RTFEM

Generated by Doxygen 1.8.14

Contents

Chapter 1

Hierarchical Index

1.1 Class Hierarchy

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

Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 3

Class Documentation

3.1 rtfem::FEMAssembler Class Reference

Public Member Functions

- Matrix **ComputeGlobalStiffness** (const std::shared_ptr< FEMModel > fem_model)

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Solver/FEMAssembler.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/Solver/FEMAssembler.cpp

3.2 rtfem::FEMModel Class Reference

`#include <FEMModel.h>`

Public Member Functions

- **FEMModel** (std::vector< std::shared_ptr< FiniteElement >> &finite_elements_, std::vector< std::shared_ptr< Vertex >> &vertices_, const Material &&material)
- const std::vector< std::shared_ptr< FiniteElement > > & **finite_elements** () const
- const std::vector< std::shared_ptr< Vertex > > & **vertices** () const
- Material & **material** ()
- UInt **VertexCount** ()
- UInt **FiniteElementCount** ()

3.2.1 Detailed Description

FEMModel contains model of a single connected object. TODO: What does it mean ^ ?

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/FEMModel.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/FEMModel.cpp

3.3 rtfem::FEMSolver Class Reference

Public Member Functions

- **FEMSolver** (const ConstitutiveSolverType &&constitutive_solver_type, const GeometrySolverType &&geometry_solver_type, const AnalysisSolverType &&analysis_solver_type)
- const ConstitutiveSolverType & **constitutive_solver_type** ()
- const GeometrySolverType & **geometry_solver_type** ()
- const AnalysisSolverType & **analysis_solver_type** ()
- void **Solve** (const std::shared_ptr< FEMModel > fem_model)

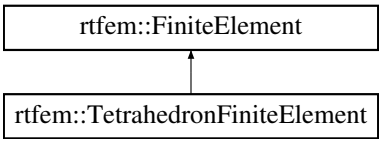
The documentation for this class was generated from the following files:

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Solver/FEMSolver.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/Solver/FEMSolver.cpp

3.4 rtfem::FiniteElement Class Reference

`#include <FiniteElement.h>`

Inheritance diagram for rtfem::FiniteElement:



Public Member Functions

- **FiniteElement** (const FiniteElementType &&type)
- const FiniteElementType & **type** () const
- const std::vector< std::shared_ptr< Vertex > > & **vertices** ()
- virtual UInt **GetVertexCount** () const =0

Protected Attributes

- std::vector< std::shared_ptr< Vertex > > **vertices_**

3.4.1 Detailed Description

Abstract class for Finite Element.

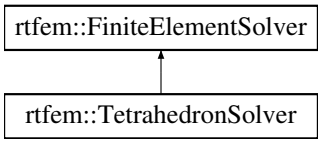
The documentation for this class was generated from the following files:

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/FiniteElement.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/FiniteElement.cpp

3.5 rtfem::FiniteElementSolver Class Reference

`#include <FiniteElementSolver.h>`

Inheritance diagram for rtfem::FiniteElementSolver:



Public Member Functions

- virtual FiniteElementSolverData **Solve** (std::shared_ptr< FiniteElement > finite_element)=0

3.5.1 Detailed Description

Computes FiniteElementSolverData for a given FiniteElement.

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Solver/FiniteElementSolver.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/Solver/FiniteElementSolver.cpp

3.6 rtfem::FiniteElementSolverData Struct Reference

`#include <FiniteElementSolver.h>`

Public Attributes

- Float **volume**
- Matrix **shape_matrix**
- Matrix **geometry_matrix**

3.6.1 Detailed Description

Contains: Volume. Shape Matrix Geometry Matrix

Coordinates: x2 is assumed to point 'up'

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Solver/FiniteElementSolver.h

3.7 rtfem::GlobalStiffnessAssembler Class Reference

`#include <GlobalStiffnessAssembler.h>`

Public Member Functions

- Matrix Compute (const std::shared_ptr< FEMModel > fem_model)

3.7.1 Detailed Description

Local Stiffness Matrix (k) is the stiffness of each element [3Ne x 3Ne] e.g. for Tetrahedron (Ne = 3) thus: (dim = [12 x 12])

Global Stiffness Matrix (K) is the stiffness of entire FEM Model [3N x 3N] e.g. For 9 vertices (dim = [27 x 27])

Partial Global Stiffness Matrix (Ke) is the matrix of dimension equal to Global Stiffness but filled with only Local Stiffness data.

3.7.2 Member Function Documentation

3.7.2.1 Compute()

```
Matrix rtfem::GlobalStiffnessAssembler::Compute (
            const std::shared_ptr< FEMModel > fem_model )
```

Computes Global Stiffness Matrix (K).

```
1) Computes Constitutive Matrix (C)
2) Computes Geometry Matrix (B) for each Finite Element
3) Computes Local Stiffness (k) for each Finite Element
    - Using Constitutive Matrix and Geometry Matrix.
4) Assembles all Local Stiffness matrices into Global Stiffness Matrix (K)
```

Parameters

fem_model	

Returns

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Solver/GlobalStiffnessAssembler.↩ h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/Solver/GlobalStiffnessAssembler.↩ cpp

3.8 rtfem::Material Struct Reference

`#include <Material.h>`

Public Attributes

- Float **young_modulus**
- Float **poisson_coefficient**

3.8.1 Detailed Description

One Material per FEMModel

TODO: Bounds of material properties (e.g. poisson [0, 0.5]

TODO: Material could be bound to each FiniteElement seperatly, allowing for 'illusion' of composite materials. That would require computing Constitutive Matrix for each FiniteElement.

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Material.h

3.9 rtfem::Matrix Class Reference

Public Member Functions

- Matrix (UInt row_count, UInt column_count)
- **Matrix** (const MatrixDimension &&matrix_dimension)
- const MatrixDimension & **dimensions** () const
- std::vector< Float > & operator[ ] (UInt i)
- const std::vector< Float > & **operator[ ]** (UInt i) const
- std::vector< Float > & GetRow (UInt i)
- const std::vector< Float > & **GetRow** (UInt i) const

3.9.1 Constructor & Destructor Documentation

3.9.1.1 Matrix()

```
rtfem::Matrix::Matrix (
            UInt row_count,
            UInt column_count )
```

Creates Matrix with row_count rows and column_count columns

Parameters

row_count	
column_count	

3.9.2 Member Function Documentation

3.9.2.1 GetRow()

```
std::vector< Float > & rtfem::Matrix::GetRow (
            UInt i )
```

Returns i-th row.

Parameters

i	

Returns

3.9.2.2 operator[]()

```
std::vector< Float > & rtfem::Matrix::operator[] (
            UInt i )
```

Returns i-th row.

Parameters

i	

Returns

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/DataStructure/Matrix.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/DataStructure/Matrix.cpp

3.10 rtfem::MatrixDimension Struct Reference

Public Member Functions

- **MatrixDimension** (UInt row_count, UInt column_count)

Public Attributes

- UInt **row_count**
- UInt **column_count**

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/DataStructure/Matrix.h

3.11 rtfem::MatrixMath Class Reference

Public Member Functions

- Float **ComputeDeterminant2** (const Matrix &matrix)
- Float **ComputeDeterminant** (const Matrix &matrix)
- Matrix ContractMatrix (const Matrix &matrix, UInt row, UInt column)

3.11.1 Member Function Documentation

3.11.1.1 ContractMatrix()

```
Matrix rtfem::MatrixMath::ContractMatrix (
            const Matrix & matrix,
            UInt row,
            UInt column )
```

Removes specified row and column thus new matrix has dimension [N-1 x M-1]

Parameters

matrix	
row	
column	

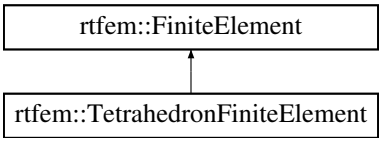
Returns

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/Math/MatrixMath.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/Math/MatrixMath.cpp

3.12 rtfem::TetrahedronFiniteElement Class Reference

Inheritance diagram for rtfem::TetrahedronFiniteElement:



Public Member Functions

- **TetrahedronFiniteElement** (std::shared_ptr< Vertex > vertex1, std::shared_ptr< Vertex > vertex2, std::shared_ptr< Vertex > vertex3, std::shared_ptr< Vertex > vertex4)
- UInt **GetVertexCount** () const override

Additional Inherited Members

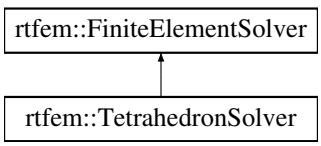
The documentation for this class was generated from the following files:

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/FiniteElements/TetrahedronFiniteElement.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/FiniteElements/TetrahedronFiniteElement.cpp

3.13 rtfem::TetrahedronSolver Class Reference

`#include <TetrahedronSolver.h>`

Inheritance diagram for rtfem::TetrahedronSolver:



Public Member Functions

- virtual FiniteElementSolverData **Solve** (std::shared_ptr< FiniteElement > finite_element) override

3.13.1 Detailed Description

Solver for Linear Tetrahedron (constant gradient of shape function). The geometry matrix B is constant with respect to X (and always will be constant, independent of material/strain equations

Solver Data: Shape Matrix: [3 x 12] Used in computing Force vector

Geometry matrix: [6 x 12] (Shape function gradient) Used in computing Stiffness Matrix

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Solver/FiniteElementSolvers/Tetrahedron↩ Solver.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/Solver/FiniteElementSolvers/Tetrahedron↩ Solver.cpp

3.14 rtfem::Vector3 Struct Reference

Public Member Functions

- **Vector3** (Float x, Float y, Float z)

Public Attributes

- Float **x**
- Float **y**
- Float **z**

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/DataStructure/Vector3.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/DataStructure/Vector3.cpp

3.15 rtfem::Vertex Class Reference

Public Member Functions

- **Vertex** (UInt id, const Vector3 &&cooridnates)
- UInt **id** () const
- const Vector3 & **coordinates** () const

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

- /home/samba/ciecierskij/programming/rt_fem/sources/include/RTFEM/FEM/Vertex.h
- /home/samba/ciecierskij/programming/rt_fem/sources/src/RTFEM/FEM/Vertex.cpp