat.c"

Definition at line 9 of file u15.c.

19.35 u16.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "anamodsalsamodules.h"
#include "sysprotransform.h"
#include "sysprolinear.h"
#include "anamod.h"
```



```
#include "nmd.h"
#include "u1516main.c"
```

Defines

- #define [MATMAKE](#) "testmat16.c"

19.35.1 Define Documentation

19.35.1.1 #define MATMAKE "testmat16.c"

Definition at line 14 of file u16.c.

19.36 u2.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
```

Functions

- static PetscErrorCode [solvebycopy](#) ([NumericalProblem](#) problem, void *dum, [NumericalSolution](#) *rsol)
- int [main](#) (int argc, char **argv)

19.36.1 Function Documentation

19.36.1.1 int main (int *argc*, char ** *argv*)

Definition at line 19 of file u2.c.

References [CHKERRQ\(\)](#), [ierr](#), [PreprocessedProblemSolving\(\)](#), [solvebycopy\(\)](#), [SysProDeclareFunctions\(\)](#), [SysProFinalize\(\)](#), and [SysProInitialize\(\)](#).

19.36.1.2 static PetscErrorCode solvebycopy ([NumericalProblem](#) *problem*, void * *dum*, [NumericalSolution](#) * *rsol*) [static]

Definition at line 9 of file u2.c.

References [CHKERRQ\(\)](#), and [ierr](#).

Referenced by [main\(\)](#).

19.37 u3.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "sysprotransform.h"
#include "string.h"
```

Functions

- static PetscErrorCode [solvebycopy](#) ([NumericalProblem](#) problem, void *dum, [NumericalSolution](#) *rsol)
- static PetscErrorCode [delprob](#) ([NumericalProblem](#) p)
- static PetscErrorCode [makesol](#) ([NumericalProblem](#) p, [NumericalSolution](#) *rs)
- static PetscErrorCode [delsol](#) ([NumericalSolution](#) s)
- static PetscErrorCode [adder](#) (const char *choice, int optionvalue, PetscTruth overwrite, [NumericalProblem](#) oldproblem, [NumericalProblem](#) *rnew, void *ctx, void **lctx, PetscTruth *success)
- static PetscErrorCode [unadder](#) (const char *choice, PetscTruth overwrite, void *ctx, void *lctx, [NumericalProblem](#) pproblem, [NumericalProblem](#) oproblem, [NumericalSolution](#) psol, [NumericalSolution](#) osol)
- static PetscErrorCode [declareadders](#) ()
- int [main](#) (int argc, char **argv)

19.37.1 Function Documentation

19.37.1.1 static PetscErrorCode [adder](#) (const char * *choice*, int *optionvalue*, PetscTruth *overwrite*, [NumericalProblem](#) *oldproblem*, [NumericalProblem](#) * *rnew*, void * *ctx*, void ** *lctx*, PetscTruth * *success*) [static]

Definition at line 63 of file u3.c.

References [CHKERRQ\(\)](#), [ierr](#), and [SysProTraceMessage\(\)](#).

Referenced by [main\(\)](#).

19.37.1.2 static PetscErrorCode [declareadders](#) () [static]

Definition at line 97 of file u3.c.

References [CHKERRQ\(\)](#), [ierr](#), and [NewTransformObject\(\)](#).

Referenced by [main\(\)](#).

19.37.1.3 static PetscErrorCode delprob (NumericalProblem *p*) [static]

Definition at line 28 of file u3.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.37.1.4 static PetscErrorCode delsol (NumericalSolution *s*) [static]

Definition at line 51 of file u3.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.37.1.5 int main (int *argc*, char ** *argv*)

Definition at line 107 of file u3.c.

References adder(), CHKERRQ(), declareadders(), DeclarePreprocessor(), delprob(), delsol(), ierr, makesol(), PreprocessedProblemSolving(), solvebycopy(), SysProDeclareFunctions(), SysProDeclareTraceFunction(), SysProDefaultTrace(), SysProFinalize(), SysProInitialize(), and unadder().

19.37.1.6 static PetscErrorCode makesol (NumericalProblem *p*, NumericalSolution * *rs*) [static]

Definition at line 39 of file u3.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.37.1.7 static PetscErrorCode solvebycopy (NumericalProblem *problem*, void * *dum*, NumericalSolution * *rsol*) [static]

Definition at line 14 of file u3.c.

References CHKERRQ(), ierr, and SysProTraceMessage().

Referenced by main().

19.37.1.8 static PetscErrorCode unadder (const char * *choice*, PetscTruth *overwrite*, void * *ctx*, void * *lctx*, NumericalProblem *pproblem*, NumericalProblem *oproblem*, NumericalSolution *psol*, NumericalSolution *osol*) [static]

Definition at line 84 of file u3.c.

Referenced by main().

19.38 u4.c File Reference

```
#include <stdlib.h>
#include "syspro.h"
#include "sysprotransform.h"
#include "string.h"
```

Functions

- static PetscErrorCode [solvebycopy](#) ([NumericalProblem](#) problem, void *dum, [NumericalSolution](#) *rsol)
- static PetscErrorCode [makeintctx](#) ([NumericalProblem](#) problem, void **ctx)
- static PetscErrorCode [delintctx](#) (void *ctx)
- static PetscErrorCode [delprob](#) ([NumericalProblem](#) p)
- static PetscErrorCode [makesol](#) ([NumericalProblem](#) p, [NumericalSolution](#) *rs)
- static PetscErrorCode [delsol](#) ([NumericalSolution](#) s)
- static PetscErrorCode [adder](#) (const char *choice, int optionvalue, PetscTruth overwrite, [NumericalProblem](#) oldproblem, [NumericalProblem](#) *rnew, void *ctx, void **lctx, PetscTruth *success)
- static PetscErrorCode [unadder](#) (const char *choice, PetscTruth overwrite, void *ctx, void *lctx, [NumericalProblem](#) pproblem, [NumericalProblem](#) oproblem, [NumericalSolution](#) psol, [NumericalSolution](#) osol)
- static PetscErrorCode [declareadders](#) ()
- int [main](#) (int argc, char **argv)

19.38.1 Function Documentation

19.38.1.1 static PetscErrorCode [adder](#) (const char * *choice*, int *optionvalue*, PetscTruth *overwrite*, [NumericalProblem](#) *oldproblem*, [NumericalProblem](#) * *rnew*, void * *ctx*, void ** *lctx*, PetscTruth * *success*) [static]

Definition at line 88 of file u4.c.

References [CHKERRQ\(\)](#), [ierr](#), and [SysProTraceMessage\(\)](#).

Referenced by [main\(\)](#).

19.38.1.2 static PetscErrorCode [declareadders](#) () [static]

Definition at line 123 of file u4.c.

References [CHKERRQ\(\)](#), [ierr](#), [NewTransformObject\(\)](#), [TransformObjectAddOption\(\)](#), and [TransformObjectDefineOption\(\)](#).

Referenced by [main\(\)](#).

19.38.1.3 `static PetscErrorCode delintctx (void * ctx) [static]`

Definition at line 41 of file u4.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.38.1.4 `static PetscErrorCode delprob (NumericalProblem p) [static]`

Definition at line 52 of file u4.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.38.1.5 `static PetscErrorCode delsol (NumericalSolution s) [static]`

Definition at line 75 of file u4.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.38.1.6 `int main (int argc, char ** argv)`

Definition at line 137 of file u4.c.

References adder(), CHKERRQ(), declareadders(), DeclarePreprocessor(), delintctx(), delprob(), delsol(), ierr, makeintctx(), makesol(), PreprocessedProblemSolving(), PreprocessorsOptionsHandling(), solvebycopy(), SysProDeclareFunctions(), SysProDeclareTraceFunction(), SysProDefaultTrace(), SysProFinalize(), SysProInitialize(), and unadder().

19.38.1.7 `static PetscErrorCode makeintctx (NumericalProblem problem, void ** ctx) [static]`

Definition at line 30 of file u4.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.38.1.8 `static PetscErrorCode makesol (NumericalProblem p, NumericalSolution * rs) [static]`

Definition at line 63 of file u4.c.

References CHKERRQ(), and ierr.

Referenced by main().

19.38.1.9 static PetscErrorCode solvebycopy (NumericalProblem *problem*, void * *dum*,
NumericalSolution * *rsol*) [static]

Definition at line 16 of file u4.c.

References CHKERRQ(), ierr, and SysProTraceMessage().

Referenced by main().

19.38.1.10 static PetscErrorCode unadder (const char * *choice*, PetscTruth *overwrite*, void *
ctx, void * *lctx*, NumericalProblem *pproblem*, NumericalProblem *oproblem*,
NumericalSolution *psol*, NumericalSolution *osol*) [static]

Definition at line 110 of file u4.c.

Referenced by main().

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