

Chapter 1

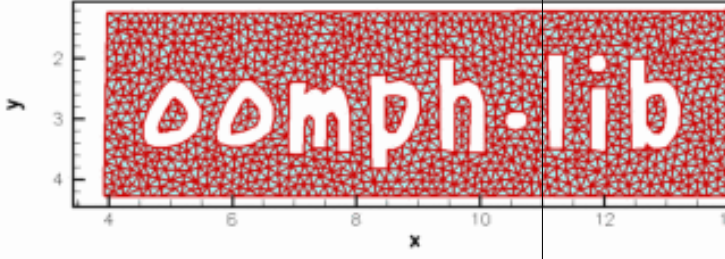
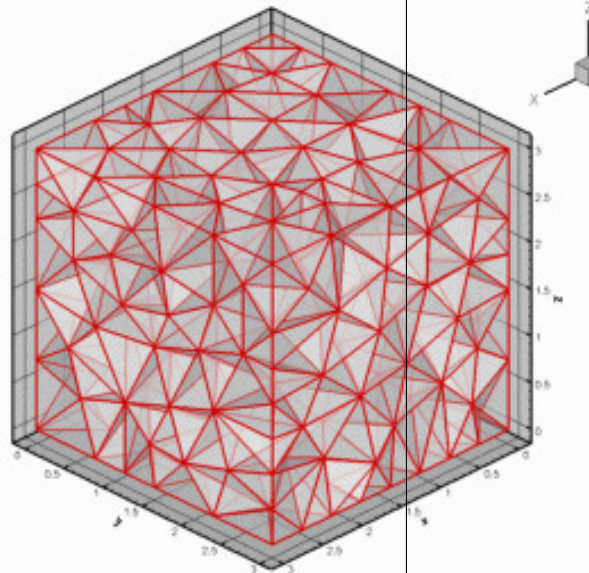
Existing (unstructured) meshes: Wrappers to third-party mesh generators

`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

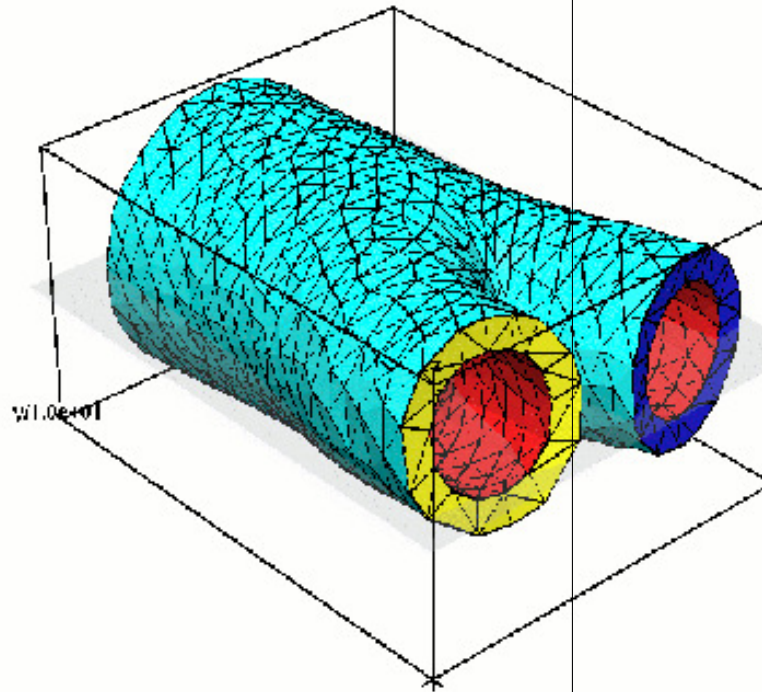
Mesh	Representative Mesh plot
<p>TriangleMesh<ELEMENT></p> <ul style="list-style-type: none"> <li>• This class creates <code>oomph-lib</code> meshes based on the output from <code>J.R.Shewchuk's</code> Delaunay mesh generator <code>Triangle</code> <li>• The mesh can be used with all <code>FiniteElements</code> that are derived from the geometric finite element <code>TElement<2, NNODE_1D></code>. <p>Example driver codes:</p> <ul style="list-style-type: none"> <li>• The use of <code>Triangle</code> and the <code>TriangleMesh</code> class are explained in a separate tutorial. <li>• In another tutorial we demonstrate how the code <code>fig2poly.cc</code> may be used to generate input files for <code>Triangle</code> based on the output from the open-source drawing program <code>xfig</code>. 	
<p>TetgenMesh<ELEMENT></p> <ul style="list-style-type: none"> <li>• This class creates <code>oomph-lib</code> meshes based on the output from <code>Hang Si's</code> open-source mesh generator <code>Tetgen</code>. <li>• The mesh can be used with all <code>FiniteElements</code> that are derived from the geometric finite element <code>TElement<3, NNODE_1D></code>. <p>Example driver codes:</p> <ul style="list-style-type: none"> <li>• The use of <code>Tetgen</code> and the <code>TetgenMesh</code> 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.](#)

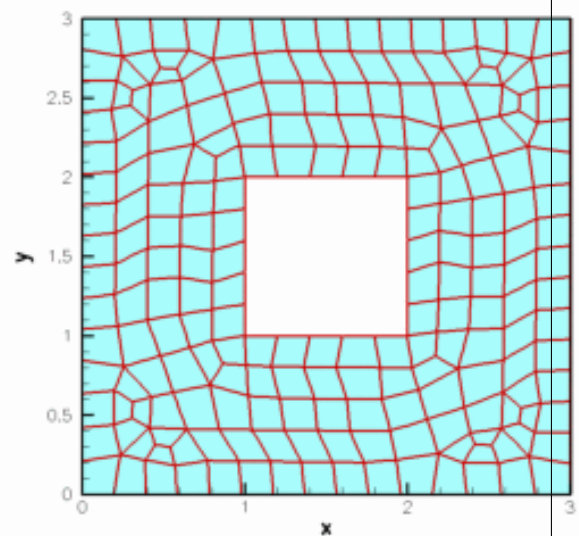


GeompackQuadMesh<ELEMENT>

- This class creates oomph-lib meshes based on the output from Barry Joe's mesh generator [Geompack++](http://members.shaw.ca/bjoe/), available as freeware at <http://members.shaw.ca/bjoe/>.
- 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.