FINEL

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Module Documentation

4.1 meshstructure Module Reference

Module that contains the data structure of a mesh associate to a problem.

Data Types

- type mesh

  Data type for a mesh.

Functions/Subroutines

- subroutine mallocnodes (meshStrct)

  Routine that allocate memory to node data.
- subroutine mallocelem (meshStrct)

  Routine that allocate memory to element data.

4.1.1 Detailed Description

Module that contains the data structure of a mesh associate to a problem.

Author

Diego T. Volpatto

4.1.2 Function/Subroutine Documentation

4.1.2.1 mallocelem()

```
subroutine meshstructure::mallocelem (
            type(mesh) meshStrct )
```

Routine that allocate memory to element data.

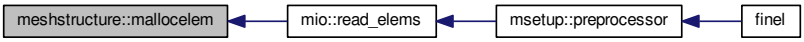
Parameters

meshStrct	[in/out] mesh structure to allocate
n	[in] number of elements

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.1.2.2 mallocnodes()

```
subroutine meshstructure::mallocnodes (
            type(mesh) meshStrct )
```

Routine that allocate memory to node data.

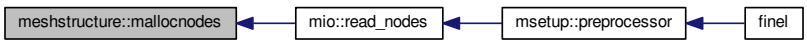
Parameters

meshStrct	[in/out] mesh structure to allocate
n	[in] number of nodes

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.2 minputreader Module Reference

Modulo responsavel por reunir subrotinas para leitura do arquivo de entrada.

Functions/Subroutines

- subroutine readinputfileds ()

  Le arquivo de input e armazena seu conteudo em um array.
- subroutine createsimpleinputfile ()

  Cria a estrutura de input usando um arquivo de entrada sem includes.
- subroutine mergeincludecontents (include_file, include_line)

  Le o conteudo do arquivo de include e armazena no array principal.
- subroutine preparefilelines (include_indexes, include_number_of_lines, number_of_includes, original_file_↩ lines)

  Efetua a alocacao da estrutura definitiva, preparando a linha dos arquivos originais para receber os includes.
- subroutine analyzefileinput (number_of_lines, number_of_includes)

  Efetua algumas analises no arquivo recebido.
- subroutine analyzefile (file_name, number_of_lines, number_of_includes)

  Efetua algumas analises no arquivo recebido.
- integer ∗4 function findinclude (position, file_lines, number_of_lines)

  Procura a n-esima palavra-chave include.
- integer ∗4 function findkeyword (keyword)

  Procura uma palavra-chave.
- subroutine readintegerkeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave to tipo inteiro. Se nao encontrado, associa o valor default fornecido.
- subroutine readintarraykeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave do tipo array de inteiro. Se nao encontrado, associa o valor default fornecido. Obs.: Atentar para o fato dessa sub-rotina ter um do "infinito".
- subroutine readstringkeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave to tipo string. Se nao encontrado, associa o valor default fornecido.
- subroutine readrealkeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave to tipo real. Se nao encontrado, associa o valor default fornecido.
- subroutine readintegerarrayvalues (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave do tipo de um array de inteiros. A leitura eh realizada linha por linha. A primeira linha informa o numero de valores a ser lido. Se nao encontrada a keyword, associa o valor default fornecido.
- subroutine readrealmatrixvalues (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave do tipo de um array bidimensional real. A leitura eh realizada linha por linha. Se nao encontrado, associa o valor default fornecido.
- subroutine readboundaryconditions (keyword, kbc, vbc, default_value)

  Efetua a leitura de uma palavra-chave do tipo de um array bidimensional real. A leitura eh realizada linha por linha. Se nao encontrado, associa o valor default fornecido.

Variables

- character(len=200), dimension(:), allocatable file_lines

  Armazena as linhas do arquivo de input.
- integer ∗4 number_of_lines

  Armazena o numero de linhas no arquivo.

4.2.1 Detailed Description

Modulo responsavel por reunir subrotinas para leitura do arquivo de entrada.

4.2.2 Function/Subroutine Documentation

4.2.2.1 analyzefile()

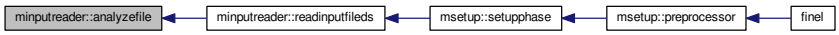
```
subroutine minputreader::analyzefile (
            character(len=200) file_name,
            integer*4 number_of_lines,
            integer*4 number_of_includes )
```

Efetua algumas analises no arquivo recebido.

Parameters

file_name	O nome do arquivo.
number_of_lines	Numero de linhas.
number_of_include	Numero de ocorrencias da palavra include.

Here is the caller graph for this function:



4.2.2.2 analyzefileinput()

```
subroutine minputreader::analyzefileinput (
            integer*4 number_of_lines,
            integer*4 number_of_includes )
```

Efetua algumas analises no arquivo recebido.

Parameters

number_of_lines	Numero de linhas.
number_of_include	Numero de ocorrencias da palavra include.

Here is the caller graph for this function:

4.2.2.3 createsimpleinputfile()

```
subroutine minputreader::createsimpleinputfile ( )
```

Cria a estrutura de input usando um arquivo de entrada sem includes.

Parameters

file_name	Nome do arquivo a ser lido.

Here is the caller graph for this function:

4.2.2.4 findinclude()

```
integer*4 function minputreader::findinclude (
            integer*4 position,
            character(len=200), dimension(:)  file_lines,
            integer*4 number_of_lines )
```

Procura a n-esima palavra-chave include.

Parameters

position	Corresponde a posicao desejada.
file_lines	Linhas do arquivo.
number_of_lines	Numero de linhas atuais.

Returns

O indice da palavra-chave no array que contem as linhas do arquivo de entrada.

Here is the caller graph for this function:

4.2.2.5 findkeyword()

```
integer*4 function minputreader::findkeyword (
            character(50) keyword )
```

Procura uma palavra-chave.

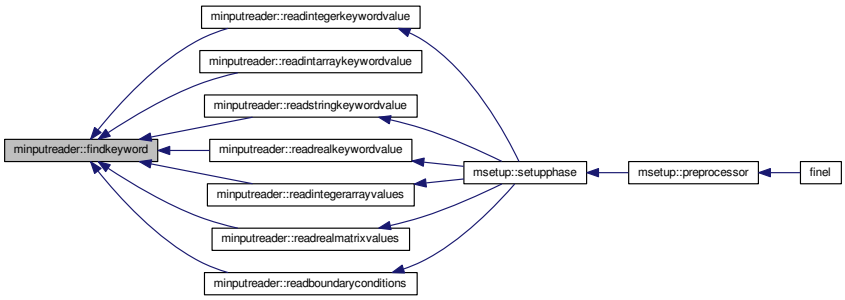
Parameters

keyword	A palavra-chave.

Returns

O indice da palavra-chave no array que contem as linhas do arquivo de entrada.

Here is the caller graph for this function:



4.2.2.6 mergeincludecontents()

```
subroutine minputreader::mergeincludecontents (
            character(len=200) include_file,
            integer*4 include_line )
```

Le o conteudo do arquivo de include e armazena no array principal.

Parameters

include_index	O index do include.
include_files	Array com includes.
include_line	A linha do include.

Here is the caller graph for this function:

4.2.2.7 preparefilelines()

```
subroutine minputreader::preparefilelines (
            integer*4, dimension(:)  include_indexes,
            integer*4, dimension(:)  include_number_of_lines,
            integer*4 number_of_includes,
            character(len=200), dimension(:)  original_file_lines )
```

Efetua a alocacao da estrutura definitiva, preparando a linha dos arquivos originais para receber os includes.

Parameters

include_indexes	Array os indices de ocorrencias dos includes.
include_number_of_lines	Array com o numero de linhas de cada include
number_of_includes	Numero de includes.
original_file_lines	Linhas do arquivo de entrada original.

Here is the caller graph for this function:

4.2.2.8 readboundaryconditions()

```
subroutine minputreader::readboundaryconditions (
             character(50) keyword,
             integer*4, dimension(:), allocatable kbc,
             real*8, dimension(:), allocatable vbc,
             real(8) default_value )
```

Efetua a leitura de uma palavra-chave do tipo de um array bidimensional real. A leitura eh realizada linha por linha. Se nao encontrado, associa o valor default fornecido.

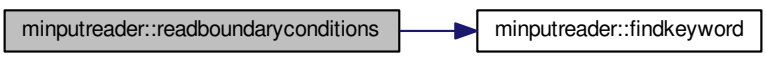
Parameters

keyword	A palavra-chave a ser encontrada.
kbc	Tipo da CC (1 = Dirichlet, 2 = Neumann).
vbc	Valor prescrito na CC.
default_value	Valor default.

Author

Diego T. Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:

4.2.2.9 readinputfileds()

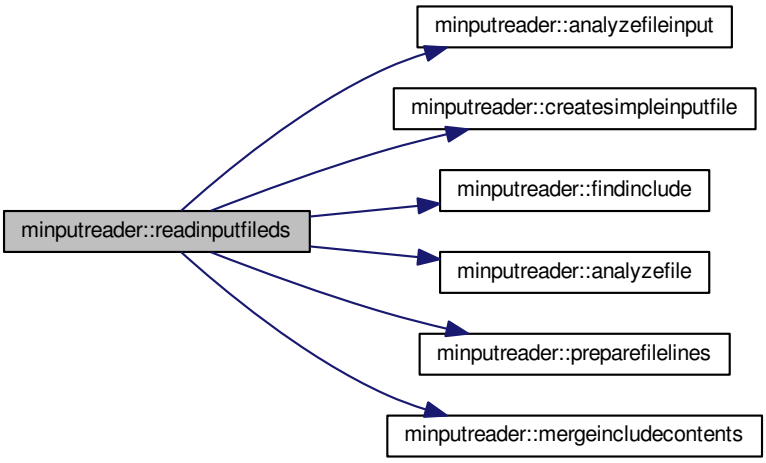
```
subroutine minputreader::readinputfileds ( )
```

Le arquivo de input e armazena seu conteudo em um array.

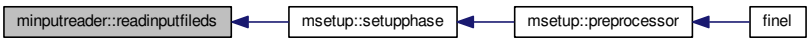
Parameters

file_name	Nome do arquivo a ser lido.

Here is the call graph for this function:



Here is the caller graph for this function:



4.2.2.10 readintarraykeywordvalue()

```
subroutine minputreader::readintarraykeywordvalue (
             character(50) keyword,
             integer*4, dimension(:), allocatable target,
             integer*4 default_value )
```

Efetua a leitura de uma palavra-chave do tipo array de inteiro. Se nao encontrado, associa o valor default fornecido. Obs.: Atentar para o fato dessa sub-rotina ter um do "infinito".

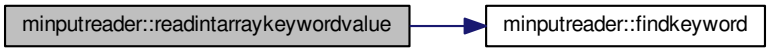
Parameters

keyword	A palavra-chave a ser encontrada.
target	Variavel onde o valor inteiro sera atribuido.
default_value	Valor default.

Author

Diego Volpatto

Here is the call graph for this function:



4.2.2.11 readintegerarrayvalues()

```
subroutine minputreader::readintegerarrayvalues (
             character(50) keyword,
             integer*4, dimension(:), allocatable target,
             integer(4) default_value )
```

Efetua a leitura de uma palavra-chave do tipo de um array de inteiros. A leitura eh realizada linha por linha. A primeira linha informa o numero de valores a ser lido. Se nao encontrada a keyword, associa o valor default fornecido.

Parameters

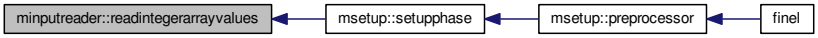
keyword	A palavra-chave a ser encontrada.
target	Variavel onde os valores serao atribuido.
default_value	Valor default.

Author

Diego T. Volpatto

Here is the call graph for this function:

Here is the caller graph for this function:



4.2.2.12 readintegerkeywordvalue()

```
subroutine minputreader::readintegerkeywordvalue (
             character(50) keyword,
              target,
             integer*4, target default_value )
```

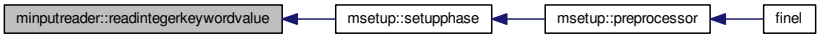
Efetua a leitura de uma palavra-chave to tipo inteiro. Se nao encontrado, associa o valor default fornecido.

Parameters

keyword	A palavra-chave a ser encontrada.
target	Variavel onde o valor inteiro sera atribuido.
default_value	Valor default.

Here is the call graph for this function:

Here is the caller graph for this function:



4.2.2.13 readrealkeywordvalue()

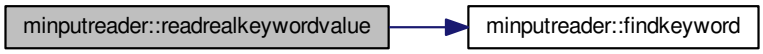
```
subroutine minputreader::readrealkeywordvalue (
             character(50) keyword,
              target,
             real(8), target default_value )
```

Efetua a leitura de uma palavra-chave to tipo real. Se nao encontrado, associa o valor default fornecido.

Parameters

keyword	A palavra-chave a ser encontrada.
target	Variavel onde o real sera atribuido.
default_value	Valor default.

Here is the call graph for this function:



Here is the caller graph for this function:

4.2.2.14 readrealmatrixvalues()

```
subroutine minputreader::readrealmatrixvalues (
             character(50) keyword,
             real*8, dimension(:,:), allocatable target,
             real(8) default_value )
```

Efetua a leitura de uma palavra-chave do tipo de um array bidimensional real. A leitura eh realizada linha por linha. Se nao encontrado, associa o valor default fornecido.

Parameters

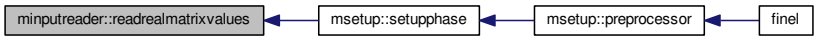
keyword	A palavra-chave a ser encontrada.
target	Variavel onde os valores serao atribuido.
default_value	Valor default.

Author

Diego T. Volpatto

Here is the call graph for this function:

Here is the caller graph for this function:



4.2.2.15 readstringkeywordvalue()

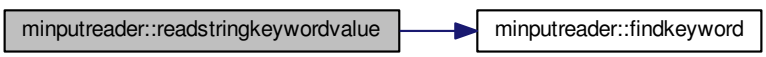
```
subroutine minputreader::readstringkeywordvalue (
             character(50) keyword,
             character(len=*) target,
             character(len=*) default_value )
```

Efetua a leitura de uma palavra-chave to tipo string. Se nao encontrado, associa o valor default fornecido.

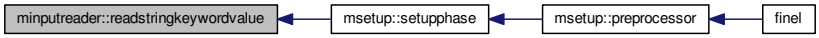
Parameters

keyword	A palavra-chave a ser encontrada.
target	Variavel onde a string sera atribuido.
default_value	Valor default.

Here is the call graph for this function:



Here is the caller graph for this function:



4.2.3 Variable Documentation

4.2.3.1 file_lines

```
character(len=200), dimension(:), allocatable minputreader::file_lines
```

Armazena as linhas do arquivo de input.

4.2.3.2 number_of_lines

```
integer*4 minputreader::number_of_lines
```

Armazena o numero de linhas no arquivo.

4.3 mio Module Reference

Contains input/output variables and routines.

Functions/Subroutines

- subroutine openfiles ()

  Open IO files.
- subroutine closefiles ()

  Close IO files.
- subroutine read_nodes (mesh_)

  Subroutine to read node data file generated by EasyMesh.
- subroutine read_elems (mesh_)

  Subroutine to read element data file generated by EasyMesh.
- subroutine print_sol (mesh_, scalar_, tstep)

  Prints the solution of scalar field.
- subroutine print_sol_csv (mesh_, scalar_, tstep)

  Prints the solution of scalar field in the csv format aiming to compatibility with Paraview post-processing.
- subroutine print_sol_vtk (mesh_, scalar_, tstep)

  Prints the solution of scalar field in the vtk "legacy" format aiming to compatibility with Paraview post-processing.
- subroutine print_files (mesh_, scalar_, tstep)

  Record solution according to specified file kind in input.

Variables

- integer, parameter iin = 1110

  Input file id.
- integer, parameter iout = 1120

  Output file id.
- integer, parameter isol = 1130

  Solution file id.
- integer, parameter ioutn = 1140

  Node output file.
- integer, parameter ioute = 1150

  Element output file.
- integer, parameter isolcsv = 1160

  Solution csv file id.
- integer, parameter isolvtk = 1170

  Solution vtk file id.
- character(len=20), parameter infile ='input.dat'

  Input file name.
- character(len=20), parameter outfile ='output.dat'

  Output file name.
- character(len=20), parameter outnodes ='outnodes.dat'

  Output node's file name.
- character(len=20), parameter outelem ='outelem.dat'

  Output elements' file name.
- character(len=50), parameter solfile ='solution00'

  Solution file name.
- character(len=50) title
- character(len=50) file_format

4.3.1 Detailed Description

Contains input/output variables and routines.

Author

Diego T. Volpatto

4.3.2 Function/Subroutine Documentation

4.3.2.1 closefiles()

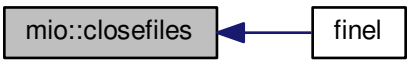
```
subroutine mio::closefiles ( )
```

Close IO files.

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.3.2.2 openfiles()

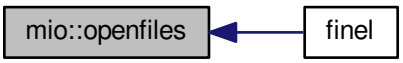
```
subroutine mio::openfiles ( )
```

Open IO files.

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.3.2.3 print_files()

```
subroutine mio::print_files (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer tstep )
```

Record solution according to specified file kind in input.

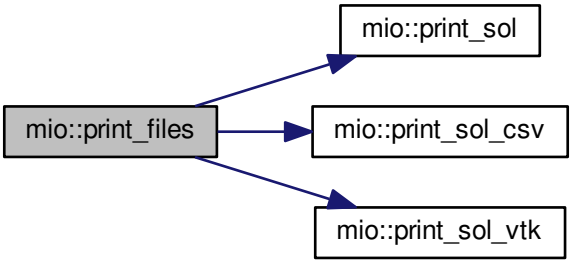
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
tstep	Time step to print

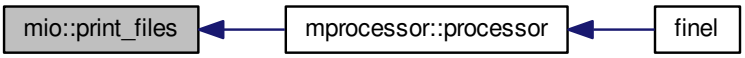
Author

Diego T. Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:



4.3.2.4 print_sol()

```
subroutine mio::print_sol (
             type(mesh) mesh_,
             type(scalarstructuresystem) scalar_,
             integer tstep )
```

Prints the solution of scalar field.

Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
tstep	Time step index

Author

Diego T. Volpatto

Here is the caller graph for this function:

4.3.2.5 print_sol_csv()

```
subroutine mio::print_sol_csv (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer tstep )
```

Prints the solution of scalar field in the csv format aiming to compatibility with Paraview post-processing.

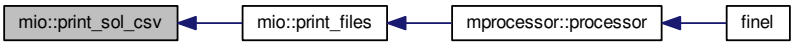
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
tstep	Time step index

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.3.2.6 print_sol_vtk()

```
subroutine mio::print_sol_vtk (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer tstep )
```

Prints the solution of scalar field in the vtk "legacy" format aiming to compatibility with Paraview post-processing.

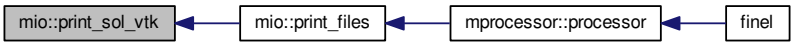
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
tstep	Current time step

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.3.2.7 read_elems()

```
subroutine mio::read_elems (
            type(mesh) mesh_ )
```

Subroutine to read element data file generated by EasyMesh.

Parameters

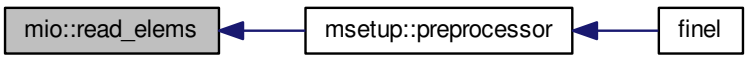
*mesh_*	[in/out] a mesh structure

Author

Diego Volpatto

Here is the call graph for this function:

Here is the caller graph for this function:



4.3.2.8 read_nodes()

```
subroutine mio::read_nodes (
            type(mesh) mesh_ )
```

Subroutine to read node data file generated by EasyMesh.

Parameters

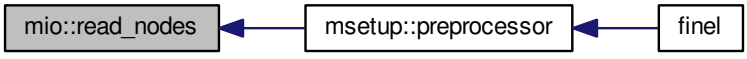
*mesh_*	[in/out] a mesh structure

Author

Diego Volpatto

Here is the call graph for this function:

Here is the caller graph for this function:



4.3.3 Variable Documentation

4.3.3.1 file_format

```
character(len=50) mio::file_format
```

4.3.3.2 iin

```
integer, parameter mio::iin = 1110
```

Input file id.

4.3.3.3 infile

```
character(len=20), parameter mio::infile ='input.dat'
```

Input file name.

4.3.3.4 iout

```
integer, parameter mio::iout = 1120
```

Output file id.

4.3.3.5 ioute

```
integer, parameter mio::ioute = 1150
```

Element output file.

4.3.3.6 ioutn

```
integer, parameter mio::ioutn = 1140
```

Node output file.

4.3.3.7 isol

```
integer, parameter mio::isol = 1130
```

Solution file id.

4.3.3.8 isolcsv

```
integer, parameter mio::isolcsv = 1160
```

Solution csv file id.

4.3.3.9 isolvtk

```
integer, parameter mio::isolvtk = 1170
```

Solution vtk file id.

4.3.3.10 outelem

```
character(len=20), parameter mio::outelem ='outelem.dat'
```

Output elements' file name.

4.3.3.11 outfile

```
character(len=20), parameter mio::outfile ='output.dat'
```

Output file name.

4.3.3.12 outnodes

```
character(len=20), parameter mio::outnodes ='outnodes.dat'
```

Output node's file name.

4.3.3.13 solfile

```
character(len=50), parameter mio::solfile ='solution00'
```

Solution file name.

4.3.3.14 title

```
character(len=50) mio::title
```

4.4 mprocessor Module Reference

Processor module to compute, assemble and solve the system.

Functions/Subroutines

- subroutine formkf (mesh_, scalar_, t)

  Form and assemble Ku = F system.
- subroutine assmb (mesh_, scalar_, nel)

  Assemble element stiffness matrix and load vector to global stiffness matrix and load vector, respectively.
- subroutine drchlt (mesh_, scalar_, n)

  Apply Dirichlet Boundary Condition.
- subroutine neumann (mesh_, scalar_, n)

  Apply Neumann Boundary Condition – 1D. Prescribe -k(x)u = vbc.
- subroutine applybc (mesh_, scalar_)

  Modify Ku=F system to incorporate BC data.
- subroutine solver (mesh_, scalar_)

  Executes Gauss reduction and forward substitution solving Ku=F.
- subroutine processor (mesh_, scalar_)

  Processor routine phase.

4.4.1 Detailed Description

Processor module to compute, assemble and solve the system.

Author

Diego T. Volpatto

4.4.2 Function/Subroutine Documentation

4.4.2.1 applybc()

```
subroutine mprocessor::applybc (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_ )
```

Modify Ku=F system to incorporate BC data.

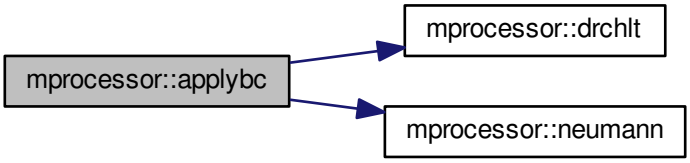
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure

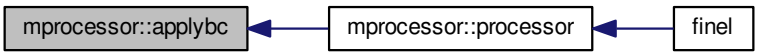
Author

Diego Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:



4.4.2.2 assmb()

```
subroutine mprocessor::assmb (
             type(mesh) mesh_,
             type(scalarstructuresystem) scalar_,
             integer nel )
```

Assemble element stiffness matrix and load vector to global stiffness matrix and load vector, respectively.

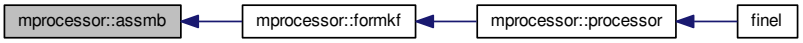
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
nel	Index of current element

Author

Diego Volpatto

Here is the caller graph for this function:



4.4.2.3 drchlt()

```
subroutine mprocessor::drchlt (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer n )
```

Apply Dirichlet Boundary Condition.

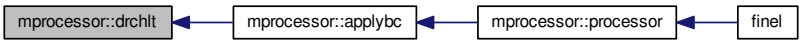
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
n	Node index of BC

Author

Diego Volpatto

Here is the caller graph for this function:



4.4.2.4 formkf()

```
subroutine mprocessor::formkf (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            real*8 t )
```

Form and assemble Ku = F system.

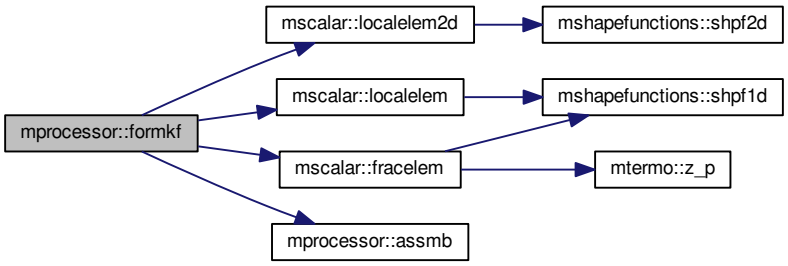
Parameters

*mesh_*	[in/out] A mesh structure
*scalar_*	[in/out] A scalar structure
t	[in] Current simulation time

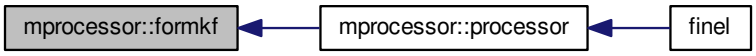
Author

Diego Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:



4.4.2.5 neumann()

```
subroutine mprocessor::neumann (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer n )
```

Apply Neumann Boundary Condition – 1D. Prescribe -k(x)u = vbc.

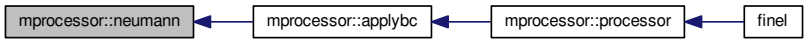
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure
n	Node index of BC

Author

Diego Volpatto

Here is the caller graph for this function:



4.4.2.6 processor()

```
subroutine mprocessor::processor (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_ )
```

Processor routine phase.

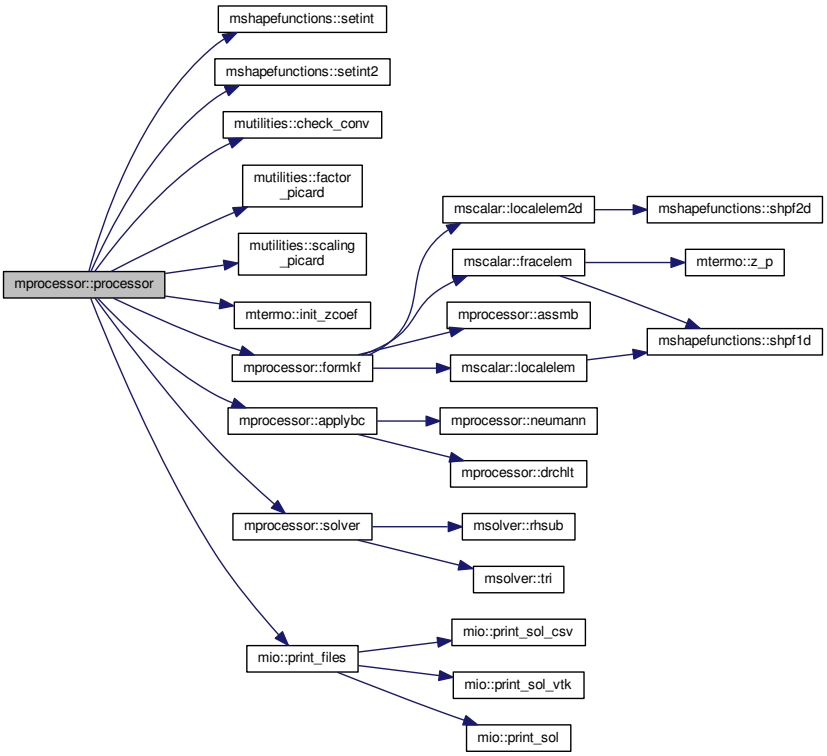
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure

Author

Diego T. Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:

4.4.2.7 solver()

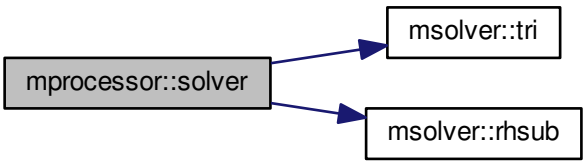
```
subroutine mprocessor::solver (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_ )
```

Executes Gauss reduction and forward substitution solving Ku=F.

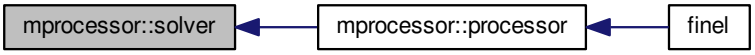
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure

Here is the call graph for this function:



Here is the caller graph for this function:



4.5 mscalar Module Reference

Contains variables and subroutine related to a general scalar problem.

Functions/Subroutines

- subroutine localelem (mesh_, scalar_, nel)

  Computes a master element contribution – 1D.
- subroutine localelem2d (mesh_, scalar_, nel)

  Computes a master element contribution – 2D.
- subroutine fracelem (mesh_, scalar_, nel, t)

  Computes a master element contribution in fracture case – 1D.

4.5.1 Detailed Description

Contains variables and subroutine related to a general scalar problem.

Author

Diego T. Volpatto

4.5.2 Function/Subroutine Documentation

4.5.2.1 fracelem()

```
subroutine mscalar::fracelem (
             type(mesh) mesh_,
             type(scalarstructuresystem) scalar_,
             integer nel,
             real*8 t )
```

Computes a master element contribution in fracture case – 1D.

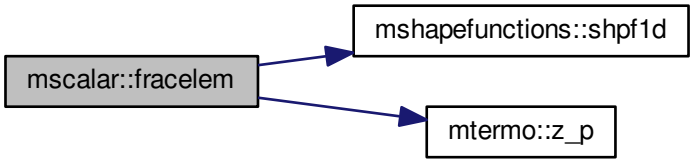
Parameters

*mesh_*	[in/out] A mesh structure
*scalar_*	[in/out] A scalar structure
nel	[in] Index of current element

Author

Diego Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:

4.5.2.2 localelem()

```
subroutine mscalar::localelem (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer nel )
```

Computes a master element contribution – 1D.

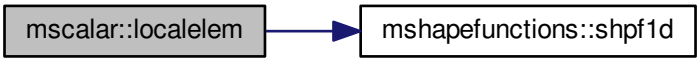
Parameters

*mesh_*	[in/out] A mesh structure
*scalar_*	[in/out] A scalar structure
nel	[in] Index of current element

Author

Diego Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:

4.5.2.3 localelem2d()

```
subroutine mscalar::localelem2d (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_,
            integer nel )
```

Computes a master element contribution – 2D.

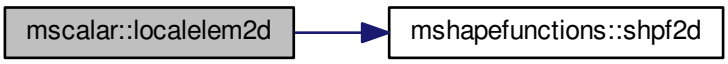
Parameters

*mesh_*	[in/out] A mesh structure
*scalar_*	[in/out] A scalar structure
nel	[in] Index of current element

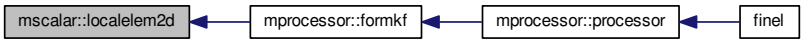
Author

Diego Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:



4.6 msetup Module Reference

Module for setup phase by IO procedures.

Functions/Subroutines

- subroutine setupphase (mesh_, scalar_)

  Reads parameters from input file.
- subroutine preprocessor (mesh_, scalar_)

  Realizes preprocessor routines.

4.6.1 Detailed Description

Module for setup phase by IO procedures.

Author

Diego T. Volpatto

4.6.2 Function/Subroutine Documentation

4.6.2.1 preprocessor()

```
subroutine msetup::preprocessor (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_ )
```

Realizes preprocessor routines.

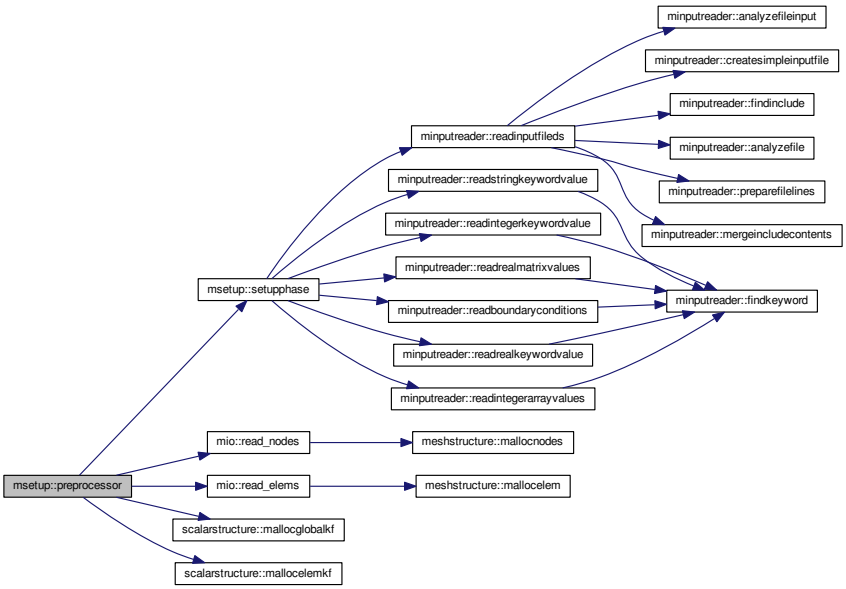
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure

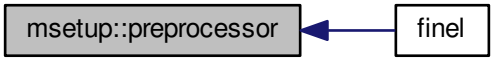
Author

Diego T. Volpatto

Here is the call graph for this function:



Here is the caller graph for this function:



4.6.2.2 setupphase()

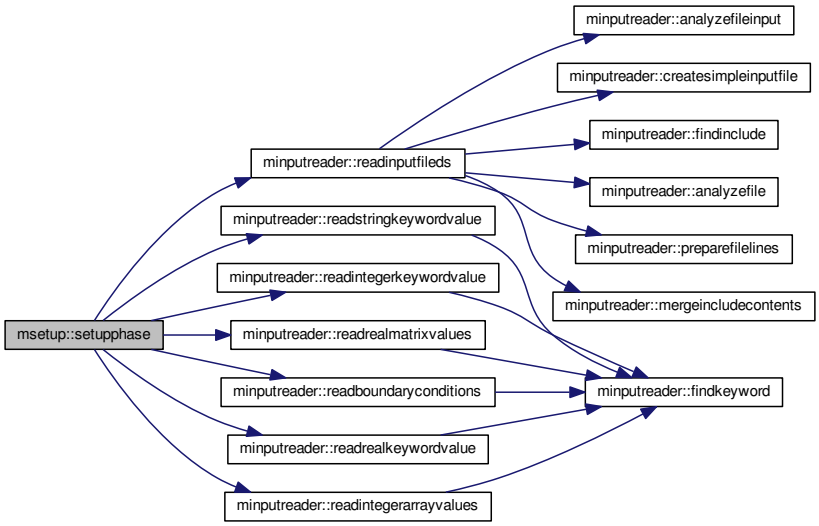
```
subroutine msetup::setupphase (
            type(mesh) mesh_,
            type(scalarstructuresystem) scalar_ )
```

Reads parameters from input file.

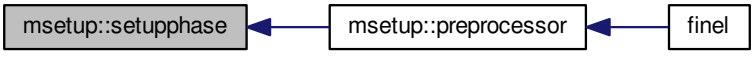
Parameters

*mesh_*	A mesh structure
*scalar_*	A scalar structure

Here is the call graph for this function:



Here is the caller graph for this function:



4.7 mshapefunctions Module Reference

Module for shape functions computations and relate operations.

Functions/Subroutines

- subroutine setint
  Gauss quadrature data set routine - 1D.
- subroutine setint2
  Gauss quadrature data set routine - 2D.
- subroutine shpf1d (xl, n, psi, dpsi)
  Calculates the values of the shape functions and their derivatives - 1D.
- subroutine shpf2d (XL, N, PSI, DPSI)
  Calculates the values of the shape functions and their derivatives - 2D.

Variables

- real ∗8, dimension(20, 20) xi
  Gauss point integration 1D.
- real ∗8, dimension(20, 20) w
  Gauss weights 1D.
- real ∗8, dimension(2, 9) xiq
  Gauss points to rectangular element.
- real ∗8, dimension(9) wq
  Gauss weights to rectangular element.
- real ∗8, dimension(2, 4) xit
  Gauss points to triangle element.
- real ∗8, dimension(4) wt
  Gauss weights to triangle element.
- integer quadext

4.7.1 Detailed Description

Module for shape functions computations and relate operations.

Author

Diego T. Volpatto

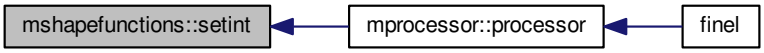
4.7.2 Function/Subroutine Documentation

4.7.2.1 setint()

```
subroutine mshapefunctions::setint ( )
```

Gauss quadrature data set routine - 1D.

Here is the caller graph for this function:

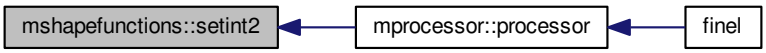


4.7.2.2 setint2()

```
subroutine mshapefunctions::setint2 ( )
```

Gauss quadrature data set routine - 2D.

Here is the caller graph for this function:



4.7.2.3 shpf1d()

```
subroutine mshapefunctions::shpf1d (
            real*8 xl,
            integer n,
            real*8, dimension(n) psi,
            real*8, dimension(n) dpsi )
```

Calculates the values of the shape functions and their derivatives - 1D.

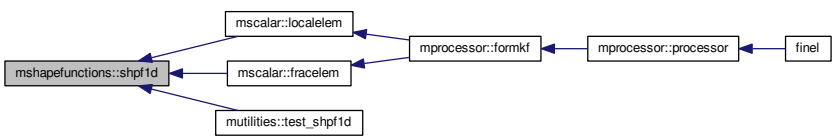
Parameters

xl	[in] specified value of master element coord
n	[in] number of element nodes
psi	[out] shape function values
dpsi	[out] derivatives shape functions values

Author

Diego Volpatto

Here is the caller graph for this function:



4.7.2.4 shpf2d()

```
subroutine mshapefunctions::shpf2d (
            real*8, dimension(2) XL,
            integer N,
            real*8, dimension(9) PSI,
            real*8, dimension(2,9) DPSI )
```

Calculates the values of the shape functions and their derivatives - 2D.

Parameters

xl	[in] specified value of master element coord
n	[in] number of element nodes
psi	[out] shape function values
dpsi	[out] derivatives shape functions values

Author

Diego Volpatto

Here is the caller graph for this function:

4.7.3 Variable Documentation

4.7.3.1 quadext

```
integer mshapefunctions::quadext
```

4.7.3.2 w

```
real*8, dimension(20,20) mshapefunctions::w
```

Gauss weights 1D.

4.7.3.3 wq

```
real*8, dimension(9) mshapefunctions::wq
```

Gauss weights to rectangular element.

4.7.3.4 wt

```
real*8, dimension(4) mshapefunctions::wt
```

Gauss weights to triangle element.

4.7.3.5 xi

```
real*8, dimension(20,20) mshapefunctions::xi
```

Gauss point integration 1D.

4.7.3.6 xiq

```
real*8, dimension(2,9) mshapefunctions::xiq
```

Gauss points to rectangular element.

4.7.3.7 xit

```
real*8, dimension(2,4) mshapefunctions::xit
```

Gauss points to triangle element.

4.8 msolver Module Reference

Contains subroutine to compute numerical solution of linear systems Ax=b.

Functions/Subroutines

- subroutine tri (A, n)

  Applies Gauss reduction in A(n,n) to obtain a superior triangular equivalent form.
- subroutine rhsub (A, x, b, n)

  Does the forward substitution on the right-side-hand.

4.8.1 Detailed Description

Contains subroutine to compute numerical solution of linear systems Ax=b.

The present module has a general purpose such that the routines here intend to be independent of others module.

Author

Diego T. Volpatto

4.8.2 Function/Subroutine Documentation

4.8.2.1 rhsub()

```
subroutine msolver::rhsub (
             real*8, dimension(n,n) A,
             real*8, dimension(n) x,
             real*8, dimension(n) b,
             integer n )
```

Does the forward substitution on the right-side-hand.

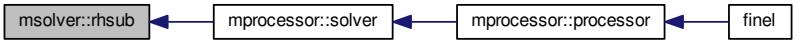
Parameters

A	[in]A matrix A(n,n)
x	[out]Solution vector
b	[in/out]RHS-vector
n	[in]Number of solution points

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.8.2.2 tri()

```
subroutine msolver::tri (
             real*8, dimension(n,n) A,
             integer n )
```

Applies Gauss reduction in A(n,n) to obtain a superior triangular equivalent form.

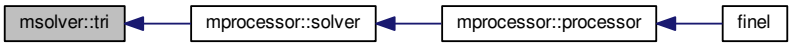
Parameters

A	[in/out]A matrix A(n,n)
n	[in]Number of rows/columns of matrix A

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.9 mtermo Module Reference

Module that contains thermodynamics function and parameters.

Functions/Subroutines

- subroutine init_zcoef

  Initializes interpolation coefficients to compute compressibility factor.
- subroutine z_p (p, Z)

  Computes compressibility factor.

Variables

- real ∗8, dimension(10) zcoef

4.9.1 Detailed Description

Module that contains thermodynamics function and parameters.

Author

Diego T. Volpatto

4.9.2 Function/Subroutine Documentation

4.9.2.1 init_zcoef()

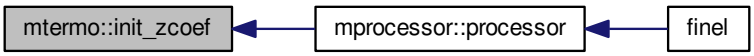
```
subroutine mtermo::init_zcoef ( )
```

Initializes interpolation coefficients to compute compressibility factor.

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.9.2.2 z_p()

```
subroutine mtermo::z_p (
            real*8 p,
            real*8 Z )
```

Computes compressibility factor.

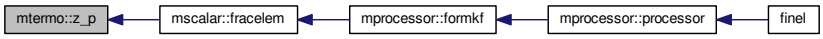
Parameters

p	[in] Pressure
Z	[out] Compressibility factor

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.9.3 Variable Documentation

4.9.3.1 zcoef

```
real*8, dimension(10) mtermo::zcoef
```

4.10 mutilities Module Reference

Module for auxiliar routines.

Functions/Subroutines

- subroutine linspace (x1, x2, nintv, x)

  Generate points between x1 and x2 equally spaced in x(i). Same idea of numpy subroutine.
- real *8 function f1 (x)

  A function to test purpose.
- subroutine quad1 (n, x1, x2)

  Subroutine that computes gaussian quadrature of f1.
- subroutine test_shpf1d (n, nelem, x)

  Check if shpf1d works properly.
- subroutine print_matrix (A, n, m)

  Prints in the screen a matrix A(n,m)
- subroutine check_conv (u, uprev, nnodes, tol, norm, flag)

  Routine to check if non-linear iteration converged.
- subroutine factor_picard (alpha, delta, eps, omega_min, omega)

  Computes underrelaxation factor for Picard iteration.
- subroutine scaling_picard (i, delta, deltap, eps, rho, omega, omega_min, alpha)

  Rescaling shape factor for underrelaxation.

4.10.1 Detailed Description

Module for auxiliar routines.

Author

Diego T. Volpatto

4.10.2 Function/Subroutine Documentation

4.10.2.1 check_conv()

```
subroutine mutilities::check_conv (
             real*8, dimension(nnodes) u,
             real*8, dimension(nnodes) uprev,
             integer nnodes,
             real*8 tol,
             real*8 norm,
             logical flag )
```

Routine to check if non-linear iteration converged.

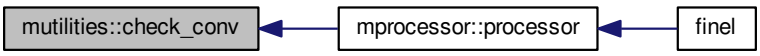
Parameters

u	Current solution vector
uprev	Previous iteration solution vector
nnodes	Number of nodes
flag	Flag for convergence checked

Author

Diego Volpatto

Here is the caller graph for this function:



4.10.2.2 f1()

```
real*8 function mutilities::f1 (
             real*8 x )
```

A function to test purpose.

Parameters

x	input coordinate

Here is the caller graph for this function:

4.10.2.3 factor_picard()

```
subroutine mutilities::factor_picard (
             real*8 alpha,
             real*8 delta,
             real*8 eps,
             real*8 omega_min,
             real*8 omega )
```

Computes underrelaxation factor for Picard iteration.

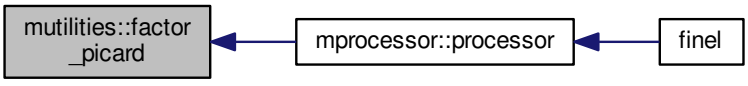
Parameters

alpha	[in] Shape factor for underrelaxation function
delta	[in] Error between two Picard iteration
eps	[in] Tolerance value (closure criterion)
omega_min	[in] Minimum value of underrelaxation function omega [out] Underrelaxation factor

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.10.2.4 linspace()

```
subroutine mutilities::linspace (
             real*8 x1,
             real*8 x2,
             integer nintv,
             real*8, dimension(:), allocatable x )
```

Generate points between x1 and x2 equally spaced in x(i). Same idea of numpy subroutine.

Parameters

x1	interval lower bound
x2	interval upper bound
nintv	num of intervals
x	vector to assemble the values

4.10.2.5 print_matrix()

```
subroutine mutilities::print_matrix (
             real*8, dimension(n,m) A,
             integer n,
             integer m )
```

Prints in the screen a matrix A(n,m)

Parameters

A	A matrix
n	Number of lines of A
m	Number of colunms of A

Author

Diego Volpatto

4.10.2.6 quad1()

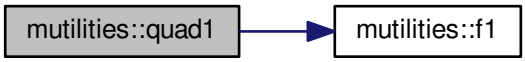
```
subroutine mutilities::quad1 (
             integer n,
             real*8 x1,
             real*8 x2 )
```

Subroutine that computes gaussian quadrature of f1.

Parameters

n	quadrature order
x1	integral lower bound
x2	integral upper bound

Here is the call graph for this function:



4.10.2.7 scaling_picard()

```
subroutine mutilities::scaling_picard (
             integer i,
             real*8 delta,
             real*8 deltap,
             real*8 eps,
             real*8 rho,
             real*8 omega,
             real*8 omega_min,
             real*8 alpha )
```

Rescaling shape factor for underrelaxation.

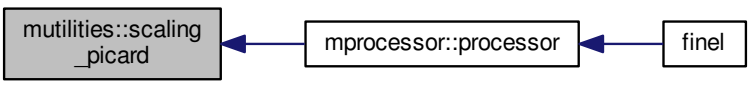
Parameters

i	[in] Current Picard iteration
delta	[in] Error between two Picard iteration
deltap	[in] Previous error between two Picard iteration
eps	[in] Tolerance value (closure criterion)
rho	[in] Scaling factor omega [in] Underrelaxation factor
omega_min	[in/out] Minimum value of underrelaxation function
alpha	[out] Shape factor for underrelaxation function

Author

Diego T. Volpatto

Here is the caller graph for this function:



4.10.2.8 test_shpf1d()

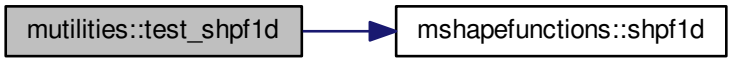
```
subroutine mutilities::test_shpf1d (
             integer n,
             integer nelem,
             real*8, dimension(nelem+1) x )
```

Check if shpf1d works properly.

Parameters

n	element node numbers
nelem	num of discrete intervals
x	master element's coordinates

Here is the call graph for this function:



4.11 scalarstructure Module Reference

Module that contains the data structure of a general scalar problem.

Data Types

- type scalarstructuresystem

  Variables and characteristic data for a scalar problem.

Functions/Subroutines

- subroutine mallocglobalkf (scalar_, n)

  Routine to allocate and clear the Ku = F system.
- subroutine mallocelemkf (scalar_, n)

  Routine to allocate and clear the element KF.

4.11.1 Detailed Description

Module that contains the data structure of a general scalar problem.

Author

Diego T. Volpatto

4.11.2 Function/Subroutine Documentation

4.11.2.1 mallocelemkf()

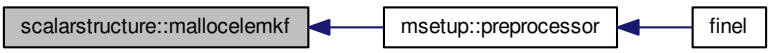
```
subroutine scalarstructure::mallocelemkf (
            type(scalarstructuresystem) scalar_,
            integer n )
```

Routine to allocate and clear the element KF.

Parameters

*scalar_*	[in/out] A general scalar structure
n	[in] Number of element nodes

Here is the caller graph for this function:



4.11.2.2 mallocglobalkf()

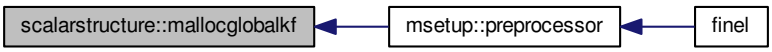
```
subroutine scalarstructure::mallocglobalkf (
            type(scalarstructuresystem) scalar_,
            integer n )
```

Routine to allocate and clear the Ku = F system.

Parameters

*scalar_*	[in/out] A general scalar structure
n	[in] Number of global nodes

Here is the caller graph for this function:



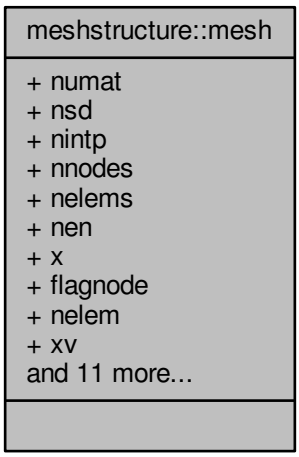
Chapter 5

Data Type Documentation

5.1 meshstructure::mesh Type Reference

Data type for a mesh.

Collaboration diagram for meshstructure::mesh:



Public Attributes

- integer numat

  Number of materials.
- integer nsd

  Number of spatial.
- integer nintp

  Number of integration points.

- integer nnodes

  Number of nodes.
- integer nelems

  Number of elements.
- integer nen

  Number of element's nodes.
- real ∗8, dimension(:,:), allocatable x

  nodes coordinates
- integer ∗4, dimension(:), allocatable flagnode

  boundary flag
- integer nelem

  Number of elements.
- real ∗8, dimension(:), allocatable xv

  Circumcenter Elem xcoor.
- real ∗8, dimension(:), allocatable yv

  Circumcenter Elem ycoor.
- integer ∗4, dimension(:,:), allocatable gnode

  Global node.
- integer ∗4, dimension(:), allocatable mat

  Element material kind.
- integer ∗4, dimension(:), allocatable ei

  i-opposite element
- integer ∗4, dimension(:), allocatable ej

  j-opposite element
- integer ∗4, dimension(:), allocatable ek

  k-opposite element
- integer ∗4, dimension(:), allocatable si

  Opposite i-side.
- integer ∗4, dimension(:), allocatable sj

  Opposite j-side.
- integer ∗4, dimension(:), allocatable sk

  Opposite k-side.
- character(50) geokind
- character(50) filename

5.1.1 Detailed Description

Data type for a mesh.

5.1.2 Member Data Documentation

5.1.2.1 ei

```
integer*4, dimension(:), allocatable meshstructure::mesh::ei
```

i-opposite element

5.1.2.2 ej

```
integer*4, dimension(:), allocatable meshstructure::mesh::ej
```

j-opposite element

5.1.2.3 ek

```
integer*4, dimension(:), allocatable meshstructure::mesh::ek
```

k-opposite element

5.1.2.4 filename

```
character(50) meshstructure::mesh::filename
```

5.1.2.5 flagnode

```
integer*4, dimension(:), allocatable meshstructure::mesh::flagnode
```

boundary flag

5.1.2.6 geokind

```
character(50) meshstructure::mesh::geokind
```

5.1.2.7 gnode

```
integer*4, dimension(:,:), allocatable meshstructure::mesh::gnode
```

Global node.

5.1.2.8 mat

```
integer*4, dimension(:), allocatable meshstructure::mesh::mat
```

Element material kind.

5.1.2.9 nelem

```
integer meshstructure::mesh::nelem
```

Number of elements.

5.1.2.10 nelems

```
integer meshstructure::mesh::nelems
```

Number of elements.

5.1.2.11 nen

```
integer meshstructure::mesh::nen
```

Number of element's nodes.

5.1.2.12 nintp

```
integer meshstructure::mesh::nintp
```

Number of integration points.

5.1.2.13 nnodes

```
integer meshstructure::mesh::nnodes
```

Number of nodes.

5.1.2.14 nsd

```
integer meshstructure::mesh::nsd
```

Number of spatial.

5.1.2.15 numat

```
integer meshstructure::mesh::numat
```

Number of materials.

5.1.2.16 si

```
integer*4, dimension(:), allocatable meshstructure::mesh::si
```

Opposite i-side.

5.1.2.17 sj

```
integer*4, dimension(:), allocatable meshstructure::mesh::sj
```

Opposite j-side.

5.1.2.18 sk

```
integer*4, dimension(:), allocatable meshstructure::mesh::sk
```

Opposite k-side.

5.1.2.19 x

```
real*8, dimension(:,:), allocatable meshstructure::mesh::x
```

nodes coordinates

5.1.2.20 xv

```
real*8, dimension(:), allocatable meshstructure::mesh::xv
```

Circumcenter Elem xcoor.

5.1.2.21 yv

```
real*8, dimension(:), allocatable meshstructure::mesh::yv
```

Circumcenter Elem ycoor.

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

- src/meshStructure.F90

5.2 scalarstructure::scalarstructuresystem Type Reference

Variables and characteristic data for a scalar problem.

Collaboration diagram for scalarstructure::scalarstructuresystem:

Public Attributes

- real ∗8, dimension(:), allocatable u
  Solution vector.
- real ∗8, dimension(:), allocatable u_prev
  Previous time step solution vector.
- real ∗8, dimension(:), allocatable u_prev_it
  Previous non-linear solution vector.
- real ∗8, dimension(:,:), allocatable lhelem
  Element left-hand system.
- real ∗8, dimension(:), allocatable rhelem
  Element right-hand system.
- real ∗8, dimension(:,:), allocatable lhsys
  Global left-hand system.
- real ∗8, dimension(:), allocatable rhsys
  Global right-hand system.
- real ∗8, dimension(:), allocatable vbc
  BC values vector.
- real ∗8, dimension(:,:), allocatable mat
  Material properties values.
- integer ∗4, dimension(:), allocatable kbc
  BC kind.
- integer ∗4, dimension(:), allocatable tprint
- integer transient
  Transient's flag.
- integer nsteps
  Number of time steps.
- real ∗8 dt
  Time step.
- integer linflag
  Flag to indicate if problem is linear or not.

5.2.1 Detailed Description

Variables and characteristic data for a scalar problem.

5.2.2 Member Data Documentation

5.2.2.1 dt

```
real*8 scalarstructure::scalarstructuresystem::dt
```

Time step.

5.2.2.2 kbc

```
integer*4, dimension(:), allocatable scalarstructure::scalarstructuresystem::kbc
```

BC kind.

5.2.2.3 lhelem

```
real*8, dimension(:,:), allocatable scalarstructure::scalarstructuresystem::lhelem
```

Element left-hand system.

5.2.2.4 lhsys

```
real*8, dimension(:,:), allocatable scalarstructure::scalarstructuresystem::lhsys
```

Global left-hand system.

5.2.2.5 linflag

```
integer scalarstructure::scalarstructuresystem::linflag
```

Flag to indicate if problem is linear or not.

5.2.2.6 mat

```
real*8, dimension(:,:), allocatable scalarstructure::scalarstructuresystem::mat
```

Material properties values.

5.2.2.7 nsteps

```
integer scalarstructure::scalarstructuresystem::nsteps
```

Number of time steps.

5.2.2.8 rhelem

```
real*8, dimension(:), allocatable scalarstructure::scalarstructuresystem::rhelem
```

Element right-hand system.

5.2.2.9 rhsys

```
real*8, dimension(:), allocatable scalarstructure::scalarstructuresystem::rhsys
```

Global right-hand system.

5.2.2.10 tprint

```
integer*4, dimension(:), allocatable scalarstructure::scalarstructuresystem::tprint
```

5.2.2.11 transient

```
integer scalarstructure::scalarstructuresystem::transient
```

Transient's flag.

5.2.2.12 u

```
real*8, dimension(:), allocatable scalarstructure::scalarstructuresystem::u
```

Solution vector.

5.2.2.13 u_prev

```
real*8, dimension(:), allocatable scalarstructure::scalarstructuresystem::u_prev
```

Previous time step solution vector.

5.2.2.14 u_prev_it

```
real*8, dimension(:), allocatable scalarstructure::scalarstructuresystem::u_prev_it
```

Previous non-linear solution vector.

5.2.2.15 vbc

```
real*8, dimension(:), allocatable scalarstructure::scalarstructuresystem::vbc
```

BC values vector.

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

- src/scalarStructure.F90

Chapter 6

File Documentation

6.1 src/driver.F90 File Reference

Functions/Subroutines

- program finel

  A FINite ELement program for general purpose problems. The present code is based in the book "Finite Elements: An Introduction" wrote by Eric Becker, Graham Carey and Tinsley Oden.

6.1.1 Function/Subroutine Documentation

6.1.1.1 finel()

```
program finel ( )
```

A FINite ELement program for general purpose problems. The present code is based in the book "Finite Elements: An Introduction" wrote by Eric Becker, Graham Carey and Tinsley Oden.

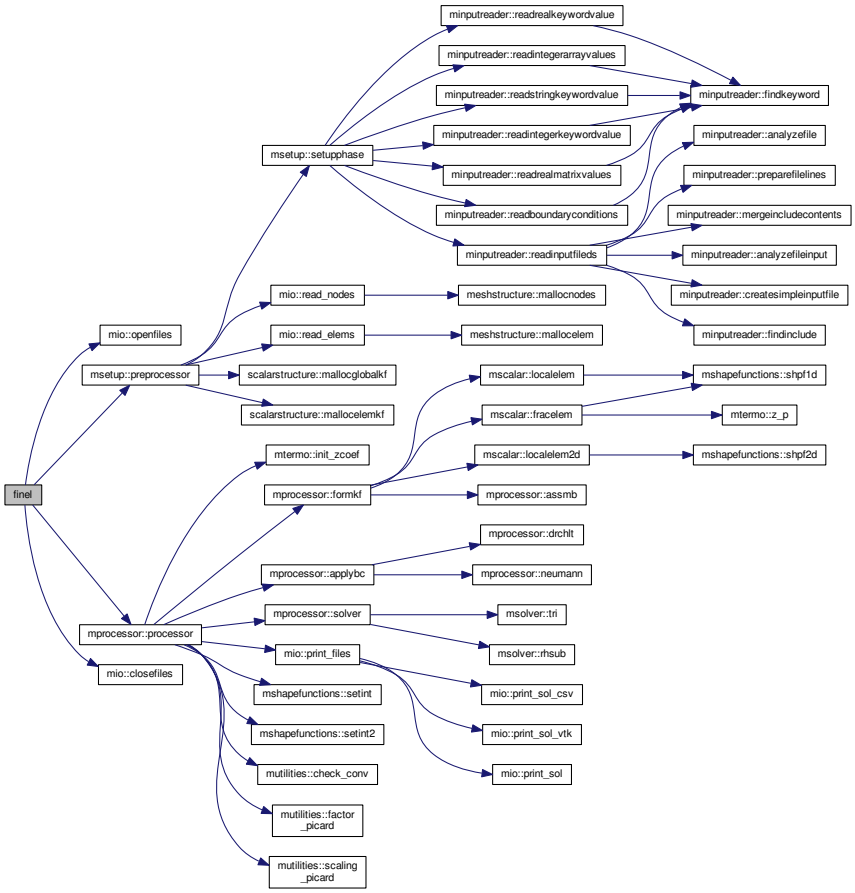
Due to the evolution of Fortran programming language, the code developed here incorporates several changes comparing to the original given in the book cited before. Modular paradigm was employed, as well a little of derived data structure.

Implementations by Diego T. Volpatto. email: volpatto@lncc.br or dtvolpatto@gmail.com

Author

Diego Tavares Volpatto

Here is the call graph for this function:



6.2 src/io.F90 File Reference

Modules

- module mio

  Contains input/output variables and routines.

Functions/Subroutines

- subroutine mio::openfiles ()

  Open IO files.
- subroutine mio::closefiles ()

  Close IO files.
- subroutine mio::read_nodes (mesh_)

  Subroutine to read node data file generated by EasyMesh.

- subroutine mio::read_elems (mesh_)

  Subroutine to read element data file generated by EasyMesh.
- subroutine mio::print_sol (mesh_, scalar_, tstep)

  Prints the solution of scalar field.
- subroutine mio::print_sol_csv (mesh_, scalar_, tstep)

  Prints the solution of scalar field in the csv format aiming to compatibility with Paraview post-processing.
- subroutine mio::print_sol_vtk (mesh_, scalar_, tstep)

  Prints the solution of scalar field in the vtk "legacy" format aiming to compatibility with Paraview post-processing.
- subroutine mio::print_files (mesh_, scalar_, tstep)

  Record solution according to specified file kind in input.

Variables

- integer, parameter mio::iin = 1110

  Input file id.
- integer, parameter mio::iout = 1120

  Output file id.
- integer, parameter mio::isol = 1130

  Solution file id.
- integer, parameter mio::ioutn = 1140

  Node output file.
- integer, parameter mio::ioute = 1150

  Element output file.
- integer, parameter mio::isolcsv = 1160

  Solution csv file id.
- integer, parameter mio::isolvtk = 1170

  Solution vtk file id.
- character(len=20), parameter mio::infile ='input.dat'

  Input file name.
- character(len=20), parameter mio::outfile ='output.dat'

  Output file name.
- character(len=20), parameter mio::outnodes ='outnodes.dat'

  Output node's file name.
- character(len=20), parameter mio::outelem ='outelem.dat'

  Output elements' file name.
- character(len=50), parameter mio::solfile ='solution00'

  Solution file name.
- character(len=50) mio::title
- character(len=50) mio::file_format

6.3 src/meshStructure.F90 File Reference

Data Types

- type meshstructure::mesh

  Data type for a mesh.

Modules

- module meshstructure

  Module that contains the data structure of a mesh associate to a problem.

Functions/Subroutines

- subroutine meshstructure::mallocnodes (meshStrct)

  Routine that allocate memory to node data.
- subroutine meshstructure::mallocelem (meshStrct)

  Routine that allocate memory to element data.

6.4 src/mInputReader.F90 File Reference

Modules

- module minputreader

  Modulo responsavel por reunir subrotinas para leitura do arquivo de entrada.

Functions/Subroutines

- subroutine minputreader::readinputfileds ()

  Le arquivo de input e armazena seu conteudo em um array.
- subroutine minputreader::createsimpleinputfile ()

  Cria a estrutura de input usando um arquivo de entrada sem includes.
- subroutine minputreader::mergeincludecontents (include_file, include_line)

  Le o conteudo do arquivo de include e armazena no array principal.
- subroutine minputreader::preparefilelines (include_indexes, include_number_of_lines, number_of_includes, original_file_lines)

  Efetua a alocacao da estrutura definitiva, preparando a linha dos arquivos originais para receber os includes.
- subroutine minputreader::analyzefileinput (number_of_lines, number_of_includes)

  Efetua algumas analises no arquivo recebido.
- subroutine minputreader::analyzefile (file_name, number_of_lines, number_of_includes)

  Efetua algumas analises no arquivo recebido.
- integer ∗4 function minputreader::findinclude (position, file_lines, number_of_lines)

  Procura a n-esima palavra-chave include.
- integer ∗4 function minputreader::findkeyword (keyword)

  Procura uma palavra-chave.
- subroutine minputreader::readintegerkeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave to tipo inteiro. Se nao encontrado, associa o valor default fornecido.
- subroutine minputreader::readintarraykeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave do tipo array de inteiro. Se nao encontrado, associa o valor default fornecido. Obs.: Atentar para o fato dessa sub-rotina ter um do "infinito".
- subroutine minputreader::readstringkeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave to tipo string. Se nao encontrado, associa o valor default fornecido.
- subroutine minputreader::readrealkeywordvalue (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave to tipo real. Se nao encontrado, associa o valor default fornecido.
- subroutine minputreader::readintegerarrayvalues (keyword, target, default_value)

Efetua a leitura de uma palavra-chave do tipo de um array de inteiros. A leitura eh realizada linha por linha. A primeira linha informa o numero de valores a ser lido. Se nao encontrada a keyword, associa o valor default fornecido.

- subroutine minputreader::readrealmatrixvalues (keyword, target, default_value)

  Efetua a leitura de uma palavra-chave do tipo de um array bidimensional real. A leitura eh realizada linha por linha. Se nao encontrado, associa o valor default fornecido.
- subroutine minputreader::readboundaryconditions (keyword, kbc, vbc, default_value)

  Efetua a leitura de uma palavra-chave do tipo de um array bidimensional real. A leitura eh realizada linha por linha. Se nao encontrado, associa o valor default fornecido.

Variables

- character(len=200), dimension(:), allocatable minputreader::file_lines

  Armazena as linhas do arquivo de input.
- integer ∗4 minputreader::number_of_lines

  Armazena o numero de linhas no arquivo.

6.5 src/processor.F90 File Reference

Modules

- module mprocessor

  Processor module to compute, assemble and solve the system.

Functions/Subroutines

- subroutine mprocessor::formkf (mesh_, scalar_, t)

  Form and assemble Ku = F system.
- subroutine mprocessor::assmb (mesh_, scalar_, nel)

  Assemble element stiffness matrix and load vector to global stiffness matrix and load vector, respectively.
- subroutine mprocessor::drchlt (mesh_, scalar_, n)

  Apply Dirichlet Boundary Condition.
- subroutine mprocessor::neumann (mesh_, scalar_, n)

  Apply Neumann Boundary Condition – 1D. Prescribe -k(x)u = vbc.
- subroutine mprocessor::applybc (mesh_, scalar_)

  Modify Ku=F system to incorporate BC data.
- subroutine mprocessor::solver (mesh_, scalar_)

  Executes Gauss reduction and forward substitution solving Ku=F.
- subroutine mprocessor::processor (mesh_, scalar_)

  Processor routine phase.

6.6 src/scalar.F90 File Reference

Modules

- module mscalar

  Contains variables and subroutine related to a general scalar problem.

Functions/Subroutines

- subroutine mscalar::localelem (mesh_, scalar_, nel)

  Computes a master element contribution – 1D.
- subroutine mscalar::localelem2d (mesh_, scalar_, nel)

  Computes a master element contribution – 2D.
- subroutine mscalar::fracelem (mesh_, scalar_, nel, t)

  Computes a master element contribution in fracture case – 1D.

6.7 src/scalarStructure.F90 File Reference

Data Types

- type scalarstructure::scalarstructuresystem

  Variables and characteristic data for a scalar problem.

Modules

- module scalarstructure

  Module that contains the data structure of a general scalar problem.

Functions/Subroutines

- subroutine scalarstructure::mallocglobalkf (scalar_, n)

  Routine to allocate and clear the Ku = F system.
- subroutine scalarstructure::mallocelemkf (scalar_, n)

  Routine to allocate and clear the element KF.

6.8 src/setup.F90 File Reference

Modules

- module msetup

  Module for setup phase by IO procedures.

Functions/Subroutines

- subroutine msetup::setupphase (mesh_, scalar_)

  Reads parameters from input file.
- subroutine msetup::preprocessor (mesh_, scalar_)

  Realizes preprocessor routines.

6.9 src/shapeFunctions.F90 File Reference

Modules

- module mshapefunctions

  Module for shape functions computations and relate operations.

Functions/Subroutines

- subroutine mshapefunctions::setint

  Gauss quadrature data set routine - 1D.
- subroutine mshapefunctions::setint2

  Gauss quadrature data set routine - 2D.
- subroutine mshapefunctions::shpf1d (xl, n, psi, dpsi)

  Calculates the values of the shape functions and their derivatives - 1D.
- subroutine mshapefunctions::shpf2d (XL, N, PSI, DPSI)

  Calculates the values of the shape functions and their derivatives - 2D.

Variables

- real ∗8, dimension(20, 20) mshapefunctions::xi

  Gauss point integration 1D.
- real ∗8, dimension(20, 20) mshapefunctions::w

  Gauss weights 1D.
- real ∗8, dimension(2, 9) mshapefunctions::xiq

  Gauss points to rectangular element.
- real ∗8, dimension(9) mshapefunctions::wq

  Gauss weights to rectangular element.
- real ∗8, dimension(2, 4) mshapefunctions::xit

  Gauss points to triangle element.
- real ∗8, dimension(4) mshapefunctions::wt

  Gauss weights to triangle element.
- integer mshapefunctions::quadext

6.10 src/solver.F90 File Reference

Modules

- module msolver

  Contains subroutine to compute numerical solution of linear systems Ax=b.

Functions/Subroutines

- subroutine msolver::tri (A, n)

  Applies Gauss reduction in A(n,n) to obtain a superior triangular equivalent form.
- subroutine msolver::rhsub (A, x, b, n)

  Does the forward substitution on the right-side-hand.

6.11 src/termo.F90 File Reference

Modules

- module mtermo

  Module that contains thermodynamics function and parameters.

Functions/Subroutines

- subroutine mtermo::init_zcoef

  Initializes interpolation coefficients to compute compressibility factor.
- subroutine mtermo::z_p (p, Z)

  Computes compressibility factor.

Variables

- real ∗8, dimension(10) mtermo::zcoef

6.12 src/utilities.F90 File Reference

Modules

- module mutilities

  Module for auxiliar routines.

Functions/Subroutines

- subroutine mutilities::linspace (x1, x2, nintv, x)

  Generate points between x1 and x2 equally spaced in x(i). Same idea of numpy subroutine.
- real ∗8 function mutilities::f1 (x)

  A function to test purpose.
- subroutine mutilities::quad1 (n, x1, x2)

  Subroutine that computes gaussian quadrature of f1.
- subroutine mutilities::test_shpf1d (n, nelem, x)

  Check if shpf1d works properly.
- subroutine mutilities::print_matrix (A, n, m)

  Prints in the screen a matrix A(n,m)
- subroutine mutilities::check_conv (u, uprev, nnodes, tol, norm, flag)

  Routine to check if non-linear iteration converged.
- subroutine mutilities::factor_picard (alpha, delta, eps, omega_min, omega)

  Computes underrelaxation factor for Picard iteration.
- subroutine mutilities::scaling_picard (i, delta, deltap, eps, rho, omega, omega_min, alpha)

  Rescaling shape factor for underrelaxation.

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