

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](#).
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1.1 Mesh list

Mesh	Representative Mesh plot
<p>TriangleMesh<ELEMENT></p> <ul style="list-style-type: none"> This class creates <code>oomph-lib</code> meshes based on the output from J.R.Shewchuk's Delaunay mesh generator <code>Triangle</code> The mesh can be used with all <code>FiniteElement</code>s 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"> The use of <code>Triangle</code> and the <code>TriangleElement</code> class are explained in a separate tutorial. 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"> This class creates <code>oomph-lib</code> meshes based on the output from Hang Si's open-source mesh generator <code>Tetgen</code>. The mesh can be used with all <code>FiniteElement</code>s 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"> The use of <code>Tetgen</code> and the <code>TetgenElement</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++**, 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.