

Using Gmsh as a mesh generator and post-processor for LAGAMINE

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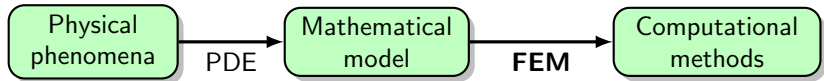
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Introduction



Why a mesh?

- Solving PDEs involving the space domain.
- Spatial discretization as a support for FE simulations.
- PDEs can be solved over a set of conforming geometric entities.

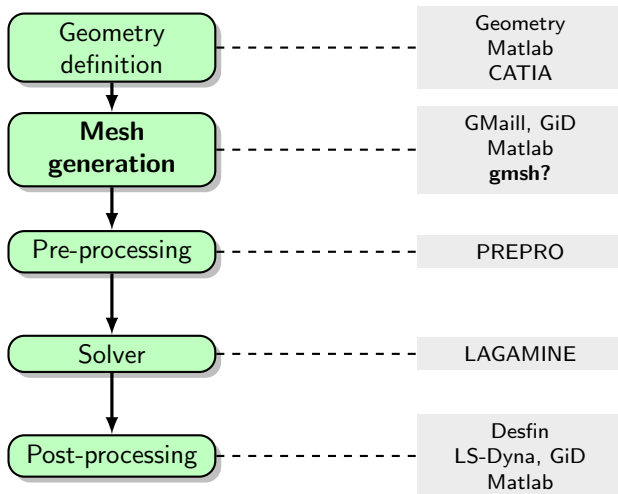
Introduction



Mesh generation

- Domain decomposition is not straightforward!
- Quality of discretization \Rightarrow quality of the FE solution.
- How we deal with it in LAGAMINE?

Current tools



*Why not use state-of-art tools
for mesh generation?*

(or for the geometry and the post-processing. . .)

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*Automatic 3D finite element mesh
generator with built-in pre- and
post-processing facilities*



*Automatic 3D finite element mesh
generator with built-in pre- and
post-processing facilities*



Overview

- Developed by C Geuzaine (**ULg**) and JF Remacle (UCL)
- Simple scripting language
- Free, open-source and multi-platform (Windows, Linux, Mac)
- More info: <http://geuz.org/gmsh/>

What we can do with Gmsh?

Modules

- 1 **Geometry** through BRep or OpenCASCADE.
- 2 **Meshing** the main core.
- 3 **Solver** . . . interface for solvers.
- 4 **Post-processing** scalar, vector and tensor fields.

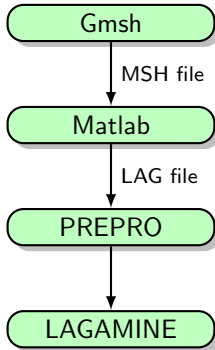
What we can do with Gmsh?

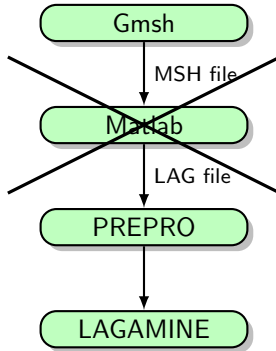
Modules

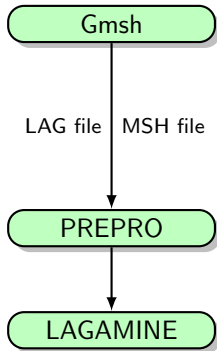
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Meshing

- Constraint: 4-nodes and 8-nodes elements.
- Structured algorithms: transfinite and extrusion.
- Unstructured algorithms: Frontal Delaunay triangular and tetrahedral and frontal quadrilateral mesh generators with size and orientation specifications.





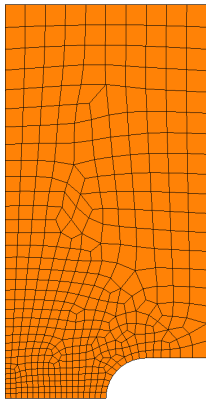


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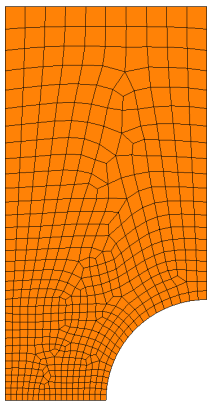
Flat specimen with notch

$R = 2 \text{ mm}$



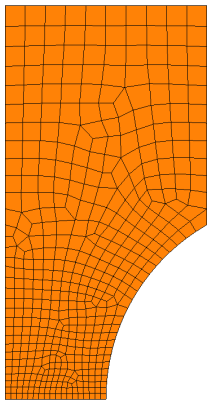
Flat specimen with notch

$R = 5 \text{ mm}$

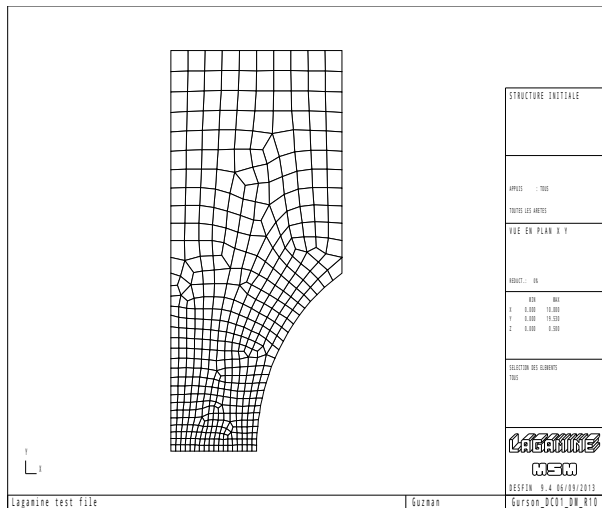


Flat specimen with notch

$R = 10 \text{ mm}$

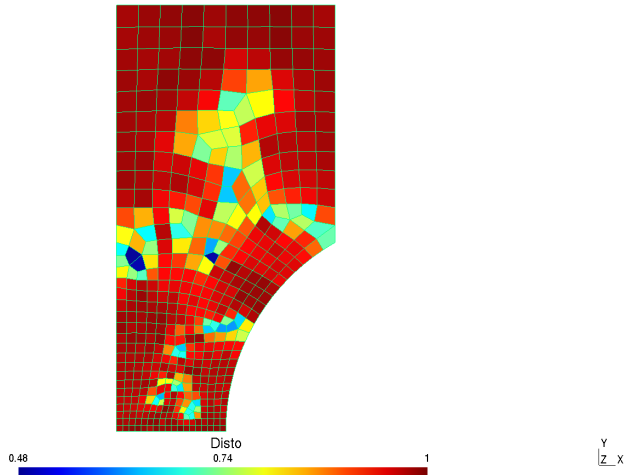


Flat specimen with notch



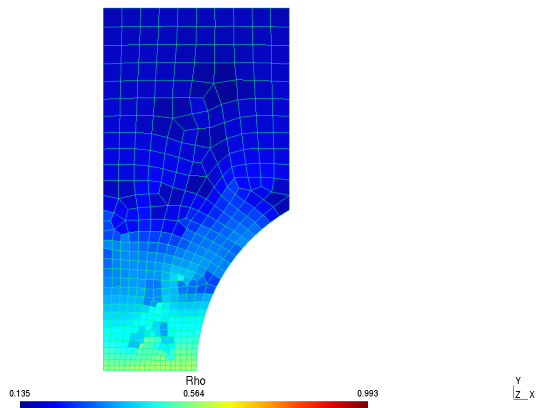
Mesh quality

Distorsion



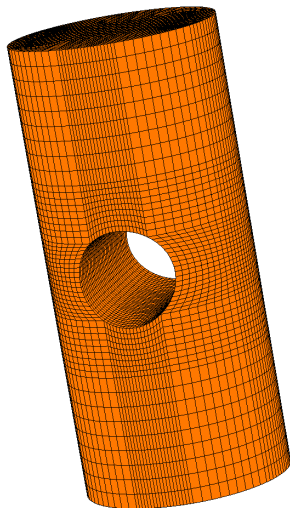
Mesh quality

ρ



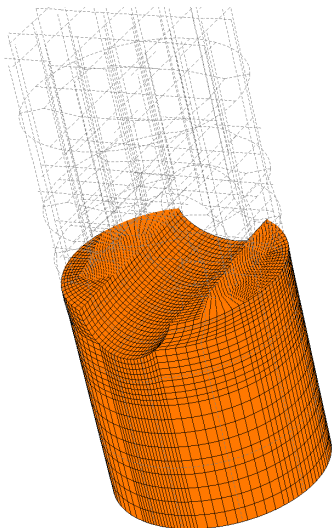
$$\rho \approx \frac{\text{min_edge_length}}{\text{max_edge_length}}$$

Cylinder with hole

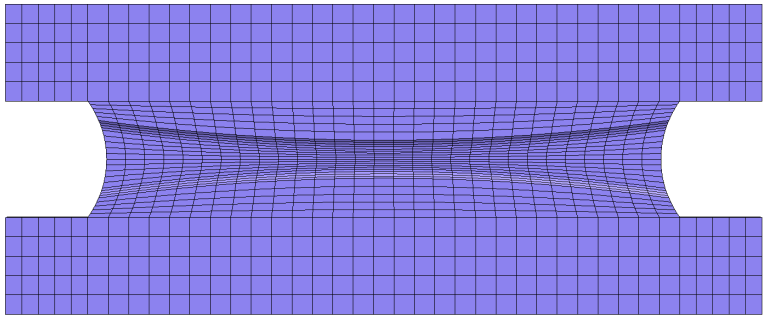


z
y x

Cylinder with hole

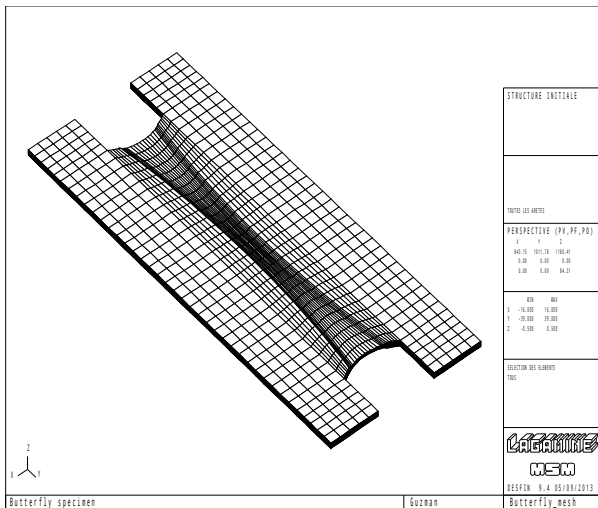


Butterfly specimen

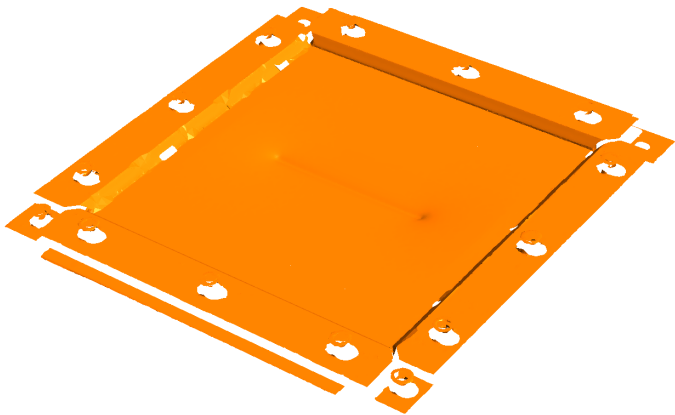


$\frac{x}{y|z}$

Butterfly specimen



CAD/CAM STL file



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Capabilities

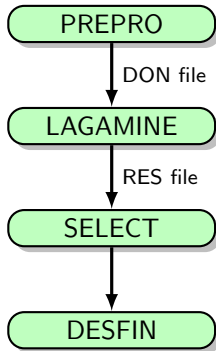
- Scalar, vector or tensor datasets (Iso-values...).
- Vector graphics output (gl2ps library), movie making capabilities, about 30 plugins,...
- Both interactive and scripting interface.

Why with LAGAMINE?

- Better capabilities than DesFin (and DREAMS).
- **Stable development and support.**
- New formatting for DON and RES files?

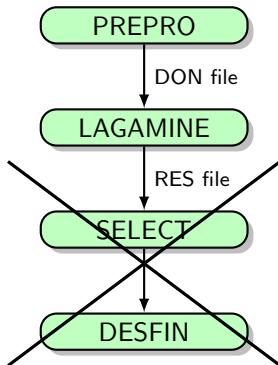
Post-processing

... in LAGAMINE



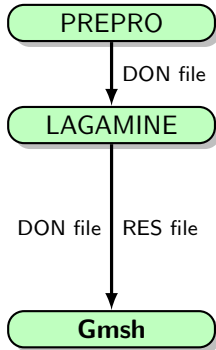
Post-processing

... in LAGAMINE



Post-processing

... in LAGAMINE



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