Chapter 1

Existing (unstructured) meshes: Wrappers to third-party mesh generators

oomph-lib does not provide its own unstructured mesh generator but has several mesh classes that generate unstructured meshes from the output of third-party unstructured mesh generators.

Notes:

- The unstructured tet and triangle meshes listed below can **not** be used with oomph-lib's mesh adaptation or node-update procedures. A suitably fine mesh has to be generated offline by the third-party mesh generator. If required, node-updates (in response to changes in the domain boundaries) have to be performed manually.
- 2. For some element types, the mesh generation process is not particularly efficient (yet!). A suitable warning message is issued in such cases.
- Since the third-party mesh generators tend to triangulate the domain with simplex elements, curvilinear boundaries are not resolved more accurately by using higher-order elements unless some post-processing is performed.
- 4. The meshes have not been tested as extensively as <code>oomph-lib's</code> structured meshes, described <code>elsewhere</code>.

1.1 Mesh list

Mesh **Representative Mesh plot** TriangleMesh<ELEMENT> • This class creates oomph-lib meshes based on the output from J.R.Shewchuk's Delaunay mesh generator Triangle \bullet The mesh can be used with all $\mathtt{Finite} {\leftarrow}$ Elements that are derived from the geometric finite element TElement < 2, NNODE 1D>. **Example driver codes:** • The use of Triangle and the Triangle ← Mesh class are explained in a separate tutorial. • In another tutorial we demonstrate how the code fig2poly.cc may be used to generate input files for Triangle based on the output from the open-source drawing program xfig. TetgenMesh<ELEMENT> • This class creates oomph-lib meshes based on the output from Hang Si's open-source mesh generator Tetgen . • The mesh can be used with all Finite↔ Elements that are derived from the geometric finite element TElement < 3, NNODE 1D>. **Example driver codes:** • The use of Tetgen and the Tetgen← Mesh class are explained in a separate tutorial.

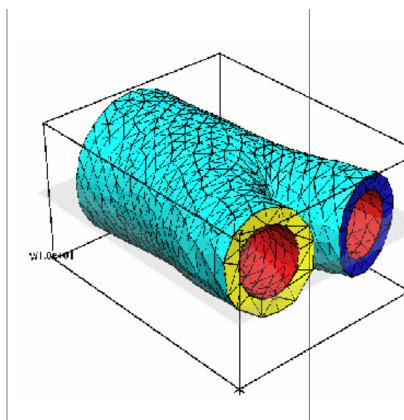
1.1 Mesh list

Generating meshes from medical scans with VMTK

• We provide the option to generate tetgenbased meshes for physiological fluid-structure interaction problems, using the Vascular Modeling Toolkit (VMTK).

Example driver codes and tutorials:

- We provide a separate tutorial that shows how to generate oomph-lib meshes from medical images.
- The methodology is used in the following driver codes:
 - The inflation of a blood vessel.
 - Finite Reynolds number flow through a (rigid) iliac bifurcation.
 - Finite Reynolds number flow through an elastic iliac bifurcation.

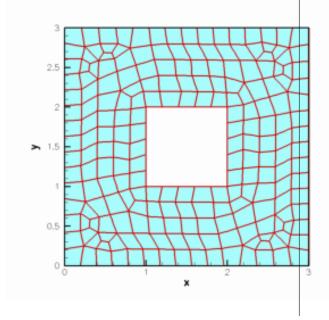


${\tt GeompackQuadMesh}{<} {\tt ELEMENT}{>}$

- This class creates <code>oomph-lib</code> meshes based on the output from Barry Joe's mesh generator <code>Geompack++</code>, available as freeware at <code>http://members.shaw.ca/bjoe/</code>.
- The mesh can be used with all Finite ← Elements that are derived from the geometric finite element QElement<2,2>.

Example driver codes:

 The use of Geompack++ and the GeompackQuadMesh class are explained in a separate tutorial.



1.2 PDF file

A pdf version of this document is available.