

pFUnit

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## Chapter 1

# pFUnit 3 - Documentation - Version 3.1 development 2015-0420-1701-58-UTC MLR

Quick links to the [code](#) or the project's [SourceForge site](#).

### 1.1 Overview

[pFUnit](#) is a unit testing framework enabling JUnit-like testing of serial and MPI-parallel software written in Fortran. Initial support for OPENMP has been implemented. [pF-Unit](#) makes use of modern Fortran programming techniques, including object oriented programming, offering a convenient, lightweight mechanism for Fortran developers to create and run software tests that specify the desired behavior for a given piece of code. The framework was originally created by developers from NASA and NGC TASC. The project is hosted at [sourceforge/projects/pfunit](https://sourceforge.net/projects/pfunit).

If you are using [pFUnit](#), please leave a note/topic at [Applications of pFUnit](#), or send a note to [Tom Clune](#), Ph.D., Advanced Software Technology Group, NASA Goddard Space Flight Center.

Please refer revisions and comments about the documentation to [Mike Rilee](#), Ph.D., Rilee Systems Technologies.

### 1.2 Contents

- [Installation](#)

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### 1.3 See Also

- [sourceforge/projects/pfunit](#)
- [NASA Modeling Guru](#)
- [JUnit.org](#)

### 1.4 LICENSE

Rights of use for GSC-15,137-1 F-UNIT, also known as [pFUnit](#), are defined by the N-ASA Open Source Agreement (version 1.3). The LICENSE document may be found in the head directory of the [pFUnit](#) distribution.

### 1.5 Copyright

Copyright 2005,2013 United States Government as represented by the Administrator of the National Aeronautics and Space Administration. All Rights Reserved.

## Chapter 2

# Obtaining pFUnit

The best way to obtain **pFUnit** is to `clone pFUnit from the git repository` from SourceForge as follows.

```
# Read Only Access
git clone git://git.code.sf.net/p/pfunit/code pFUnit
```

This will create the directory **pFUnit** in the current working directory.

You may also visit the project page at SourceForge and download the source tarfile "pFUnit.tar.gz" there.

`http://sourceforge.net/projects/pfunit/` or `http://sourceforge.net/projects/pfunit/files/latest/download`

Extracting this tarfile via a command like

```
'$ tar xzf ./pFUnit.tar.gz'
```

will place the **pFUnit** files into the current working directory.

For other ways to acquire the code visit

`https://sourceforge.net/p/pfunit/code/ci/master/tree/`

or contact the **pFUnit** team.



## Chapter 3

# Installation

### 3.1 Installing pFUnit

Comentatry for the page.

- [Prerequisites](#)
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### 3.2 Prerequisites

The development work for [pFUnit](#) has mostly been carried out on a mixture of systems, including high-end computers, Apple Mac OSX, and linux-based systems. A preliminary Windows/CYGWIN port has been contributed by a user. Full use of the system depends on the following being available.

- Fortran 2003+ (Tested with Intel 13.1+, NAG 6.0, GCC 4.8.3, 4.9+, IBM's XLF, PGI 15.1)
- The Message Passing Interface (MPI)
- OpenMP
- GNU Make
- Python

Note: Recent changes have exposed a latent bug in GCC 4.8.2. The fix is available in the GCC 4.9 development branch and will also appear in GCC 4.8.3 when that is released. Users that require older versions of GCC should use [pFUnit 2.1.x](#).

[Doxygen](#) is used to generate documentation.

The system routinely undergoes regression testing with GNU, Intel, and NAG fortran compilers and OpenMPI.

### 3.3 Obtaining pFUnit

The best way to obtain [pFUnit](#) is to [clone pFUnit from the git repository](#) from SourceForge as follows.

```
# Read Only Access
git clone git://git.code.sf.net/p/pfunit/code pFUnit
```

This will create the directory [pFUnit](#) in the current working directory.

You may also visit the project page at SourceForge and download the source tarfile "pFUnit.tar.gz" there.

<http://sourceforge.net/projects/pfunit/> or <http://sourceforge.net/projects/pfunit/files/latest/download>

Extracting this tarfile via a command like

```
'$ tar xzf ./pFUnit.tar.gz'
```

will place the [pFUnit](#) files into the current working directory.

For other ways to acquire the code visit

<https://sourceforge.net/p/pfunit/code/ci/master/tree/>

or contact the [pFUnit](#) team.

## 3.4 Manifest - What's in the directory?

In the top level of the [pFUnit](#) distribution you will see the following files.

CMakeLists.txt - Initial support for cmake-based builds.

COPYRIGHT - Contains information pertaining to the use and distribution of [pFUnit](#).

Examples - Contains examples of how to use [pFUnit](#) once it is installed.

GNUmakefile - The top level makefile for building and installing [pFUnit](#).

LICENSE - The NASA Open Source Agreement for GSC-15,137-1 F-UNIT, also known as [pFUnit](#).

README-INSTALL - Basic documentation on [pFUnit](#) installation and use.

bin - Executables used to construct and perform unit tests.

include - Files to be included into makefiles or source, including use code.

source - Source code and scripts of the [pFUnit](#) library and framework.

tests - Source code for unit testing [pFUnit](#) itself.

tools - Tools used to help develop, build, and install [pFUnit](#).

VERSION - Contains a string describing the current version of the framework.

## 3.5 Configuration

Little needs to be done to configure [pFUnit](#) for the build, however there are several environment variables on which the package depends.

'F90\_VENDOR' - is set to include the correct makefile in /include, i.e. GNU, Intel, NAG, or PGI. Case insensitive file systems may cause some confusion from time-to-time.

'F90' - is set to the Fortran compiler being used: e.g. ifort for Intel, gfortran for GNU.

'COMPILER' - is set according to 'F90\_VENDOR' and is automatically set in the top level makefile.

For MPI-based unit testing, your setup may require the following as well.

'MPIF90'

```
$ export MPIF90=mpif90
```

As a convenience for working with multiple MPI configurations, you may also set the following.

'MPIRUN'

```
$ export MPIRUN=/some.path/mpirun
```

### PFUNIT\_MAX\_ARRAY\_RANK

'PFUNIT\_MAX\_ARRAY\_RANK' - controls the maximum size of the arrays asserts are defined over. If PFUNIT\_MAX\_ARRAY\_RANK is not set, the default is 5 and pFUnit's assertions will be able to handle arrays up to rank 5, i.e. A(:, :, :, :). PFUNIT\_MAX\_ARRAY\_RANK and MAX\_RANK do not refer to MPI ranks (process id within a group). Example:

```
$ export PFUNIT_MAX_ARRAY_RANK=5
```

'PFUNIT\_MAX\_RANK' is a deprecated way to set maximum rank and is to be removed in version 4.

'DOXYGEN' - To generate documentation, set DOXYGEN to the desired executable. NOTE: Doxygen Version 1.8.5 does not respect CamelCase names from Fortran source code by currently converting all to lowercase. It does this to get HTML links correct for references in the source code that also do not respect the CamelCase convention. The Fortran standard specifies case insensitivity. Doxygen 1.7.x seems to better respect CamelCase.

```
$ export DOXYGEN=/opt/local/share/doxygen/doxygen-1.7.6/bin/doxygen
```

## 3.6 Building pFUnit

### 3.6.1 Building pFUnit for testing serial codes (Non-MPI)

1. Change to the directory into which pFUnit has been placed. 2. Set the environment variables (for example in bash):

```
$ export F90=gfortran-mp-4.8
$ export F90_VENDOR=GNU
```

3. To build pFUnit for unit testing of serial codes, execute make. The unit tests for pFUnit itself will run automatically.

```
$ make tests
```

3.1 Occasionally on the first run through, one will get a spurious (runtime) error, for example in the unix process component.

Re-execute "make tests" to check again.

4. At this point the pFUnit object library is in the source directory, along with a large number of Fortran module files.

### 3.6.2 Building pFUnit for testing parallel codes (MPI)

To build pFUnit for unit testing MPI-based codes, be sure that the environment is properly set up for the MPI implementation you are using. Depending on your local environment, you may need execute the build within a batch or other job queuing system, e.g. an



interactive batch job under PBS. The steps for building pFUnit start out the same as for the serial case above, but add `MPI=YES` to the environment to switch on MPI support. The MPI-based unit tests for pFUnit itself will run automatically. Again, occasionally a spurious (runtime) error may appear on the first execution.

3. Execute make as follows.

```
$ make tests MPI=YES
```

4. At this point an MPI-enabled pFUnit object library is in the source directory, along with a large number of Fortran module files.

Also, one may get some harmless "no symbols" warnings when the pFUnit library is constructed.

### 3.6.3 OPENMP

Initial (limited) support for OPENMP has been implemented. At this writing, a basic functionality is available.

The process for building pFUnit for testing OPENMP-based codes is similar to that for other paradigms.

3. To compile for OPENMP support execute make as follows.

```
$ make tests OPENMP=YES
```

4. At this point the OPENMP-enabled pFUnit is ready to be installed.

### 3.6.4 Cleaning

To clean the pFUnit build directory for the space or to rebuild there are two options.

1. Make clean to remove object files and other intermediate products.

```
$ make clean
```

2. Make distclean to remove libraries and other more final products.

```
$ make distclean
```

3. Some directories support a 'make src\_clean' to remove intermediate products in subdirectories.

### 3.6.5 Documentation

A start at documentation for pFUnit is in the documentation directory. Doxygen is our primary documentation tool. To make the documentation, which will be generated in the

documentation directory, please invoke the following from the top level of your [pFUnit](#) distribution.

```
$ make documentation
```

Or to make a reference manual.

```
$ make documentation/pFUnit2-ReferenceManual.pdf
```

To select a specific version of Doxygen, please set the DOXYGEN environment variable as in [Configuration](#). You may wish to do this if your code uses CamelCase names as current versions of Doxygen (1.8.5) do not respect this convention for Fortran.

### 3.6.6 CMAKE

Initial support for CMAKE has been implemented. At this writing, a basic functionality is available.

3. The process for building [pFUnit](#) using cmake is as follows. In the top directory of the distribution make a new directory to support the build, then change to that directory and run cmake (pointing back to the source) to generate the required makefiles.

```
$ mkdir build
$ cd build
$ # e.g. cmake -DMPI=YES -DOPENMP=NO -DINSTALL_PATH=<A path> <path to source>
$ cmake -DMPI=NO ..
$ make tests
```

One may also set the environment variable PFUNIT instead of setting INSTALL\_PATH on the cmake command line as given above.

If your MPI installation does not provide mpirun, you may try to set -DMPI\_USE\_MPIEXEC=YES to tell CMake to use its FindMPI function to find out how to execute the tests.

4. If the build is successful, then at this point make install should work.

## 3.7 Installation

### 3.7.1 Installation - Serial

To install [pFUnit](#) for regular use, set INSTALL\_DIR to the location in which to place [pFUnit](#). This can be done on the make command line. For example, after compiling [pFUnit](#) for serial use (MPI absent or MPI=NO), please try.

```
$ # In the top of the pFUnit build directory.
$ make install INSTALL_DIR=/opt/pfunit/pfunit-serial
```

Note: you may need special privileges to install in some locations, e.g. via sudo.

To test the installation set PFUNIT to INSTALL\_DIR, then change the working directory to Examples in pFUnit distribution and execute "buildIt," which will run a number of examples. These include some expected failures.

```
$ # In the top pFUnit build directory...
$ export PFUNIT=/opt/pfunit/pfunit-serial
$ cd Examples
$ ./buildIt
```

### 3.7.2 Installation - MPI

For installing an MPI-enabled pFUnit library, change to the top of the distribution and execute make with MPI=YES. You may need to "make distclean" first. After compilation and pFUnit passes its self-tests, then installation proceeds as for the serial case above.

```
$ make install INSTALL_DIR=/opt/pfunit/pfunit-parallel
```

To test, set PFUNIT and go into Examples/MPI\_Halo directory.

```
$ # In the top pFUnit build directory...
$ export PFUNIT=/opt/pfunit/pfunit-parallel
$ # The variable MPIF90 must be set to the appropriate build script.
$ export MPIF90=mpif90
$ cd Examples/MPI_Halo
$ make
```

This will compile and run a set of parallel examples that includes intentional failures.

### 3.7.3 Installation - OPENMP

At this time the OPENMP version of pFUnit can be installed in the same way as for the serial or MPI-parallel codes. OPENMP support, tests, and examples are limited as of this writing.

### 3.7.4 Installation - DEFAULT DIRECTORY

If INSTALL\_DIR is not set, "make install" will attempt to install pFUnit into the top build directory. This will create directories such as lib and mod in the top level of the build directory and will overwrite the include/base.mk with include/base-install.mk. If this is not desired, then "make develop" will put back the original base.mk, which is the file to be used for development and building pFUnit. In general, we recommend installing to a directory that is not also the build directory.



# Chapter 4

## Usage

- [Usage - Configuration](#)
- [Usage - Hello World](#)
- [Usage - Preprocessor](#)
- [Compiling and Executing The Test](#)

### 4.1 Usage

#### 4.1.1 Usage - Configuration

For regular use, after installation, the same compiler/MPI development configuration that was used to build [pFUnit](#) should be used. Once the environment variables and paths associated with the environment are set, to configure [pFUnit](#), please set the following.

'PFUNIT' - set to the directory into which [pFUnit](#) was installed.

'F90\_VENDOR' - set to Intel, GNU, NAG, or PGI accordingly.

#### 4.1.2 Usage - Hello World

For an example of a simple usage of [pFUnit](#), see [Examples/Simple/tests](#).

The simplest way to write a test is to write a preprocessor input file (extension ".pf"), which is a Fortran free format file with preprocessor directives added. An example from "helloWorld.pf" follows.

```
! from helloWorld.pf
@test
```

```

subroutine testHelloWorld()
  use pfunit_mod
  implicit none
  @assertEqual("Hello World!","Hello World!")
end subroutine testHelloWorld

```

One then instructs the preprocessor to construct a suite to execute these tests via the "testSuites.inc" file as follows.

```

! from testSuites.inc
ADD_TEST_SUITE(helloWorld_suite)

```

At this point, one can invoke the preprocessor to generate a Fortran file that when compiled and linked with [pFUnit](#) will execute the tests. For more information please see [The Preprocessor - pFUnitParser](#) or try out the examples in [Example/Simple](#).

## 4.2 Usage - Preprocessor

Please see [The Preprocessor - pFUnitParser](#).

## 4.3 Compiling and Executing The Test

An example of a GNU make rule for for the final step of compiling a test follows.

```

# This step presumes "include $(PFUNIT)/include/base.mk" earlier in the
# makefile.
tests.x: testSuites.inc myTests.pf
  $(F90) -o $@ -I$(PFUNIT)/mod -I$(PFUNIT)/include \
    $(PFUNIT)/include/driver.F90 \
    ./*$(OBJ_EXT) $(LIBS) $(FFLAGS)

```

To execute the tests, one invokes "./tests.x" with the appropriate command line options (see below).

### 4.3.1 - Compiling and Executing the Tests (MPI PARALLEL)

One invokes MPI-based parallel tests according to the MPI framework being used. For example:

```

$ mpirun -np 4 tests.x

```

### 4.3.2 Command Line Options

The executable test program provides several command line options, when "include/driver.F90" is used, as it is automatically when using the PFUNIT preprocessor.

-v or -verbose	Verbose execution.
-d or -debug	Provide debugging information.
-h	Print help message.
-o <outputfile>	Direct <a href="#">pFUnit</a> messages to a file.
-robust	Use the robust runner. Runs tests as processes so failures do not halt testing.
-max-timeout-duration <duration> Limit detection time for robust runner.	
-max-launch-duration <duration> Limit detection time for robust runner.	
-skip <number of tests to skip>	Use the subset runner, which runs a subset of the tests in a suite.

An example from Examples/Robust:

```
$ ./tests.x -robust
```





## Chapter 5

# Development

Generally [pFUnit](#) development is performed in the build directory structure. Care should be taken to make clean or distclean in between configuration changes. As stated in - [Installation](#), it is best to set `INSTALL_DIR` and "make install" [pFUnit](#) to another directory that can be placed in a user's paths.



## Chapter 6

# Feedback & Support

- [Feedback](#)
- [Support](#)

### 6.1 Feedback

Feedback is welcome, please use the facilities at [sourceforge/projects/pfunit](#) to share your views.

Open a [ticket](#) for bugs, features, and patch recommendations.

If you use [pFUnit](#), please let us know by leaving a note in our [Applications of pFUnit](#) forum, or email [Tom Clune](#), Ph.D., NASA Goddard Space Flight Center. - Letting us know about your application helps us seek support for [pFUnit](#)'s continued development and improvement.

### 6.2 Support

Please open a [ticket](#) for bugs, features, and patch recommendations. For longer term needs or considerations, please visit our [discussion forums](#) or contact - [Tom Clune](#), Ph.D., NASA Goddard Space Flight Center.

You may also find some help at [FAQ and Tips](#).

[pFUnit](#) supports the software development of several weather and climate simulations efforts. We constantly seek to improve and correct [pFUnit](#) for our users' benefit, granting priority to the needs of our major users. Please share with us information about your application on our [Applications of pFUnit](#) forum.



## Chapter 7

# FAQ and Tips

- [FAQ](#)
  - [Zero Tests Run](#)
  - [Some Tests Are Not Running](#)
  - [Intel Fortran Version 13: -DINTEL\\_13](#)
  - [Segmentation Faults and Odd Link Errors](#)
- [Tips](#)
  - [Environment Modules](#)
  - [Compile Time Errors](#)
  - [Intermediate files used by pFUnit](#)
  - [Ignoring whitespace differences in assertions on strings.](#)

### 7.1 FAQ

#### 7.1.1 Zero Tests Run

*Symptom:* The system under test compiles and runs fine, but reports zero tests run.

*Solutions:*

- There is no `testSuites.inc` file. Please add a `testSuites.inc` that lists the suites to add via `ADD_TEST_SUITE (the_suite_to_add)`, one to a line.
- There is no `-DUSE_MPI` passed to the compiler during the build. Please add to the compiler invocation. Please see [Some Tests Are Not Running](#).

### 7.1.2 Some Tests Are Not Running

*Symptom:* The system under test compiles and runs fine, but reports that some tests don't run.

*Solutions:*

- There is no `-DUSE_MPI` passed to the compiler during the build. Please add as in the following example.

```
% $PFUNIT/bin/pFUnitParser.py test_pio.pf test_pio.F90
% mpif90 -DUSE_MPI $PFUNIT/include/driver.F90 \
%      -I$PFUNIT/mod -L$PFUNIT/lib -lpfunit test_pio.F90

% mpirun -np 8 ./a.out

.
Time:          0.004 seconds

OK
```

### 7.1.3 Intel Fortran Version 13: -DINTEL\_13

Using version 13 is deprecated. We have encountered problems using version 13, which we believe may be due to subtle compiler bugs. We strongly recommend upgrading to the latest version possible.

To make [pFUnit](#) work with Intel Fortran Version 13, please ensure that `-DINTEL_13` is passed to the compiler when building or using [pFUnit](#). In the build process for [pFUnit](#), this is added to the make variables `CPPFLAGS` and `FPPFLAGS`.

### 7.1.4 Segmentation Faults and Odd Link Errors

Q. [pFUnit](#) fails to build or now leads to segmentation faults. Did something change?

A. One cause for failure to build or odd runtime segmentation faults is when we change compiler configurations and some object or library files are left over from a previous environment. This might be hard to spot, for example, during compiler upgrades. - Switching from one compiler to another, e.g. from Intel to GNU, is more likely to generate link-time errors if old code is still around. A few items to check follow.

- Execute `make distclean` or remove objects (or their directories if using CMAKE) associated with previous builds.
- Ensure [pFUnit](#) and user applications are compiled using compatible (or the same) compilers.
- Ensure the environment variable `PFUNIT` is set to the appropriate install directory.

Finally, it is quite possible that a bug has been uncovered. Please contact the development team or open a [bug ticket](#).

## 7.2 Tips

### 7.2.1 Environment Modules

Though not strictly required, the Environment Modules package can be a convenient way to package, maintain, and switch between environments. This can be particularly important for [pFUnit](#), which must be built using the same tool suite being used for development, e.g. compilers, linkers, etc. [To do: A sample [pFUnit](#) modulefile is provided in the OTHER directory.]

### 7.2.2 Compile Time Errors

Compile time errors like "'include [...]include/.mk" not found' likely signify that you are not executing make in the top level directory during a build. Alternatively, during regular usage after installation, PFUNIT has not been set.

During building, if you wish to compile in a subdirectory within the [pFUnit](#) hierarchy, please try setting the COMPILER environment variable on the make command line. For example:

```
$ make all COMPILER=Intel
```

### 7.2.3 Intermediate files used by pFUnit

If you wish to see the intermediate files, use the target .PRECIOUS in the makefile to keep them from being deleted. For example:

```
# In GNUmakefile
.PRECIOUS: %_cpp.F90
```

### 7.2.4 Ignoring whitespace differences in assertions on strings.

Several options exist for how to compare strings with assertEquals.

```
call assertEquals(expectedString, foundString, &
    & whitespace=IGNORE_DIFFERENCES )
```

#### WhitespaceOptions:

- **IGNORE\_DIFFERENCES** ignores whitespace differences (number and value).
- **IGNORE\_ALL** strictly ignores all whitespace (spaces & tabs).
- **TRIM\_ALL** strictly ignores leading and trailing whitespace.
- **KEEP\_ALL** keeps all whitespace as significant, even discriminating between tabs and spaces.

Example usages can be seen in `tests/Test_AssertBasic.F90` or `Examples/Simple/tests/helloWorld.pf`.



## Chapter 8

# Platform Specific Notes

### 8.1 Mac OSX

The MacPorts package management system is a convenient way to install and maintain many packages, including gcc which includes gfortran.

### 8.2 Windows/CYGWIN

User contributed code for Windows/CYGWIN has been added, but is currently not tested and supported by the [pFUnit](#) team. At this writing, 2013-1031, serial Examples and MPI are not known to be supported. Please contact us if you wish to either contribute or otherwise discuss this port.

### 8.3 Intel Fortran Version 13: -DINTEL\_13

To make [pFUnit](#) work with Intel Fortran Version 13, please ensure that `-DINTEL_13` is passed to the compiler when building or using [pFUnit](#). In the build process for [pFUnit](#), this is added to the make variables CPPFLAGS and FPPFLAGS.



## Chapter 9

# Acknowledgments

Thanks to the following for their review and comments: B. Van Aartsen, T. Clune.

Windows/CYGWIN contributions from E. Lezar.

PGI port contributions from M. Leair (PG Group).

Other acknowledgments: S.P. Santos (NCAR), M. Hambley (UK Met Office), J. Krishna (ANL).

The design of [pFUnit](#) is strongly influenced by [JUnit](#).

Initial [pFUnit](#) 2 documentation by Michael Rilee (Rilee Systems Technologies).



## Chapter 10

# Known Installations & Versions

master - The current release.

development - The cutting edge of [pFUnit](#) development.

mock\_services - Experimental support for mocking.

pfunit\_2.1.0 - A feature freeze prior to a major upgrade of the preprocessor.



## Chapter 11

### TODO

- Make other directory.
- Make Environment Modules example in other directory.





## Chapter 12

# The Preprocessor - pFUnitParser

Overview of Preprocessor (pFUnitParser.py)

- [Using The Preprocessor](#)
  - [Configuration - testSuites.inc](#)
  - [Invocation](#)
  - [Command Line Options](#)
  - [Preprocessor Input File \(.pf\)](#)
  - [Directives](#)
    - \* [@Test](#)
    - \* [@MPITest](#)
    - \* [@Assert](#) (or [Preprocessor Directives](#))
    - \* [@Parameters](#)
    - \* [@TestCase](#)

//

### 12.1 Using The Preprocessor

How to write tests using the ".pf" files. We expect this to be the main way people write pFUnit-based tests. Please see the Examples directory for a wide range of examples. The .pf files themselves are generally to be found in an example's "tests" subdirectory.

### 12.1.1 Configuration - testSuites.inc

The include file "testSuites.inc" tells the preprocessor to generate code for TestSuites listed therein. The suite names are based on the TestCases provided in the preprocessor input file or the name of the preprocessor input file (.pf) itself. For example, if no module is defined in a .pf file, i.e. the preprocessor will define the module, one can set up a "testSuites.inc" as follows.

```
! To load "exampleTestsNoModule.pf".
ADD_TEST_SUITE(exampleTestsNoModule_suite)
```

For a .pf file that contains a module associated with a test suite the syntax is as follows.

```
! To load "exampleTests.pf" implementing the module exampleTests_mod.
ADD_TEST_SUITE(exampleTests_mod_suite)
```

### 12.1.2 Invocation

To run the preprocessor on on a preprocessor input file "exampleTests.pf", invoke:

```
$ ${PFUNIT}/bin/pFUnitParser.py exampleTests.pf exampleTests.F90
```

A convenient GNUmakefile rule is as follows.

```
%.F90: %.pf
    ${PFUNIT}/bin/pFUnitParser.py $< $@
```

### 12.1.3 Preprocessor Input File (.pf)

The preprocessor input file is a Fortran free format file that contains subroutines, including those implementing the suite of tests, or a module with the tests, TestCases, and support for parameters. The preprocessor reads and parses this file producing a fortran file implementing the tests, automating some boilerplate code. Embedded "@" directives inform the preprocessor about information needed to generate the test suite. If the .pf file does not implement a module providing a test suite, the preprocessor will use the name of .pf file referred to by "testSuites.inc". Currently only one test suite per .pf file is allowed, a limitation of the current implementation of the parser.

Many example .pf files may be found in the examples' "tests" subdirectories in the - Examples directory.

Below we present the most commonly used directives first, but in a .pf file using all of these capabilities, the most common order is as follows.

- @Parameters
- @TestCase
- @Test or @MPITest
  - @Assert

### 12.1.4 Directives

Preprocessor "@" directives, which in keeping with Fortran style are not case sensitive, instruct the preprocessor how to interpret parts of the code relevant to the generation of the test suite. The most important directives follow.

#### 12.1.4.1 @Test

This directive is used to indicate a test routine to the preprocessor, which then includes it in the test suite. There may be multiple tests in the .pf file, each annotated by the @Test directive.

@Test also supports MPI-parallel tests (see [@MPITest](#)).

An example, from Examples/Fixture:

```
@Test
  subroutine testBracketInterior(this)
    class (Test_LinearInterpolator), intent(inout) :: this
    @assertEqual([3,4], this%interpolator%getBracket(at=4.))
  end subroutine testBracketInterior

@Test
  subroutine testInterpolateAtNode(this)
    class (Test_LinearInterpolator), intent(inout) :: this
    @assertEqual(2., this%interpolator%interpolate(at=3.))
  end subroutine testInterpolateAtNode
```

#### 12.1.4.2 @MPITest

[@MPITest](#) is deprecated as @Test now handles this case.

This directive indicates an MPI parallel test to the preprocessor, which then includes it in an MPI enabled test suite. The directive takes a single argument, the requested number of MPI processes to run. The syntax, exemplified by one of the tests from Examples/MPI\_Halo:

```
@Test ( npes=[1,2,3])
subroutine testHaloInterior(this)
  use Halo_mod
  use pfunit_mod
  implicit none
  class (MpiTestMethod) :: this

  integer, parameter :: N = 2
  real :: a(N,0:N+1)
  integer :: p

  p = this%getProcessRank()
  a(:,1:N) = p
```

```
a(:,0) = -1
a(:,N+1) = -1

call haloFill(a, this%getMpiCommunicator())

@assertEqual(real(p), a(1,1))
@assertEqual(real(p), a(2,1))
@assertEqual(real(p), a(1,2))
@assertEqual(real(p), a(2,2))

end subroutine testHaloInterior
```

#### 12.1.4.3 @Assert

The @Assert directives are expanded into calls to similarly named [pFUnit](#) library routines. The syntax for the directives follows the pattern for @assertEqual below.

```
@assertEqual(expected,found,'An identifying or explanatory message.')
```

The preprocessor will automatically add information about source location (file & line number) to the call emitted to the test suite code. It also adds the check for exceptions.

For more information about @assert directives, please refer to the following.

- [@assertEqual](#)
- [@assertTrue](#)
- [@assertEqualUserDefined](#)
- [@assertFalse](#)
- [@assertLessThan](#)
- [@assertLessThanOrEqual](#)
- [@assertGreaterThan](#)
- [@assertGreaterThanOrEqual](#)
- [@assertIsMemberOf](#)
- [@assertContains](#)
- [@assertAny](#)
- [@assertAll](#)
- [@assertNotAll](#)
- [@assertNone](#)

- [@assertIsPermutationOf](#)
- [@assertExceptionRaised](#)
- [@assertSameShape](#)
- [@assertIsNaN](#)
- [@assertIsFinite](#)
- [@assertAssociated](#)
- [@assertNotAssociated](#)
- [@assertEquivalent](#)

#### 12.1.4.4 @Parameters

The `@Parameter` directive indicates the declaration of the parameterized type used to generate the iteration over the multiple parameter values. It also identifies the names of the parameters to be iterated over. The preprocessor extracts type information from the declaration of the parameter type collection that immediately follows the directive. This directive will set up the iteration. To define the parameter values per iteration the `getParameters` method of the abstract `ParameterizedTest` must be implemented. For example:

```
@Parameters = [p1,p2]
type, extends(AbstractTestParameter) :: exampleCase
  integer :: i
  real :: x
end type exampleCase
```

#### 12.1.4.5 @TestCase

This directive identifies to the preprocessor the `TestCase` declaration. The type declared at this point extends `TestCase` (or its extension), which includes setting methods such as the following: `setUp`, `tearDown`, `runMethod`, `userMethod`. For the extension `MPITestCase`, as with `ParameterizedTestCase`, you have the option (requirement if parameters are used) to set `getParameters` and `getParameterString`. For example:

```
@TestCase
type, extends(MPITestCase) :: Test_Parameters
  integer :: p1, p2
  procedure(runMethod), pointer :: userMethod => null()
contains
  procedure, nopass :: getParameters
  procedure :: getParameterString => getParameterString_
  procedure :: runMethod
end type Test_Parameters
```



## Chapter 13

# @Assert Preprocessor Directives

- [@assertEqual](#)
- [@assertTrue](#)
- [@assertEqualUserDefined](#)
- [@assertFalse](#)
- [@assertLessThan](#)
- [@assertLessThanOrEqual](#)
- [@assertGreaterThan](#)
- [@assertGreaterThanOrEqual](#)
- [@assertIsMemberOf](#)
- [@assertContains](#)
- [@assertAny](#)
- [@assertAll](#)
- [@assertNotAll](#)
- [@assertNone](#)
- [@assertIsPermutationOf](#)
- [@assertExceptionRaised](#)
- [@assertSameShape](#)
- [@assertIsNaN](#)

- [@assertIsFinite](#)
- [@assertAssociated](#)
- [@assertNotAssociated](#)
- [@assertEquivalent](#)

## 13.1 @Assert Preprocessor Directives

### 13.1.1 @assertEqual

### 13.1.2 @assertTrue

### 13.1.3 @assertEqualUserDefined

A convenience function that allows a user to write

```
@assertEqualUserDefined(a,b)
```

instead of

```
call assertTrue(a==b, ...)
```

while a more instructive error message about the arguments and source code position is added by the preprocessor. The user may add an error message as follows.

```
@assertEqualUserDefined(a,b,message='a and b should be equal here.')
```

### 13.1.4 @assertFalse

### 13.1.5 @assertLessThan

### 13.1.6 @assertLessThanOrEqual

### 13.1.7 @assertGreaterThan

### 13.1.8 @assertGreaterThanOrEqual

### 13.1.9 @assertIsMemberOf

### 13.1.10 @assertContains



13.1.11 @assertAny

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13.1.13 @assertNotAll

13.1.14 @assertNone

13.1.15 @assertIsPermutationOf

13.1.16 @assertExceptionRaised

13.1.17 @assertSameShape

13.1.18 @assertIsNaN

13.1.19 @assertIsFinite

13.1.20 @assertAssociated

maps to a call to the logical intrinsic function associated.

```
@assertAssociated(a)
```

becomes

```
call assertTrue(associated(a))
```

The directive also handles the two-argument pointer-target case.

```
@assertAssociated(pointer, target)
```

becomes

```
call assertTrue(associated(pointer, target))
```

neglecting message and source location information.

A message may be passed as follows.

```
@assertAssociated(a, message="A message.")
```

```
@assertAssociated(pointer, target, message="A message.")
```

### 13.1.21 @assertNotAssociated

This directive is the same as `assertAssociated`, except that it maps to `assertFalse`. This directive was originally released as `assertUnAssociated`.

### 13.1.22 @assertEquivalent

This directive compares two logical values and throws an exception annotated with some useful information. We get a special directive for this one because comparing logicals uses the `.eqv.` infix operator in standard Fortran. The arguments `a` and `b` below may be 1d arrays.

```
@assertEquivalent (a,b)
```

becomes

```
call assertTrue(a.eqv.b)
```

neglecting the specification of message and source location information.

## Chapter 14

### Revision Notes

- 2015-0320 PGI port workarounds, including examples. 3.1. MLR
- 2014-1211 Minor updates for 3.0.2. MLR
- 2014-1110, 2014-1031 Minor edits. MLR
- 2014-0915 Minor updates for 3.0.1. MLR
- 2014-0404 Updated for release of 3.0. TLC
- 2014-0131, 2014-0205. Updated. MLR
- 2013-1227. First note of OPENMP additions by T. Clune. MLR.
- 2013-1212. Initial draft of Doxygen version. MLR
- 2013-1107. Minor edits. MLR
- 2013-1031. Added user contributed code for Windows/CYGWIN & IBM's XLF. MLR
- 2013-0830-1359. Minor corrections and added MPIF90 to 6.2. MLR
- 2013-0806-1345. Corrected git reference. Was using old URL. MLR
- 2013-0805. Initial draft. MLR



# Chapter 15

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## Chapter 16

# Data Type Index

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## Chapter 17

# Data Type Documentation

### 17.1 AbstractTestParameter\_mod Module Reference

#### Data Types

- type **AbstractTestParameter**
- interface **toString**

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

- AbstractTestParameter.F90

### 17.2 AbstractTestResult\_mod Module Reference

#### Data Types

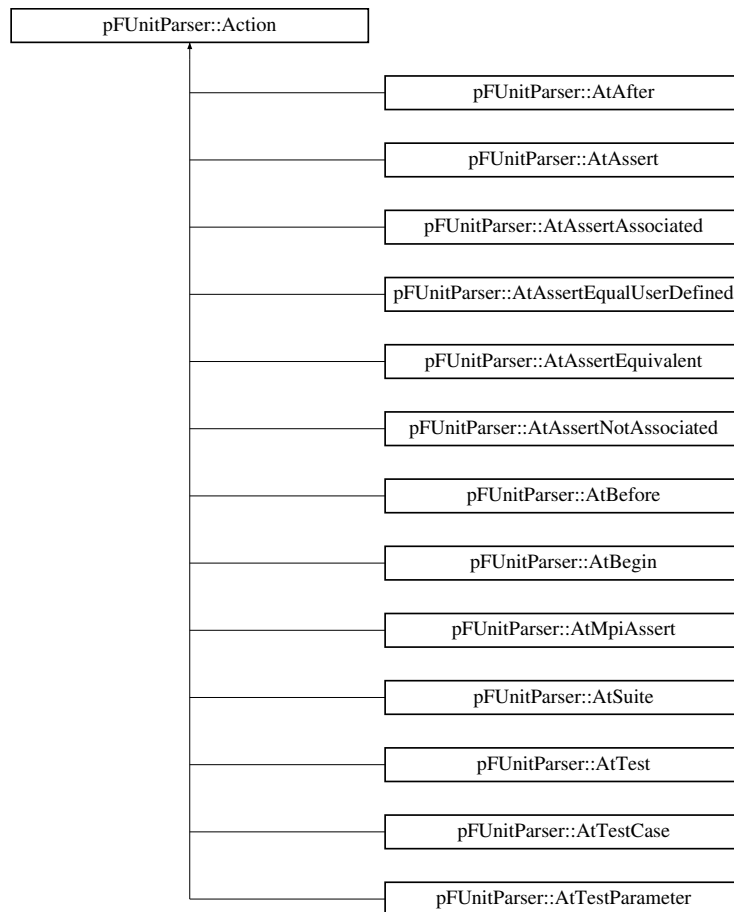
- type **AbstractTestResult**
- interface **errorCount**
- interface **failureCount**
- interface [getErrors](#)
- interface **getFailures**
- interface **getName**
- interface **getRunTime**
- interface [getSuccesses](#)
- interface **runCount**
- interface **setName**
- interface [wasSuccessful](#)

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

- AbstractTestResult.F90

### 17.3 pFUnitParser::Action Class Reference

Inheritance diagram for pFUnitParser::Action:



#### Public Member Functions

- def **apply**

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

- `pFUnitParser.py`

## 17.4 `add_mod` Module Reference

### Public Member Functions

- real function **add** (`x`, `y`)
- real function **add** (`x`, `y`)

The documentation for this module was generated from the following files:

- `Robust/src/add.F90`
- `Simple/src/add.F90`

## 17.5 `addComplex_mod` Module Reference

### Public Member Functions

- complex function, `dimension(size(z0))` **add** (`z0`, `z1`)

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

- `addComplex.F90`

## 17.6 `CodeUtilities::ArrayDescription` Class Reference

### Public Member Functions

- `def __init__`
- `def NAME`
- `def DECLARE`
- `def DECLARESCALAR`
- `def KIND`
- `def RANK`
- `def FTYPE`
- `def EXPANDSHAPE`
- `def FailureMessageFork`

### Public Attributes

- **fType**
- **kind**
- **rank**

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

- CodeUtilities.py

## 17.7 Assert\_mod Module Reference

<BriefDescription>

### 17.7.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- Assert.F90

## 17.8 AssertBasic\_mod Module Reference

Provides fundamental assertions over the most basic types, a foundation for providing test services to end users.

## Data Types

- interface **assertEqual**
- interface **assertExceptionRaised**
- interface **assertFail**
- interface **assertFalse**
- interface **assertIsFinite**
- interface **assertIsNaN**
- interface **assertTrue**
- interface **fail**
- type **UnusableArgument**

## Public Member Functions

- subroutine **assertExceptionRaisedMessage** (message, location)
- subroutine, public **assertSameShape** (shapeA, shapeB, message, location)
- logical function, public **conformable** (shapeA, shapeB)
- logical function, public **nonConformable** (shapeA, shapeB)
- subroutine, public **assertAny** (conditions, message, location)
- subroutine, public **assertAll** (conditions, message, location)
- subroutine, public **assertNone** (conditions, message, location)
- subroutine, public **assertNotAll** (conditions, message, location)
- subroutine **assertIsNaN\_double** (x, message, location)
- subroutine **assertIsFinite\_single** (x, message, location)
- subroutine **assertIsFinite\_double** (x, message, location)

### 17.8.1 Detailed Description

Provides fundamental assertions over the most basic types, a foundation for providing test services to end users.

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

**Note**

For assertions on strings whitespace may or may not be significant to a test. We now have several options for dealing with whitespace via the optional argument `Whitespace`. These options are `IGNORE_ALL`, `TRIM_ALL`, and `KEEP_ALL`. - Usage is as follows.

```
call assertEquals(expectedString, foundString, & & Whitespace==  
IGNORE_ALL )
```

**WhitespaceOptions:**

- **TRIM\_ALL** ignores leading and trailing whitespace.
- **KEEP\_ALL** keeps all whitespace as significant, even discriminating between tabs and spaces.
- **IGNORE\_ALL** ignores all whitespace (spaces & tabs).

Example usages can be seen in `tests/Test_AssertBasic.F90` or `Examples/Simple/tests/helloWorld.pf`.

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

- `AssertBasic.F90`

## 17.9 `GenerateAssertsOnArrays::AssertRealArrayArgument Class` - Reference

**Public Member Functions**

- `def __init__`
- `def updateDescriptions`
- `def getAssertionName`
- `def getExpectedDescription`
- `def getFoundDescription`
- `def getTolerance`

**Public Attributes**

- `assertionName`
- `expectedFType`
- `expectedPrecision`
- `expectedRank`

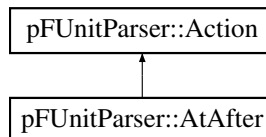
- **foundFType**
- **foundPrecision**
- **foundRank**
- **tolerance**
- **expectedDescription**
- **foundDescription**

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

- `GenerateAssertsOnArrays.py`

## 17.10 pFUnitParser::AtAfter Class Reference

Inheritance diagram for pFUnitParser::AtAfter:



### Public Member Functions

- `def __init__`
- `def match`
- `def action`

### Public Attributes

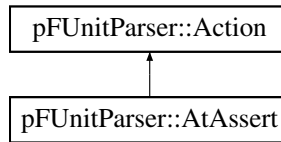
- **parser**

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

- `pFUnitParser.py`

## 17.11 pFUnitParser::AtAssert Class Reference

Inheritance diagram for pFUnitParser::AtAssert:



### Public Member Functions

- def `__init__`
- def `match`
- def `appendSourceLocation`
- def `action`

### Public Attributes

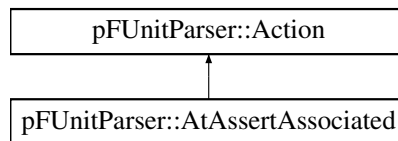
- `parser`

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

- `pFUnitParser.py`

## 17.12 pFUnitParser::AtAssertAssociated Class Reference

Inheritance diagram for pFUnitParser::AtAssertAssociated:



### Public Member Functions

- def `__init__`
- def `match`
- def `appendSourceLocation`
- def `action`



## Public Attributes

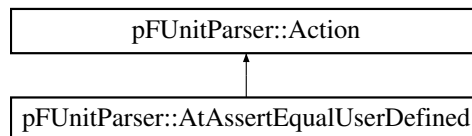
- **parser**

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

- pFUnitParser.py

## 17.13 pFUnitParser::AtAssertEqualUserDefined Class Reference

Inheritance diagram for pFUnitParser::AtAssertEqualUserDefined:



## Public Member Functions

- def **\_\_init\_\_**
- def **match**
- def **appendSourceLocation**
- def **action**

## Public Attributes

- **parser**

### 17.13.1 Detailed Description

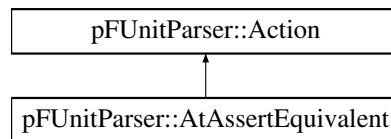
Convenience directive replacing `(a,b)` with a call to `assertTrue(a==b)` and an error message, if none is provided when invoked.

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

- pFUnitParser.py

## 17.14 pFUnitParser::AtAssertEquivalent Class Reference

Inheritance diagram for pFUnitParser::AtAssertEquivalent:



### Public Member Functions

- def `__init__`
- def `match`
- def `appendSourceLocation`
- def `action`

### Public Attributes

- `parser`

### 17.14.1 Detailed Description

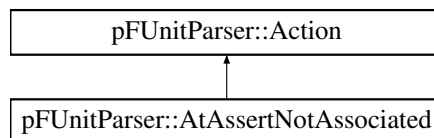
Convenience directive replacing `(a,b)` with a call to `assertTrue(a.eqv.b)` and an error message, if none is provided when invoked.

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

- pFUnitParser.py

## 17.15 pFUnitParser::AtAssertNotAssociated Class Reference

Inheritance diagram for pFUnitParser::AtAssertNotAssociated:



### Public Member Functions

- def `__init__`
- def `match`
- def `appendSourceLocation`
- def `action`

### Public Attributes

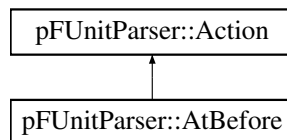
- `parser`
- `name`

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

- pFUnitParser.py

## 17.16 pFUnitParser::AtBefore Class Reference

Inheritance diagram for pFUnitParser::AtBefore:



### Public Member Functions

- def `__init__`
- def `match`
- def `action`

### Public Attributes

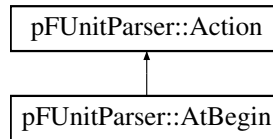
- `parser`

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

- pFUnitParser.py

## 17.17 pFUnitParser::AtBegin Class Reference

Inheritance diagram for pFUnitParser::AtBegin:



### Public Member Functions

- def `__init__`
- def `match`
- def `action`

### Public Attributes

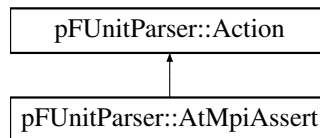
- `parser`

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

- pFUnitParser.py

## 17.18 pFUnitParser::AtMpiAssert Class Reference

Inheritance diagram for pFUnitParser::AtMpiAssert:



### Public Member Functions

- def `__init__`
- def `match`
- def `appendSourceLocation`
- def `action`

### Public Attributes

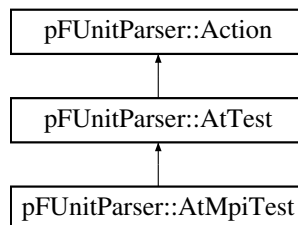
- **parser**

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

- pFUnitParser.py

## 17.19 pFUnitParser::AtMpiTest Class Reference

Inheritance diagram for pFUnitParser::AtMpiTest:



### Public Member Functions

- def **\_\_init\_\_**

### Public Attributes

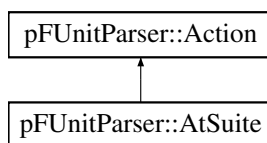
- **parser**
- **keyword**

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

- pFUnitParser.py

## 17.20 pFUnitParser::AtSuite Class Reference

Inheritance diagram for pFUnitParser::AtSuite:



### Public Member Functions

- def `__init__`
- def `match`
- def `action`

### Public Attributes

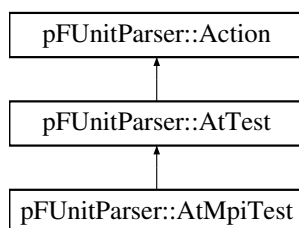
- `parser`

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

- `pFUnitParser.py`

## 17.21 pFUnitParser::AtTest Class Reference

Inheritance diagram for pFUnitParser::AtTest:



### Public Member Functions

- def `__init__`
- def `match`
- def `action`

### Public Attributes

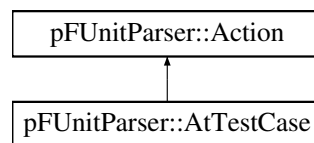
- **parser**
- **keyword**

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

- pFUnitParser.py

## 17.22 pFUnitParser::AtTestCase Class Reference

Inheritance diagram for pFUnitParser::AtTestCase:



### Public Member Functions

- def **\_\_init\_\_**
- def **match**
- def **action**

### Public Attributes

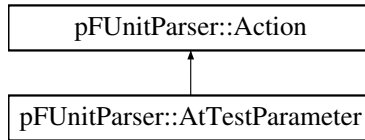
- **parser**

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

- pFUnitParser.py

## 17.23 pFUnitParser::AtTestParameter Class Reference

Inheritance diagram for pFUnitParser::AtTestParameter:



### Public Member Functions

- def `__init__`
- def `match`
- def `action`

### Public Attributes

- `parser`

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

- `pFUnitParser.py`

## 17.24 TestCaseB\_mod::B\_Parameter Type Reference

### Public Member Functions

- procedure `toString`
- procedure `toString`

### Public Attributes

- real `phi`
- real `theta`

The documentation for this type was generated from the following files:

- `ParameterizedTestCaseB.F90`
- `ParameterizedTestCaseB.pf`

## 17.25 BaseTestRunner\_mod Module Reference

<BriefDescription>



## Data Types

- type **BaseTestRunner**
- interface **run2**

### 17.25.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- BaseTestRunner.F90

## 17.26 BeforeAfter\_mod Module Reference

### Public Member Functions

- subroutine **first** (this)
- subroutine **last** (this)
- subroutine **firstAndLastCalled** (this)
- subroutine **succeeds** (this)
- subroutine **fails** (this)

### Public Attributes

- integer **countStart** = 0
- integer **countComplete** = 0

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

- Examples/MPI\_Halo/tests/beforeAfter.pf

## 17.27 BrokenSetUpCase\_mod Module Reference

<BriefDescription>

### Data Types

- type **BrokenSetUpCase**

### Public Member Functions

- type(BrokenSetUpCase) function, pointer, public **newBrokenSetUpCase** ()

### 17.27.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

20 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- BrokenSetUpCase.F90

## 17.28 BrokenTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- type **BrokenTestCase**

### Public Member Functions

- subroutine **tearDown** (this)

#### 17.28.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

20 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- BrokenTestCase.F90

## 17.29 TestCaseC\_mod::C\_Parameter Type Reference

### Public Member Functions

- procedure **toString**
- procedure **toString**

### Public Attributes

- real **phi**
- real **theta**

The documentation for this type was generated from the following files:

- MpiParameterizedTestCaseC.F90
- MpiParameterizedTestCaseC.pf

## 17.30 Cases\_mod Module Reference

### Data Types

- type [MyParamType](#)
- type [MyTestCase](#)

### Public Member Functions

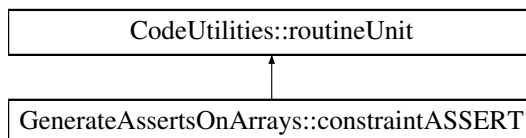
- type([MyParamType](#)) function **newMyParam** (i)
- type([MyTestCase](#)) function **newMyTestCase** (param)
- subroutine **test\_odd** (this)
- subroutine **test\_even** (this)
- character(:) function, allocatable **toString** (this)

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

- Test\_Cases.pf

## 17.31 GenerateAssertsOnArrays::constraintASSERT Class - Reference

Inheritance diagram for GenerateAssertsOnArrays::constraintASSERT:



### Public Member Functions

- def [\\_\\_init\\_\\_](#)  
*Dependency injection.*

### Public Attributes

- **expectedDescr**
- **foundDescr**

- **name**
- [name1](#)

*Add in the extra module procedures...*

- [tolerance](#)

*If you need another kind of code generator, perhaps conditioned on eDesc., fDesc., or tol, then that logic would go here...*

### 17.31.1 Constructor & Destructor Documentation

17.31.1.1 `def GenerateAssertsOnArrays::constraintASSERT::__init__( self, assertionName, expectedDescr, foundDescr, tolerance )`

Dependency injection.

Will generate "assert"+assertionName assertionName="Equal" This next line actually generates the text of the code.

### 17.31.2 Member Data Documentation

17.31.2.1 `GenerateAssertsOnArrays::constraintASSERT::name1`

Add in the extra module procedures...

If needed... Kluge. Need to make makeSubroutineNames and load the extra interface entries there.

17.31.2.2 `GenerateAssertsOnArrays::constraintASSERT::tolerance`

If you need another kind of code generator, perhaps conditioned on eDesc., fDesc., or tol, then that logic would go here...

E.g. to implement `assertEqual(Logical(...))`

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

- `GenerateAssertsOnArrays.py`

## 17.32 Test\_mod::countTestCases Interface Reference

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

- `Test.F90`

## 17.33 `mods::pre::pre2::dataString` Class Reference

### Public Member Functions

- def `__init__`
- def `insert`
- def `getLength`
- def `getPosition`
- def `setPosition`
- def `getItem`
- def `getDataAtPosition`
- def `getData`
- def `getSlice`
- def `getSliceForward`
- def `removeSlice`
- def `getCurrentData`
- def `insertAtCurrent`
- def `append`
- def `advanceAndGetNextData`
- def `validPosition`
- def `findToEnd`
- def `match`
- def `matchToEnd`
- def `searchToEnd`
- def `searchToPosition`
- def `finditerToEnd`
- def `finditerToPosition`

### Public Attributes

- `data`
- `position`

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

- `pre2.py`

## 17.34 `DebugListener_mod` Module Reference

<BriefDescription>

## Data Types

- interface **DebugListener**

## Public Member Functions

- subroutine **addFailure** (this, testName, exceptions)
- subroutine **startTest** (this, testName)

### 17.34.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- DebugListener.F90

## 17.35 CodeUtilities::declaration Class Reference

### Public Member Functions

- def **\_\_init\_\_**
- def **generate**

### Public Attributes

- **simpleDeclaration**
- **fullDeclaration**
- **name**

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

- CodeUtilities.py

## 17.36 DynamicTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- interface **delete**
- type **DynamicTestCase**
- interface **testmethod**

### Public Member Functions

- type(DynamicTestCase) function, pointer, public **newDynamicTestCase** (test-Method, name)

#### 17.36.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- DynamicTestCase.F90



## 17.37 Exception\_mod Module Reference

### Data Types

- interface **anyExceptions**
- interface **catch**
- interface **getNumExceptions**
- interface **throw**

### Public Member Functions

- subroutine, public **initializeGlobalExceptionList** ()
- type(Exception) function, public **catchNext** (preserve)
- type(Exception) function, dimension(:), allocatable, public **getExceptions** ()
- logical function, public **noExceptions** ()
- logical function, public **anyErrors** ()
- subroutine, public **gatherExceptions** (context)
- subroutine, public **clearAll** ()

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

- Exception.F90

## 17.38 Expectation\_mod Module Reference

### Data Types

- type **Expectation**
- type **Predicate**
- type **Subject**
- interface **subVoid**

### Public Member Functions

- type(Predicate) function, public **newPredicate** (name)
- type(Subject) function, public **newSubject** (name, sub)
- type(Subject) function, public **newSubjectNameOnly** (name)
- type(Expectation) function, public **newExpectation** (subj, pred)

### Public Attributes

- type(Predicate), parameter, public **wasCalled** = Predicate('wasCalled')
- type(Predicate), parameter, public **wasNotCalled** = Predicate('wasNotCalled')
- type(Predicate), parameter, public **wasCalledOnce** = Predicate('wasCalled-Once')

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

- Expectation.F90

## 17.39 Fixture\_mod Module Reference

### Public Member Functions

- subroutine **mySetup** ()
- subroutine **myTearDown** ()
- subroutine **testRead** ()
- subroutine **testEOF** ()

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

- fixtureTests.pf

## 17.40 FixtureTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- interface **delete**
- type **FixtureTestCase**

### Public Member Functions

- type(FixtureTestCase) function, public **newFixtureTestCase** ()
- subroutine, public **simpleTestMethod** (this)
- subroutine, public **methodA** (this)
- subroutine, public **methodB** (this)

### 17.40.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

20 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- FixtureTestCase.F90

## 17.41 CodeUtilities::fortranSubroutineSignature Class Reference

### Public Member Functions

- def **\_\_init\_\_**
- def **setReturnFType**
- def **addArg**
- def **generateInterfaceEntry**
- def **generateImplementationSignature**
- def **generateImplementationClose**

### Public Attributes

- **name**
- **ArgumentToFType**
- **ReturnFType**
- **SubroutineType**

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

- CodeUtilities.py

### 17.42 AbstractTestResult\_mod::getErrors Interface Reference

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

- AbstractTestResult.F90

### 17.43 Test\_mod::getName Interface Reference

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

- Test.F90

### 17.44 AbstractTestResult\_mod::getSuccesses Interface Reference

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

- AbstractTestResult.F90

### 17.45 Halo\_mod Module Reference

#### Public Member Functions

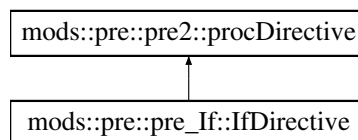
- subroutine **haloFill** (array, communicator)

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

- Halo.F90

### 17.46 mods::pre::pre\_If::IfDirective Class Reference

Inheritance diagram for mods::pre::pre\_If::IfDirective:



### Public Member Functions

- def **evaluate**

### Public Attributes

- **startPosition**
- **newPosition**

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

- pre\_lf.py

## 17.47 CodeUtilities::implementation Class Reference

### Public Member Functions

- def **\_\_init\_\_**
- def **generate**

### Public Attributes

- **name**
- **source**

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

- CodeUtilities.py

## 17.48 CodeUtilities::interfaceBlock Class Reference

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

- CodeUtilities.py

## 17.49 mods::pre::pre\_If::interval Class Reference

### Public Member Functions

- def `__init__`
- def `getInterval`
- def `setInterval`
- def `getStart`
- def `getEnd`

### Public Attributes

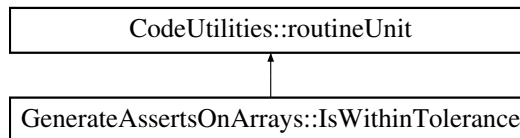
- `start`
- `end`
- `interval`

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

- `pre_if.py`

## 17.50 GenerateAssertsOnArrays::IsWithinTolerance Class Reference

Inheritance diagram for `GenerateAssertsOnArrays::IsWithinTolerance`:



### Public Member Functions

- def `__init__`

### Public Attributes

- `rank`
- `precision`
- `name`

## 17.51 `Test_RestrictSphericalCoordinates_mod::LatLonCase` Type Reference 87

- `fType`
- `declaration`
- `declarations`

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

- `GenerateAssertsOnArrays.py`

## 17.51 `Test_RestrictSphericalCoordinates_mod::LatLonCase` Type - Reference

### Public Member Functions

- procedure `toString`

### Public Attributes

- real `lat`
- real `lon`
- real `restrictedLat`
- real `restrictedLon`

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

- `Test_RestrictedSphericalCoordinates.pf`

## 17.52 `LinearInterpolator_mod` Module Reference

### Data Types

- interface `LinearInterpolator`
- type `Node`

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

- `LinearInterpolator.F90`

## 17.53 MakeInfinity\_mod Module Reference

<BriefDescription>

### Public Member Functions

- real(r32) function, public **makeInf\_32** ()
- real(r64) function, public **makeInf\_64** ()

### 17.53.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC SIVO

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- MakeInfinity.F90

## 17.54 MakeNaN\_mod Module Reference

<BriefDescription>

### Public Member Functions

- real(r32) function, public **makeNaN\_32** ()
- real(r64) function, public **makeNaN\_64** ()



### 17.54.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- MakeNaN.F90

## 17.55 Mock\_mod Module Reference

<BriefDescription>

**Data Types**

- type **Mock**

### 17.55.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

12 May 2014

**Note**

<A note here.> <Or starting here...>

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

- Mock.F90

## 17.56 MockCall\_mod Module Reference

<BriefDescription>

### Data Types

- type **MockCall**

### Public Member Functions

- type(MockCall) function, public **newMockCall** (name)

#### 17.56.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- MockCall.F90

## 17.57 MockListener\_mod Module Reference

<BriefDescription>

### Data Types

- type **MockListener**

### Public Member Functions

- subroutine **startTest** (this, testName)

### 17.57.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

20 Mar 2015

#### Note

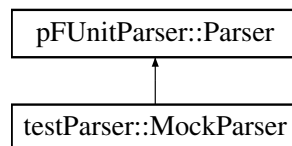
<A note here.> <Or starting here...>

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

- MockListener.F90

## 17.58 testParser::MockParser Class Reference

Inheritance diagram for testParser::MockParser:



### Public Member Functions

- def `__init__`
- def `nextLine`
- def `reset`

### Public Attributes

- `saveLines`
- `lines`
- `outputFile`
- `outLines`
- `userTestCase`
- `userTestMethods`
- `currentSelfObjectName`

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

- `testParser.py`

## 17.59 MockRepository\_mod Module Reference

<BriefDescription>

### Data Types

- interface `addExpectationThat_`
- type `MockRepository`
- interface `registerMockCallBy_`
- interface `subVoid`

### Public Member Functions

- type(MockRepository) function, pointer, public `newMockRepository ()`
- subroutine `expectCall` (this, obj, method)

### Public Attributes

- integer, parameter, public `MAX_LEN_METHOD_NAME = 32`
- integer, parameter, public `MAX_LEN_CALL_REGISTRATION = 32`
- class(MockRepository), pointer, public `MockRepositoryPointer = > null()`

### 17.59.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- MockRepository.F90

## 17.60 MockSUT\_mod Module Reference

### Data Types

- type **MockSUT**

### Public Member Functions

- type(MockSUT) function, allocatable, public **newMockSUT** (repository)
- subroutine **method1** (this)

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

- Test\_MockRepository.F90

## 17.61 testParser::MockWriter Class Reference

### Public Member Functions

- def **\_\_init\_\_**
- def **write**

### Public Attributes

- **parser**

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

- testParser.py

## 17.62 CodeUtilities::module Class Reference

### Public Member Functions

- def **\_\_init\_\_**
- def **generate**
- def **addDeclaration**
- def **addImplementation**
- def **addRoutineUnit**
- def **addInterfaceBlock**
- def **getName**
- def **setFileName**
- def **getFileName**

### Public Attributes

- **name**
- **declarations**
- **implementations**
- **generation**
- **fileName**

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

- CodeUtilities.py

## 17.63 MpiContext\_mod Module Reference

<BriefDescription>

## Data Types

- type `MpiContext`
- interface `newMpiContext`

## Public Member Functions

- subroutine `barrier` (this)

### 17.63.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- `MpiContext.F90`

## 17.64 `MpiStubs_mod` Module Reference

<BriefDescription>

## Public Member Functions

- subroutine, public `MPI_Comm_rank` (comm, rank, ier)
- subroutine, public `MPI_Comm_size` (comm, size, ier)
- subroutine, public `MPI_Comm_dup` (comm, newComm, ier)
- subroutine, public `MPI_Comm_group` (comm, group, ier)
- subroutine, public `MPI_Group_range_incl` (group, n, ranges, newGroups, ier)
- subroutine, public `MPI_Comm_create` (comm, group, newComm, ier)

### Public Attributes

- integer, parameter, public **MPI\_COMM\_WORLD** = -1
- integer, parameter, public **MPI\_COMM\_NULL** = -1
- integer, parameter, public **MPI\_COMM\_SUCCESS** = 0

### 17.64.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- MpiStubs.F90

### 17.65 MpiTestCase\_mod Module Reference

<BriefDescription>

#### Data Types

- type **MpiTestCase**

#### Public Member Functions

- recursive subroutine **runBare** (this)
- integer function **getMpiCommunicator** (this)
- integer function **getProcessRank** (this)



### 17.65.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- `MpiTestCase.F90`

## 17.66 `MpiTestCaseB_mod::MpiTestCaseB` Type Reference

### Public Member Functions

- procedure **setUp**
- procedure **tearDown**
- procedure **setUp**
- procedure **tearDown**

### Public Attributes

- integer **componentI**

The documentation for this type was generated from the following files:

- `MpiTestCaseB.F90`
- `MpiTestCaseB.pf`

## 17.67 `MpiTestCaseB_mod` Module Reference

### Data Types

- type `MpiTestCaseB`

### Public Member Functions

- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)
- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)

The documentation for this module was generated from the following files:

- `MpiTestCaseB.F90`
- `MpiTestCaseB.pf`

## 17.68 `MpiTestMethod_mod` Module Reference

<BriefDescription>

### Data Types

- interface **mpiMethod**
- type **MpiTestMethod**
- interface **newMpiTestMethod**

### 17.68.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- `MpiTestMethod.F90`

## 17.69 `MpiTestParameter_mod` Module Reference

### Data Types

- type **`MpiTestParameter`**

### Public Member Functions

- `type(MpiTestParameter)` function, public **`newMpiTestParameter`** (`num-ProcessesRequested`)

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

- `MpiTestParameter.F90`

## 17.70 `pFUnitParser::MyError` Class Reference

Inherits `Exception`.

### Public Member Functions

- `def __init__`
- `def __str__`

### Public Attributes

- **`value`**

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

- `pFUnitParser.py`

## 17.71 `Cases_mod::MyParamType` Type Reference

### Public Member Functions

- procedure **`toString`**

### Public Attributes

- integer `i`

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

- `Test_Cases.pf`

## 17.72 `Cases_mod::MyTestCase` Type Reference

### Public Attributes

- integer `i`

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

- `Test_Cases.pf`

## 17.73 `TestCaseC_mod::newC_Parameter` Interface Reference

### Public Member Functions

- type([C\\_Parameter](#)) function `newC_Parameter_phiTheta` (`npes`, `phi`, `theta`)
- elemental function `newC_Parameter_case` (`i`)
- type([C\\_Parameter](#)) function `newC_Parameter_phiTheta` (`npes`, `phi`, `theta`)
- elemental function `newC_Parameter_case` (`i`)

The documentation for this interface was generated from the following files:

- `MpiParameterizedTestCaseC.F90`
- `MpiParameterizedTestCaseC.pf`

## 17.74 `node_mod` Module Reference

### Data Types

- interface `node`

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

- `node.F90`

## 17.75 ParallelContext\_mod Module Reference

<BriefDescription>

### Data Types

- interface **allReduceLogical**
- interface **gatherInteger**
- interface **gatherLogical**
- interface **gatherString**
- interface **getNumProcesses**
- type **ParallelContext**
- interface **processRank**
- interface **sum**

### 17.75.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- ParallelContext.F90

## 17.76 ParallelException\_mod Module Reference

<BriefDescription>

### Data Types

- interface **anyExceptions**
- interface **getNumExceptions**

### Public Member Functions

- subroutine, public **gather** (context)

#### 17.76.1 Detailed Description

<BriefDescription>

##### Author

Tom Clune, NASA/GSFC

##### Date

07 Nov 2013

##### Note

<A note here.> <Or starting here...>

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

- ParallelException.F90

#### 17.77 ParameterizedTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- type **ParameterizedTestCase**

### Public Attributes

- integer, parameter, public **MAX\_LEN\_LABEL** = 32

### 17.77.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- ParameterizedTestCase.F90

## 17.78 Params\_mod Module Reference

<BriefDescription>

### Public Attributes

- integer, parameter, public **MAX\_LENGTH\_NAME** = 128
- integer, parameter **R32** = selected\_real\_kind(p=6)
- integer, parameter **R64** = selected\_real\_kind(p=14)
- integer, parameter **C32** = selected\_real\_kind(p=6)
- integer, parameter **C64** = selected\_real\_kind(p=14)
- integer, parameter **I32** = INT32
- integer, parameter **I64** = INT64
- integer, parameter **NEQP** = 0
- integer, parameter **EQP** = 1
- integer, parameter **GTP** = 2
- integer, parameter **GEP** = 3
- integer, parameter **LTP** = 4
- integer, parameter **LEP** = 5
- integer, parameter **RELEQP** = 6

### 17.78.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

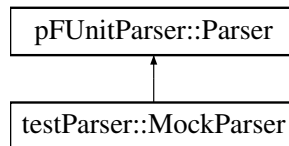
<A note here.> <Or starting here...>

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

- Params.F90

## 17.79 pFUnitParser::Parser Class Reference

Inheritance diagram for pFUnitParser::Parser:



### Public Member Functions

- def **\_\_init\_\_**
- def **commentLine**
- def **run**
- def **isComment**
- def **nextLine**
- def **printHeader**
- def **printTail**
- def **printWrapUserTestCase**
- def **printRunMethod**



- def **printParameterHeader**
- def **printMakeSuite**
- def **addSimpleTestMethod**
- def **addMpiTestMethod**
- def **addUserTestMethod**
- def **printMakeCustomTest**
- def **makeWrapperModule**
- def **final**

#### Public Attributes

- **fileName**
- **inputFile**
- **outputFile**
- **defaultSuiteName**
- **suiteName**
- **currentLineNumber**
- **userModuleName**
- **userTestCase**
- **userTestMethods**
- **wrapModuleName**
- **actions**

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

- pFUnitParser.py

## 17.80 Test\_Parameters\_mod::peCase Type Reference

#### Public Member Functions

- procedure **toString**

#### Public Attributes

- integer **p1**
- integer **p2**

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

- parameterizedTests.pf

## 17.81 pFUnit Module Reference

<BriefDescription>

### Public Member Functions

- integer function **run** ()

### 17.81.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- pFUnitPackage.F90

## 17.82 pFUnit\_mod Module Reference

<BriefDescription>

### Public Member Functions

- subroutine, public **initialize** (useMpi)
- subroutine, public **finalize** (successful)

### 17.82.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- pFUnit.F90

## 17.83 PrivateException\_mod Module Reference

<BriefDescription>

### Data Types

- type **Exception**
- type **ExceptionList**
- interface **newException**

### Public Member Functions

- type(ExceptionList) function, public **newExceptionList** ()
- logical function **noExceptions** (this)

### Public Attributes

- integer, parameter, public **MAXLEN\_MESSAGE** = 80\*15
- integer, parameter, public **MAXLEN\_FILE\_NAME** = 80
- character(len=\*), parameter, public **NULL\_MESSAGE** = ”

### 17.83.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

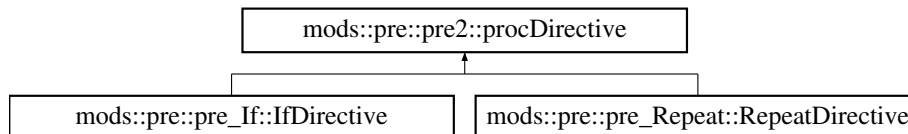
<A note here.> <Or starting here...>

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

- Exception.F90

## 17.84 mods::pre::pre2::procDirective Class Reference

Inheritance diagram for mods::pre::pre2::procDirective:



### Public Member Functions

- def `__init__`
- def `getLength`
- def `match`
- def `evaluate`
- def `getNewPosition`
- def `addTokenRE`
- def `searchTokenToEnd`
- def `searchTokenToPosition`
- def `finditerTokenToPosition`
- def `makeTokenErrorMessage`

## Public Attributes

- **name**
- **newPosition**
- **tokens**
- **TokenREs**

### 17.84.1 Member Function/Subroutine Documentation

17.84.1.1 **def mods::pre::pre2::procDirective::addTokenRE ( self, args, key, defaultToken, prefix = r''' (?i) [ \t]\*''', postfix = '' )**

Add a token/create an RE with a prefix that by default ignores preceding whitespace. Stores the RE in a dictionary for this directive. Note this currently expects complex tokens like <EndToken> not something as overloaded as a close paren.

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

- pre2.py

## 17.85 RemoteProxyTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- interface **RemoteProxyTestCase**

### 17.85.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

**Note**

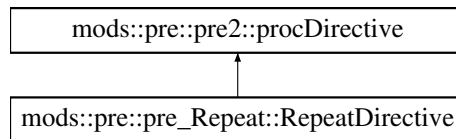
<A note here.> <Or starting here...>

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

- RemoteProxyTestCase.F90

## 17.86 mods::pre::pre\_Repeat::RepeatDirective Class Reference

Inheritance diagram for mods::pre::pre\_Repeat::RepeatDirective:

**Public Member Functions**

- def **evaluate**

**Public Attributes**

- **startPosition**
- **newPosition**

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

- pre\_Repeat.py

## 17.87 ResultPrinter\_mod Module Reference

<BriefDescription>

**Data Types**

- type **ResultPrinter**

## Public Member Functions

- type(ResultPrinter) function, public **newResultPrinter** (unit)
- subroutine **addError** (this, testName, exceptions)
- subroutine **startTest** (this, testName)
- subroutine **print** (this, result)
- subroutine **printHeader** (this, runTime)
- subroutine **printFooter** (this, result)

### 17.87.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- ResultPrinter.F90

## 17.88 RobustRunner\_mod Module Reference

<BriefDescription>

### Data Types

- interface **RobustRunner**
- type **TestCaseMonitor**

### Public Member Functions

- subroutine **runWithResult** (this, aTest, context, result)
- subroutine **launchRemoteRunner** (this, numSkip)
- subroutine **startTest** (this, testName)
- subroutine **addFailure** (this, testName, exceptions)
- subroutine **addError** (this, testName, exceptions)
- type(TestResult) function **createTestResult** (this)

#### 17.88.1 Detailed Description

<BriefDescription>

##### Author

Tom Clune, NASA/GSFC

##### Date

07 Nov 2013

##### Note

<A note here.> <Or starting here...>

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

- RobustRunner.F90

### 17.89 robustTestSuite\_mod Module Reference

<BriefDescription>

#### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testRunSucceeds** ()
- subroutine **testRunAssertFailure** ()
- subroutine **testRunStops** ()



### 17.89.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

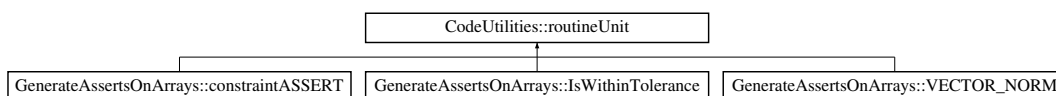
<A note here.> <Or starting here...>

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

- robustTestSuite.F90

## 17.90 CodeUtilities::routineUnit Class Reference

Inheritance diagram for CodeUtilities::routineUnit:



### Public Member Functions

- def **\_\_init\_\_**
- def **setName**
- def **getName**
- def **setDeclaration**
- def **addDeclaration**
- def **setImplementation**
- def **getDeclaration**
- def **getDeclarations**
- def **getImplementation**
- def **clearDeclarations**

### Public Attributes

- **name**
- **declaration**
- **declarations**
- **implementation**

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

- CodeUtilities.py

## 17.91 SerialContext\_mod Module Reference

<BriefDescription>

### Data Types

- type **SerialContext**

### Public Member Functions

- type(SerialContext) function, public **newSerialContext** ()

### Public Attributes

- type(SerialContext), parameter, public **THE\_SERIAL\_CONTEXT** = SerialContext()

### 17.91.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- SerialContext.F90

## 17.92 SimpleTestCase\_mod Module Reference

<BriefDescription>

**Data Types**

- interface **method**
- type **SimpleTestCase**

**Public Member Functions**

- type(TestSuite) function, public **suite** ()
- type(SimpleTestCase) function, public **newSimpleTestCase** (name, user-Method)
- subroutine, public **method1** (this)
- subroutine, public **method2** (this)
- subroutine, public **methodWith2Exceptions** (this)
- subroutine **delete\_** (this)

### 17.92.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- SimpleTestCase.F90

## 17.93 SourceLocation\_mod Module Reference

<BriefDescription>

### Data Types

- type **SourceLocation**

### Public Attributes

- character(len=MAXLEN\_FILE\_NAME), parameter, public **UNKNOWN\_FILE\_NAME** = '<unknown file>'
- integer, parameter, public **UNKNOWN\_LINE\_NUMBER** = -1
- type(SourceLocation), parameter, public **UNKNOWN\_SOURCE\_LOCATION** = SourceLocation()

### 17.93.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- SourceLocation.F90

## 17.94 SphericalCoordinates\_mod Module Reference

### Data Types

- interface **SphericalCoordinates**

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

- SphericalCoordinates.F90

## 17.95 TestListener\_mod::startTest Interface Reference

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

- TestListener.F90

## 17.96 StringConversionUtilities\_mod Module Reference

A collection of utilities used throughout the framework.

### Data Types

- interface **toString**
- type **WhitespaceOptions**

### Public Member Functions

- character(len=len\_trim(a)+1+len\_trim(b)) function, public **appendWithSpace** (a, b)
- character(len=:) function, allocatable, public **nullTerminate** (string)
- character(len=:) function, allocatable, public **unlessScalar** (vShape, string)
- logical function, public **whitespacep** (c)
- character(len=:) function, allocatable, public **trimAll** (s)
- character(len=:) function, allocatable, public **trimTrailingWhitespace** (s)

### Public Attributes

- integer, parameter, public **MAXLEN\_STRING** = 80
- type(WhitespaceOptions), parameter, public **IGNORE\_ALL** = WhitespaceOptions(IGNORE\_ALL\_)
- type(WhitespaceOptions), parameter, public **TRIM\_ALL** = WhitespaceOptions(-TRIM\_ALL\_)
- type(WhitespaceOptions), parameter, public **KEEP\_ALL** = WhitespaceOptions(-KEEP\_ALL\_)
- type(WhitespaceOptions), parameter, public **IGNORE\_DIFFERENCES** = - WhitespaceOptions(IGNORE\_DIFFERENCES\_)

#### 17.96.1 Detailed Description

A collection of utilities used throughout the framework.

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- StringConversionUtilities.F90

### 17.97 SubsetRunner\_mod Module Reference

<BriefDescription>

#### Data Types

- interface **SubsetRunner**

## Public Member Functions

- subroutine **addFailure** (this, testName, exceptions)
- subroutine **startTest** (this, testName)

### 17.97.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- SubsetRunner.F90

## 17.98 SurrogateTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- interface **getName**
- interface **runBare**
- interface **setName**
- type **SurrogateTestCase**

### 17.98.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- SurrogateTestCase.F90

## 17.99 SUT\_mod Module Reference

<BriefDescription>

**Data Types**

- type **SUT**

### 17.99.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_MockRepository.F90



## 17.100 Test\_mod::Test Type Reference

### Public Member Functions

- procedure([countTestCases](#)), deferred **countTestCases**
- procedure([run](#)), deferred **run**
- procedure([getName](#)), deferred **getName**
- procedure **setName**

### Public Attributes

- integer **placeholder**

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

- Test.F90

## 17.101 Test\_Assert\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type([TestSuite](#)) function, public **suite** ()
- subroutine **testAssertEqualStringDiffer1st** ()

### 17.101.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_Assert.F90

## 17.102 Test\_AssertBasic\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testAssertTrueF** ()
- subroutine **testAssertIsFinite** ()
- subroutine **testAssertExceptionRaised** ()
- subroutine **testAssertFail** ()

### 17.102.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_AssertBasic.F90

## 17.103 Test\_AssertComplex\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testEquals\_C\_complexScalar** ()
- subroutine **testEquals\_C\_0D1D** ()
- subroutine **testEquals\_C\_1D\_nonConformable1** ()
- subroutine **testEquals\_C\_2D\_SingleElementDifferent** ()
- subroutine **testEquals\_C\_MultiD\_SingleElementDifferent** ()
- subroutine **testEquals\_C\_MultiD\_SingleElementDifferent1**
- subroutine **testEquals\_C\_MultiD\_SingleElementDifferent2**
- subroutine **testEquals\_C\_MultiD\_SingleElementDifferent3**
- subroutine **testEquals\_C\_MultiD\_SingleElementDifferent4**
- subroutine **testEquals\_C\_MultiD\_SingleElementDifferent5**
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff1** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff2** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff3** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff4** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff5** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff6** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff7** ()
- subroutine **testEquals\_C\_MultiDMultiPrec\_SingleEltDiff8** ()
- subroutine **testEquals\_ScalarWithTolerance** ()
- subroutine **testEquals\_C\_MultiDWithTolerance** ()
- subroutine **testEquals\_C\_MultiDWithTolerance1** ()
- subroutine **testEquals\_C\_MultiDWithTolerance64** ()
- subroutine **testEquals\_C\_MultiDWithTolerance64\_1** ()
- subroutine **testEquals\_C\_MultiDWithTolerance64\_2** ()
- subroutine **testEquals\_C\_MultiDSourceLocation** ()
- subroutine **testEquals\_4DPComplex\_DifferenceReport** ()
- subroutine **testEquals\_ComplexMultiD\_SingleElementNE1**
- subroutine **testEquals\_ComplexMultiD\_SingleElementRE1**
- subroutine **testEquals\_ComplexMultiD\_SingleEltVarious1**
- subroutine **assertCatch** (string, location)

### 17.103.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_AssertComplex.F90

## 17.104 Test\_AssertInteger\_mod Module Reference

<BriefDescription>

**Public Member Functions**

- type(TestSuite) function, public **suite** ()
- subroutine **testAssertEqual\_equal** ()

### 17.104.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_AssertInteger.F90

## 17.105 Test\_AssertReal\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testEquals\_0D1D** ()
- subroutine **testEquals\_1D\_nonConformable1** ()
- subroutine **testEquals\_2D\_SingleElementDifferent** ()
- subroutine **testEquals\_MultiD\_SingleElementDifferent** ()
- subroutine **testEquals\_MultiD\_SingleElementDifferent1**
- subroutine **testEquals\_MultiD\_SingleElementDifferent2**
- subroutine **testEquals\_MultiD\_SingleElementDifferent3**
- subroutine **testEquals\_MultiD\_SingleElementDifferent4**
- subroutine **testEquals\_MultiD\_SingleElementDifferent5**
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff1** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff2** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff3** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff4** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff5** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff6** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff7** ()
- subroutine **testEquals\_MultiDMultiPrec\_SingleEltDiff8** ()
- subroutine **testEquals\_ScalarWithTolerance** ()
- subroutine **testEquals\_ScalarWithToleranceNoMsg** ()
- subroutine **testEquals\_VectorWithToleranceNoMsg** ()
- subroutine **testEquals\_MultiDWithTolerance** ()
- subroutine **testEquals\_MultiDWithTolerance1** ()
- subroutine **testEquals\_MultiDWithTolerance64** ()
- subroutine **testEquals\_MultiDWithTolerance64\_1** ()
- subroutine **testEquals\_MultiDWithTolerance64\_2** ()
- subroutine **testEquals\_MultiDSourceLocation** ()

- subroutine **testEquals\_ScalarAndLocation** ()
- subroutine **testEquals\_ScalarInfinity\_equal** ()
- subroutine **testEquals\_ScalarInfinity\_unequal\_A** ()
- subroutine **testEquals\_ScalarInfinity\_unequal\_B** ()
- subroutine **testEquals\_ScalarInfinity\_unequal\_C** ()
- subroutine **testEquals\_MultiD\_SingleElementGT1**
- subroutine **testEquals\_MultiD\_SingleElementGT2**
- subroutine **testEquals\_MultiD\_SingleEltVarious1**
- subroutine **testEquals\_MultiD\_SingleEltVarious2**
- subroutine **assertCatch** (string, location)

### 17.105.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

20 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- Test\_AssertReal.F90

## 17.106 Test\_BasicOpenMP\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testRunWithOpenMP** ()
- subroutine **testSerializeExceptions** ()

### 17.106.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_BasicOpenMP.F90

## 17.107 Test\_Exception\_mod Module Reference

<BriefDescription>

**Public Member Functions**

- type(TestSuite) function, public **suite** ()
- subroutine **testGetNumExceptions** ()
- subroutine **testCatchSucceed** ()
- subroutine **testGetLineNumber** ()
- subroutine **testGetFileName** ()

### 17.107.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

20 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_Exception.F90

## 17.108 Test\_FixtureTestCase\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testRunWithFixture** ()
- subroutine **testBrokenTestCase** ()
- subroutine **testBrokenSetUpCase** ()

### 17.108.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_FixtureTestCase.F90



## 17.109 Test\_LinearInterpolator\_mod::Test\_LinearInterpolator Type Reference 129

### 17.109 Test\_LinearInterpolator\_mod::Test\_LinearInterpolator Type Reference

#### Public Member Functions

- procedure **setUp**
- procedure **tearDown**

#### Public Attributes

- type(LinearInterpolator) **interpolator**

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

- Test\_LinearInterpolator.pf

### 17.110 Test\_LinearInterpolator\_mod Module Reference

#### Data Types

- type [Test\\_LinearInterpolator](#)

#### Public Member Functions

- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testBracketAtNode** (this)
- subroutine **testBracketInterior** (this)
- subroutine **testInterpolateAtNode** (this)
- subroutine **testInterpolateConstant** (this)

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

- Test\_LinearInterpolator.pf

### 17.111 Test\_MockCall\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(`TestSuite`) function, public **suite** ()
- subroutine **testExpectOneIntegerArgument**
- subroutine **testFailExpectOneIntegerArgument**

#### 17.111.1 Detailed Description

<BriefDescription>

##### Author

Tom Clune, NASA/GSFC

##### Date

21 Mar 2015

##### Note

<A note here.> <Or starting here...>

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

- `Test_MockCall.F90`

### 17.112 `Test_MockRepository_mod` Module Reference

#### Public Member Functions

- type(`TestSuite`) function, public **suite** ()
- subroutine **testNoAction** ()

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

- `Test_MockRepository.F90`

### 17.113 `Test_mod` Module Reference

<BriefDescription>

## Data Types

- interface [countTestCases](#)
- interface [getName](#)
- interface **run**
- type [Test](#)

### 17.113.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- Test.F90

## 17.114 Test\_MpiContext\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testNumProcesses1** (context)

### 17.114.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_MpiContext.F90

## 17.115 Test\_MpiException\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **test\_anyExceptions\_none** (this)
- subroutine **test\_getNumExceptions** (this)
- subroutine **test\_gather** (this)

### 17.115.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_MpiException.F90

## 17.116 Test\_MpiParameterizedTestCase\_mod Module Reference

<BriefDescription>

### Data Types

- type **ExtendedTestParameter**
- interface **method**
- type **Test\_MpiTestCase**

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- type(Test\_MpiTestCase) function, public **newTest\_MpiTestCase** (name, user-Method, testParameter)
- subroutine **testToString** (this)
- recursive subroutine **runMethod** (this)

### 17.116.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

21 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- Test\_MpiParameterizedTestCase.F90

## 17.117 Test\_MpiTestCase\_mod Module Reference

<BriefDescription>

## Data Types

- interface **method**
- type **Test\_MpiTestCase**

## Public Member Functions

- type(TestSuite) function, public **suite** ()
- type(Test\_MpiTestCase) function, public **newTest\_MpiTestCase** (name, user-Method, numProcesses)
- subroutine **testRunOn2Processors** (this)
- subroutine **brokenProcess1** (this)
- subroutine **brokenOnProcess2** (this)
- subroutine **testFailOn1** (this)
- subroutine **testFailOn2** (this)
- subroutine **testTooFewProcs** (this)
- recursive subroutine **runMethod** (this)

### 17.117.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

21 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- Test\_MpiTestCase.F90

## 17.118 Test\_Parameters\_mod::Test\_Parameters Type Reference

### Public Attributes

- integer **p1**
- integer **p2**

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

- parameterizedTests.pf

## 17.119 Test\_Parameters\_mod Module Reference

### Data Types

- type [peCase](#)
- type [Test\\_Parameters](#)

### Public Member Functions

- type([Test\\_Parameters](#)) function **newTest** (testParameter)
- type([peCase](#)) function **newPeCase** (p1, p2)
- type([peCase](#)) function, dimension(:), allocatable **getParameters** ()
- character(:) function, allocatable **toString** (this)
- subroutine **testParamBroken** (this)

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

- parameterizedTests.pf

## 17.120 Test\_RestrictSphericalCoordinates\_mod::Test\_Restrict-SphericalCoordinates Type Reference

### Public Attributes

- real **lat**
- real **lon**
- real **restrictedLat**
- real **restrictedLon**

- type(SphericalCoordinates) **unrestricted**
- type(SphericalCoordinates) **restricted**

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

- Test\_RestrictedSphericalCoordinates.pf

## 17.121 Test\_RestrictSphericalCoordinates\_mod Module Reference

### Data Types

- type [LatLonCase](#)
- type [Test\\_RestrictSphericalCoordinates](#)

### Public Member Functions

- type([Test\\_RestrictSphericalCoordinates](#)) function **newTest** (testParameter)
- type([LatLonCase](#)) function, dimension(:), allocatable **getParameters** ()
- subroutine **testRestrict** (this)
- character(:) function, allocatable **toString** (this)

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

- Test\_RestrictedSphericalCoordinates.pf

## 17.122 Test\_RobustRunner\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testRunVariety** ()

### 17.122.1 Detailed Description

<BriefDescription>



**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_RobustRunner.F90

## 17.123 Test\_SimpleTestCase\_mod Module Reference

<BriefDescription>

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- type(TestSuite) function **internalSuite** ()
- subroutine **testWorks** ()
- subroutine **testFails** ()
- subroutine **testRunSuite** ()
- subroutine **testRunMethodShouldFail** ()

### 17.123.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_SimpleTestCase.F90

## 17.124 Test\_StringConversionUtilities\_mod Module Reference

<BriefDescription>

**Public Member Functions**

- type(TestSuite) function, public **suite** ()
- subroutine **testToStringInteger1D** ()

### 17.124.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_StringConversionUtilities.F90

## 17.125 Test\_TestMethod\_mod Module Reference

<BriefDescription>

---

## Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testMethodWasRun** ()
- subroutine **testWasRun** ()

### 17.125.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

21 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- Test\_TestMethod.F90

## 17.126 Test\_TestResult\_mod Module Reference

<BriefDescription>

## Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testGetNumRun** ()
- subroutine **testGetNumFailed** ()
- subroutine **testAddListenerEnd** ()
- subroutine **testAddListenerStart** ()
- subroutine **testAddListenerFailure** ()

### 17.126.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

21 Mar 2015

#### Note

<A note here.> <Or starting here...>

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

- Test\_TestResult.F90

### 17.127 Test\_TestSuite\_mod Module Reference

<BriefDescription>

#### Data Types

- type **Verbose**

#### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testCountTestCases** ()
- subroutine **testCountTestCasesNestedA** ()
- subroutine **testCountTestCasesNestedB** ()
- subroutine **testCountTestCasesNestedC** ()
- subroutine **testGetTestCases** ()
- subroutine **myTestMethod** ()

### 17.127.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_TestSuite.F90

## 17.128 Test\_UnixProcess\_mod Module Reference

<BriefDescription>

**Public Member Functions**

- type(TestSuite) function, public **suite** ()
- subroutine **testIsActive** ()

### 17.128.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

21 Mar 2015

**Note**

<A note here.> <Or starting here...>

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

- Test\_UnixProcess.F90

## 17.129 Test\_XmlPrinter\_mod Module Reference

Output test messages in junit.xsd-compatible XML.

### Public Member Functions

- type(TestSuite) function, public **suite** ()
- subroutine **testValidXml** ()
- subroutine **compareXMLFileToExpectation** (xmlFile)

### 17.129.1 Detailed Description

Output test messages in junit.xsd-compatible XML.

**Author**

Halvor Lund

**Date**

2014 July

**Note**

Set up a test failure and feed it to an XML-based printer so that we can test its output. Use command line call (via "system") to try to find "xmllint," and if available, use it to validate the output against junit.xsd. Either way, check the output against a hard-coded expected result (a regression test).

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

- Test\_XmlPrinter.F90

## 17.130 TestA\_mod Module Reference

### Public Member Functions

- subroutine **testMethodA** ()
- subroutine **testMethodB** ()
- subroutine **testMethodC** (this)
- subroutine **testMethodA** ()
- subroutine **testMethodB** ()
- subroutine **testMethodC** (this)

The documentation for this module was generated from the following files:

- TestA.F90
- TestA.pf

## 17.131 TestCase\_mod Module Reference

<BriefDescription>

### Data Types

- type **ConcreteSurrogate**
- type **TestCase**
- type **TestCaseReference**

### Public Member Functions

- recursive subroutine **runBare** (this)
- recursive subroutine **runBare\_surrogate** (this)

### 17.131.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- TestCase.F90

### 17.132 TestCaseA\_mod::TestCaseA Type Reference

**Public Member Functions**

- procedure **setUp**
- procedure **tearDown**
- procedure **setUp**
- procedure **tearDown**

**Public Attributes**

- integer **componentI**

The documentation for this type was generated from the following files:

- TestCaseA.F90
- TestCaseA.pf

### 17.133 TestCaseA\_mod Module Reference

**Data Types**

- type [TestCaseA](#)

**Public Member Functions**

- subroutine **setUp** (this)
- subroutine **tearDown** (this)



- subroutine **testA** (this)
- subroutine **testB** (this)
- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)

The documentation for this module was generated from the following files:

- `TestCaseA.F90`
- `TestCaseA.pf`

## 17.134 `TestCaseB_mod::TestCaseB` Type Reference

### Public Member Functions

- procedure **setUp**
- procedure **tearDown**
- procedure **setUp**
- procedure **tearDown**

### Public Attributes

- integer, dimension(:), allocatable **table**
- real **phi**
- real **theta**

The documentation for this type was generated from the following files:

- `ParameterizedTestCaseB.F90`
- `ParameterizedTestCaseB.pf`

## 17.135 `TestCaseB_mod` Module Reference

### Data Types

- type [B\\_Parameter](#)
- type [TestCaseB](#)

### Public Member Functions

- type([TestCaseB](#)) function **newTestCaseB** (testParameter)
- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)
- character(:) function, allocatable **toString** (this)
- type([TestCaseB](#)) function **newTestCaseB** (testParameter)
- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)
- character(:) function, allocatable **toString** (this)

The documentation for this module was generated from the following files:

- ParameterizedTestCaseB.F90
- ParameterizedTestCaseB.pf

## 17.136 TestCaseC\_mod::TestCaseC Type Reference

### Public Member Functions

- procedure **setUp**
- procedure **tearDown**
- procedure **setUp**
- procedure **tearDown**

### Public Attributes

- integer, dimension(:), allocatable **table**
- real **phi**
- real **theta**

The documentation for this type was generated from the following files:

- MpiParameterizedTestCaseC.F90
- MpiParameterizedTestCaseC.pf

## 17.137 TestCaseC\_mod Module Reference

### Data Types

- type [C\\_Parameter](#)
- interface [newC\\_Parameter](#)
- type [TestCaseC](#)

### Public Member Functions

- type([TestCaseC](#)) function **newTestCaseC** (testParameter)
- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)
- subroutine **testC** (this)
- type([C\\_Parameter](#)) function **newC\_Parameter\_phiTheta** (npes, phi, theta)
- elemental function **newC\_Parameter\_case** (i)
- type([C\\_Parameter](#)) function, allocatable **paramGenerator** ()
- character(:) function, allocatable **toString** (this)
- type([TestCaseC](#)) function **newTestCaseC** (testParameter)
- subroutine **setUp** (this)
- subroutine **tearDown** (this)
- subroutine **testA** (this)
- subroutine **testB** (this)
- subroutine **testC** (this)
- type([C\\_Parameter](#)) function **newC\_Parameter\_phiTheta** (npes, phi, theta)
- elemental function **newC\_Parameter\_case** (i)
- type([C\\_Parameter](#)) function, allocatable **paramGenerator** ()
- character(:) function, allocatable **toString** (this)

The documentation for this module was generated from the following files:

- `MpiParameterizedTestCaseC.F90`
- `MpiParameterizedTestCaseC.pf`

## 17.138 TestFailure\_mod Module Reference

<BriefDescription>

## Data Types

- type **TestFailure**

### 17.138.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- TestFailure.F90

## 17.139 mods::pre::pre\_lf::TestIfDirective Class Reference

### Public Member Functions

- def **testTokenNotFound1**
- def **testNoTest**
- def **testIFTestFalse**
- def **testIFTestTrue1**
- def **testIFTestTrue2**
- def **testIFClearTokens**
- def **testIFClearTokensUntilEnd1**

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

- pre\_lf.py

## 17.140 mods::pre::interleavedp::TestInterleaved Class Reference

### Public Member Functions

- def **test\_InOrder**
- def **test\_NumberMismatch**
- def **test\_OrderMismatch1**
- def **test\_OrderMismatch2**
- def **test\_OrderMismatch3**
- def **test\_ElseMid1**
- def **test\_ElseMid2**
- def **test\_ElseMid3**
- def **test\_ElseMid4**
- def **test\_ElseMid5**
- def **test\_ElseMid6**
- def **test\_ElseMid7**
- def **test\_ElseMid8**
- def **test\_ElseMid9**
- def **test\_ElseMid10**

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

- interleavedp.py

## 17.141 TestListener\_mod Module Reference

<BriefDescription>

### Data Types

- interface **addFailure**
- interface **endRun**
- interface **endTest**
- type **ListenerPointer**
- interface **startTest**
- type **TestListener**

### Public Member Functions

- subroutine **addError** (this, testName, exceptions)
- subroutine **setDebug** (this)

### 17.141.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- TestListener.F90

### 17.142 TestMethod\_mod Module Reference

<BriefDescription>

**Data Types**

- interface **empty**
- interface **newTestMethod**
- type **TestMethod**

#### 17.142.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- TestMethod.F90

## 17.143 mods::pre::parseArgs::TestParseArgs Class Reference

**Public Member Functions**

- def **test\_ParseArgs\_OneArgWithBrackets1**
- def **test\_ParseArgs\_OneArgWithBrackets2**
- def **test\_ParseArgs\_OneArgWithBrackets3**
- def **test\_ParseArgs\_OneArgWithBrackets4**
- def **test\_ParseArgs\_OneArgWithBrackets5**
- def **test\_ParseArgs\_OneArgWithBrackets6**
- def **test\_ParseArgs\_OneArgWithBrackets7**
- def **test\_ParseArgs\_oneArg**
- def **test\_ParseArgs\_twoArgs1**
- def **test\_ParseArgs\_twoArgs2**
- def **test\_ParseArgs\_oneArgArray1**
- def **test\_ParseArgs\_TwoArgArray**
- def **test\_ParseArgs\_ThreeArgs**

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

- parseArgs.py

## 17.144 parseDirectiveArgs::TestParseDirectiveArgs Class Reference

**Public Member Functions**

- def **test\_args1**
- def **test\_args2**
- def **test\_args3**
- def **test\_args4**
- def **test\_args5**

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

- parseDirectiveArgs.py

## 17.145 testParser::TestParseLine Class Reference

### Public Member Functions

- def **testCppSetLineAndFile**
- def **testGetSubroutineName**
- def **testGetSelfObjectName**
- def **testGetType**
- def **testAtTest**
- def **testAtTestNoParens**
- def **testAtTestFail**
- def **testAtTestSkipComment**
- def **testAtMpiTest**
- def **testMatchAtTestCase**
- def **testMatchAtAssertEqual**
- def **testParseArgsFirstRest**
- def **testParseArgsFirstSecondRest**
- def **testMatchAtAssertAssociated**
- def **testMatchAtAssertAssociatedOverloaded1**
- def **testMatchAtAssertAssociatedOverloaded2**
- def **testMatchAtAssertUnAssociated**
- def **testMatchAtAssertUnAssociatedWith**
- def **testMatchAtAssertNotassociated**
- def **testMatchAtAssertNotassociatedWith**
- def **testMatchAtAssertEqualUserDefined**
- def **testMatchAtAssertEqualUserDefinedWithMessage**
- def **testMatchAtAssertEquivalent**
- def **testMatchAtAssertOther**
- def **testMatchAtMpiAssert**
- def **testMatchAtBefore**
- def **testMatchAtAfter**
- def **testMatchAtSuite**

### 17.145.1 Member Function/Subroutine Documentation

#### 17.145.1.1 def testParser::TestParseLine::testAtMpiTest ( *self* )

Check that a line starting with '@mpitest' is detected as an annotation and that optional parameters are collected.



**17.145.1.2 def testParser::TestParseLine::testAtTest ( self )**

Check that a line starting with '@test' is detected as an annotation.

**17.145.1.3 def testParser::TestParseLine::testAtTestFail ( self )**

Check that useful error is sent if next line is not properly formatted.

**17.145.1.4 def testParser::TestParseLine::testAtTestNoParens ( self )**

Check that test procedure with no parens is accepted.

**17.145.1.5 def testParser::TestParseLine::testAtTestSkipComment ( self )**

Ignore comment lines between @test and subroutine foo().

**17.145.1.6 def testParser::TestParseLine::testMatchAtAfter ( self )**

Check that a line starting with '@after\*' ...

**17.145.1.7 def testParser::TestParseLine::testMatchAtAssertAssociated ( self )**

Check that a line starting with '@assertAssociated' is detected as an annotation.

**17.145.1.8 def testParser::TestParseLine::testMatchAtAssertAssociated-Overloaded1 ( self )**

Check that a line starting with '@assertAssociated' is detected as an annotation. atAssertAssociated(a,b) implies a points to b. Overriding the name @assertAssociated.

**17.145.1.9 def testParser::TestParseLine::testMatchAtAssertAssociated-Overloaded2 ( self )**

Check that a line starting with '@assertAssociated' is detected as an annotation. atAssertAssociated(a,b) implies a points to b. Overriding the name @assertAssociated.

**17.145.1.10 def testParser::TestParseLine::testMatchAtAssertEqual ( self )**

Check that a line starting with '@assertEqual' is detected as an annotation.

**17.145.1.11 def testParser::TestParseLine::testMatchAtAssertEqualUserDefined ( self )**

Check that a line starting with '@assertEqualUserDefined' is detected as an annotation. atAssertEqualUserDefined(a,b) implies a points to b.

**17.145.1.12 def testParser::TestParseLine::testMatchAtAssertEqualUserDefined-  
WithMessage ( self )**

Check that a line starting with '@assertEqualUserDefined' is detected as an annotation. atAssertEqualUserDefined(a,b) implies a points to b.

**17.145.1.13 def testParser::TestParseLine::testMatchAtAssertEquivalent ( self )**

Check that a line starting with '@assertEquivalent' is detected as an annotation. atAssertEquivalent(a,b) implies a points to b.

**17.145.1.14 def testParser::TestParseLine::testMatchAtAssertNotassociated ( self )**

Check that a line starting with '@assertNotAssociated' is detected as an annotation.

**17.145.1.15 def testParser::TestParseLine::testMatchAtAssertNotassociatedWith ( self )**

Check that a line starting with '@assertNotassociatedWith' is detected as an annotation. atAssertNotassociated(a,b) implies a points to b.

**17.145.1.16 def testParser::TestParseLine::testMatchAtAssertOther ( self )**

Check that a line starting with '@assert\*' is detected as an annotation.

**17.145.1.17** `def testParser::TestParseLine::testMatchAtAssertUnAssociated ( self )`

Check that a line starting with '@assertUnAssociated' is detected as an annotation.

**17.145.1.18** `def testParser::TestParseLine::testMatchAtAssertUnAssociatedWith ( self )`

Check that a line starting with '@assertUnAssociatedWith' is detected as an annotation. `atAssertUnAssociated(a,b)` implies `a` points to `b`.

**17.145.1.19** `def testParser::TestParseLine::testMatchAtBefore ( self )`

Check that a line starting with '@before\*' ...

**17.145.1.20** `def testParser::TestParseLine::testMatchAtMpiAssert ( self )`

Check that a line starting with '@mpiAssert\*' is detected as an annotation.

**17.145.1.21** `def testParser::TestParseLine::testMatchAtSuite ( self )`

Check that a line starting with '@suite changes the suite name ...

**17.145.1.22** `def testParser::TestParseLine::testMatchAtTestCase ( self )`

Check that a line starting with '@testcase' is detected as an annotation.

**17.145.1.23** `def testParser::TestParseLine::testParseArgsFirstRest ( self )`

Test that the first-rest argument parsing is adequate.

**17.145.1.24** `def testParser::TestParseLine::testParseArgsFirstSecondRest ( self )`

Test that the `first-second-rest` argument parsing is adequate.

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

- `testParser.py`

**17.146** `parseBrackets::TestRejoinBracketed` Class Reference**Public Member Functions**

- `def testRejoinBracketed`
- `def testParseBrackets`

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

- `parseBrackets.py`

**17.147** `mods::pre::pre_Repeat::TestRepeatDirective` Class Reference**Public Member Functions**

- `def test_copyBlock1`
- `def test_copyBlock2`
- `def test_copyBlock2Vars`
- `def test_copyBlock2VarsMulti`
- `def test_copyBlock2VarsMultiWithStrings`
- `def test_copyNaiveRecursion`
- `def test_copyNaiveRecursion1`
- `def test_copyFunction1`

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

- `pre_Repeat.py`

**17.148** `TestResult_mod` Module Reference

<BriefDescription> Note: A possible extension point for user-specialized TestResults.

## Data Types

- type **TestResult**

## Public Member Functions

- type(TestResult) function, public **newTestResult** (name)
- subroutine **addError** (this, aTest, exceptions)
- subroutine **addSuccess** (this, aTest)
- integer function **failureCount** (this)
- subroutine **endTest** (this, aTest)
- subroutine **addListener** (this, listener)

### 17.148.1 Detailed Description

<BriefDescription> Note: A possible extension point for user-specialized TestResults.

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- TestResult.F90

## 17.149 TestRunner\_mod Module Reference

<BriefDescription>

## Data Types

- interface **newTestRunner**
- type **TestRunner**

### Public Member Functions

- type(TestResult) function **run** (this, aTest, context)
- subroutine **startTest** (this, testName)
- subroutine **addFailure** (this, testName, exceptions)

#### 17.149.1 Detailed Description

<BriefDescription>

##### Author

Tom Clune, NASA/GSFC

##### Date

07 Nov 2013

##### Note

<A note here.> <Or starting here...>

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

- TestRunner.F90

#### 17.150 TestSuite\_mod Module Reference

<BriefDescription>

##### Data Types

- interface **newTestSuite**
- type **TestReference**
- type **TestSuite**

##### Public Member Functions

- recursive subroutine **addTest** (this, aTest)

### 17.150.1 Detailed Description

<BriefDescription>

#### Author

Tom Clune, NASA/GSFC

#### Date

07 Nov 2013

#### Note

<A note here.> <Or starting here...>

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

- TestSuite.F90

## 17.151 ThrowFundamentalTypes\_mod Module Reference

<BriefDescription>

### Data Types

- interface **throwDifferentValues**
- interface **throwDifferentValuesWithLocation**

### Public Member Functions

- subroutine, public **throwNonConformable** (shapeExpected, shapeFound, location)
- character(len=MAXLEN\_SHAPE) function, public **locationFormat** (iLocation)

### 17.151.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- ThrowFundamentalTypes.F90

## 17.152 UnixPipeInterfaces\_mod Module Reference

<BriefDescription>

### Data Types

- interface **fgets**
- interface **free**
- interface **getdelim**
- interface **getline**
- interface **pclose**
- interface **popen**

### Public Attributes

- integer(C\_INT), parameter, public **CLOSE\_FAILED** = -1

### 17.152.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC



**Date**

07 Nov 2013

**Note**

<A note here.> <Or starting here...>

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

- UnixPipeInterfaces.F90

## 17.153 UnixProcess\_mod Module Reference

<BriefDescription>

**Data Types**

- interface **UnixProcess**

**Public Member Functions**

- character(len=:) function, allocatable **makeCommand** (baseCommand, runIn-Background)
- logical function **isActive** (this)
- character(len=:) function, allocatable **getDelim** (this, delimiter)
- integer function **getPid** (this)

### 17.153.1 Detailed Description

<BriefDescription>

**Author**

Tom Clune, NASA/GSFC

**Date**

07 Nov 2013

**Note**

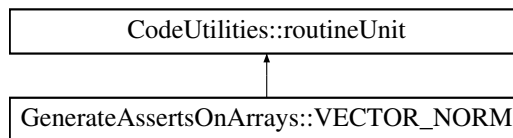
<A note here.> <Or starting here...>

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

- UnixProcess.F90

### 17.154 GenerateAssertsOnArrays::VECTOR\_NORM Class Reference

Inheritance diagram for GenerateAssertsOnArrays::VECTOR\_NORM:

**Public Member Functions**

- def `__init__`

**Public Attributes**

- **rank**
- **fType**
- **precision**
- **name**
- **declaration**
- **declarations**

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

- GenerateAssertsOnArrays.py

### 17.155 AbstractTestResult\_mod::wasSuccessful Interface Reference

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

- AbstractTestResult.F90

## 17.156 WrapbeforeAfter Module Reference

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

- beforeAfter.F90

## 17.157 WrapMpiTestCaseB\_mod Module Reference

### Data Types

- interface **userTestMethod**
- type **WrapUserTestCase**

### Public Member Functions

- subroutine **runMethod** (this)
- type(WrapUserTestCase) function, public **makeCustomTest** (methodName, testMethod, npesRequested)

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

- MpiTestCaseB.F90

## 17.158 Wrapsimple Module Reference

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

- simple.F90

## 17.159 WrapTestA\_mod Module Reference

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

- TestA.F90

## 17.160 WrapTestCaseA\_mod Module Reference

### Data Types

- interface **userTestMethod**
- type **WrapUserTestCase**

### Public Member Functions

- subroutine **runMethod** (this)
- type(WrapUserTestCase) function, public **makeCustomTest** (methodName, testMethod)

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

- TestCaseA.F90

## 17.161 WrapTestCaseB\_mod Module Reference

### Data Types

- interface **userTestMethod**
- type **WrapUserTestCase**

### Public Member Functions

- subroutine **runMethod** (this)
- type(WrapUserTestCase) function, public **makeCustomTest** (methodName, testMethod, testParameter)

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

- ParameterizedTestCaseB.F90

## 17.162 WrapTestCaseC\_mod Module Reference

### Data Types

- interface **userTestMethod**
- type **WrapUserTestCase**

### Public Member Functions

- subroutine **runMethod** (this)
- type(WrapUserTestCase) function, public **makeCustomTest** (methodName, testMethod, testParameter, npesRequested)

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

- MpiParameterizedTestCaseC.F90

## 17.163 XmlPrinter\_mod Module Reference

<BriefDescription>

### Data Types

- type **XmlPrinter**

### Public Member Functions

- type(XmlPrinter) function, public **newXmlPrinter** (unit)
- subroutine **addError** (this, testName, exceptions)
- subroutine **startTest** (this, testName)
- subroutine **print** (this, result)
- subroutine **printHeader** (this, result)
- subroutine **printFailure** (this, label, aFailedTest)
- subroutine **printExceptions** (this, label, testName, exceptions)
- subroutine **printFailure1** (this, label, aFailedTest)
- subroutine **printFailures** (this, label, failures)
- subroutine **printTestName** (this, testName)
- subroutine **printSuccess** (this, aSuccessTest)
- subroutine **printSuccesses** (this, successes)
- subroutine **printFooter** (this, result)
- character(:) function, allocatable **cleanXml** (string\_in)

### 17.163.1 Detailed Description

<BriefDescription>

**Author**

Halvor Lund, SINTEF Energy Research

**Date**

30 Jan 2014

**Note**

<A note here.> Need to improve the handling of nested quotes.

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

- XmlPrinter.F90