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:

1. 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.

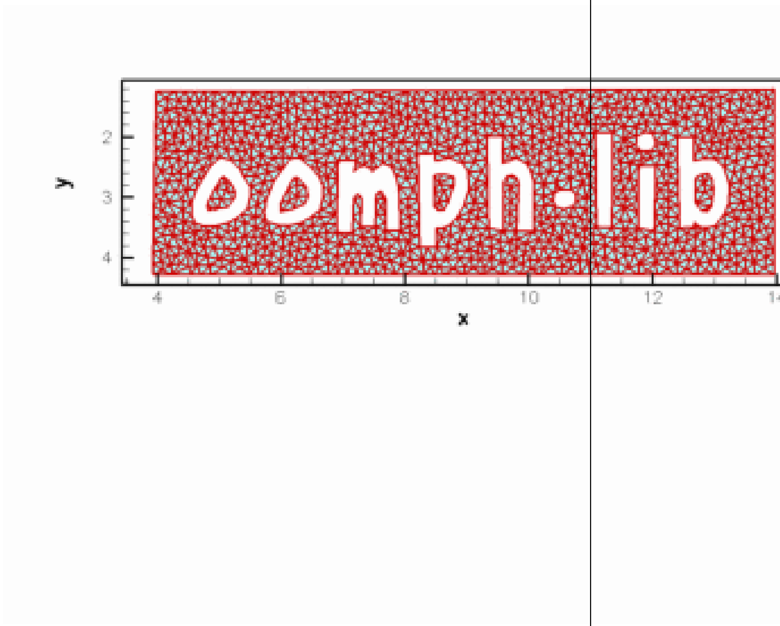
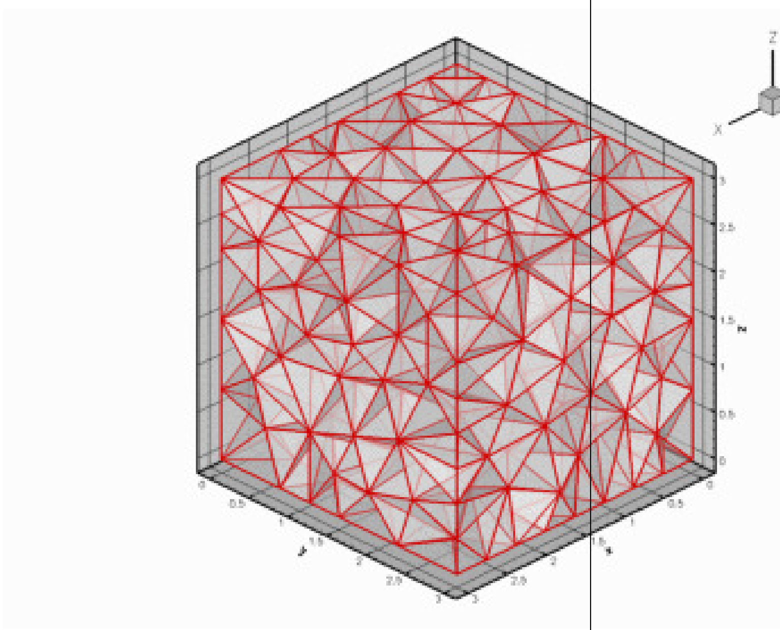
2. For some element types, the mesh generation process is not particularly efficient (yet!). A suitable warning message is issued in such cases.

3. 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 `oomph-lib's` structured meshes, described `elsewhere.`

   .

1.1 Mesh list

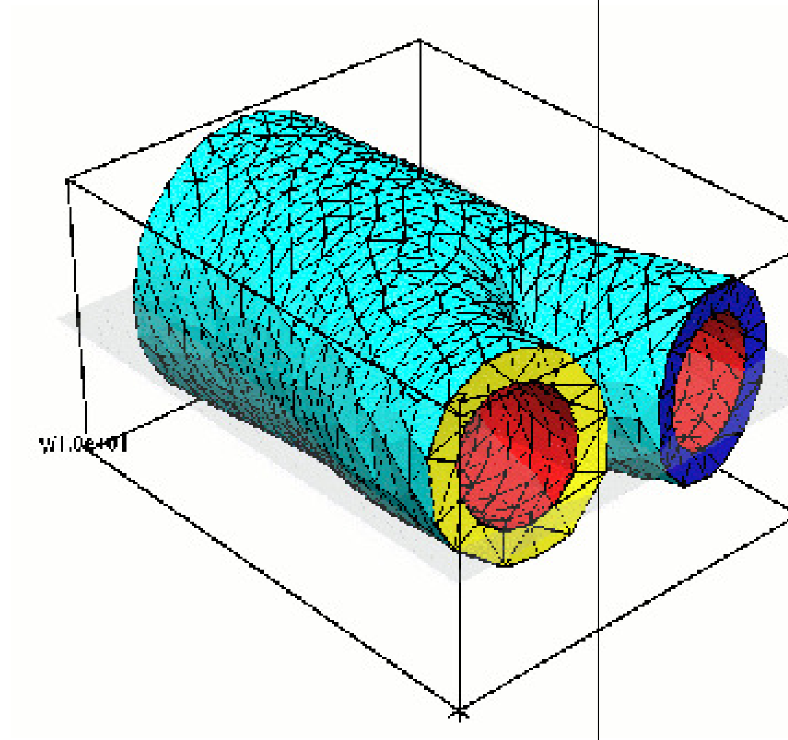
Mesh	Representative Mesh plot
TriangleMesh<ELEMENT> • This class creates oomph-lib meshes based on the output from J.R.Shewchuk's Delaunay mesh generator Triangle • The mesh can be used with all FiniteElements that are derived from the geometric finite element TElement<2,NNODE_1D>. **Example driver codes:** • The use of Triangle and the TriangleMesh 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 FiniteElements that are derived from the geometric finite element TElement<3,NNODE_1D>. **Example driver codes:** • The use of Tetgen and the TetgenMesh class are explained in a separate tutorial.	

Generating meshes from medical scans with VMTK

- We provide the option to generate tetgen-based 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.

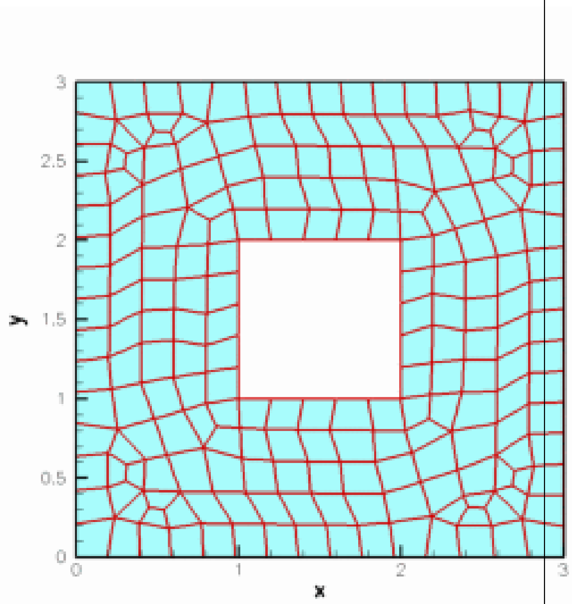


GeompackQuadMesh<ELEMENT>

- This class creates `oomph-lib` meshes based on the output from Barry Joe's mesh generator Geompack++, available as freeware at http://members.shaw.ca/bjoe/.
- The mesh can be used with all `FiniteElements` 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.