Exercise 1

August 16, 2016

1 Assignment

In engineering, the stresses are one of the prinicipal variables which helps to predict the failure of a mechanical component, defined by a specific shape and material, and subjected to specific boundary conditions. Particular zones in a given mechanical component where stresses "concentrates" and tends to infinity in the continumm must be avoided. This stress concentration depends on the shape of the component and special emphasis should be put on this issue during designing process. Finite element analysis helps to predict the stress distribution of a mechanical piece under certain boundary conditions. This is of great help for the engineer during the design process. As the cost of performing a computer simulation of a given mechanical component is low compared with experiments, the engineer has the oportunity to redesign several times a specific component and evaluate its performance until all usage requeriments are fullfiled.

Let's consider an L-shaped beam made of aluminium subjected only to Dirichlet boundary conditions. The geometry, material properties and boundary conditions are given by Fig. 1.

- Run this problem using Ostero and postprocess the results with ParaView.
- Using ParaView, look for the point of maximum σ_{xx} stress (to do this, split horizontally the Layout, create a SpreadSheet View and sort the SIGXX variable).
- Refine the mesh and see how this value (and position) evolves. To refine the mesh, edit the .geo file and check for the hints. How is the

evolution of the maximum value of σ_{xx} after refining the mesh several times?

- Propose a new design to improve this performance. Why the performance you observed in the previous point is undesired?
- Generate the geometry and mesh of your proposed design and perform a mesh convergence analysis to check the improvement.

If you get lost, in the RESOLUTION folder you will find several hints that will help you with the fullfilment of this assignment.

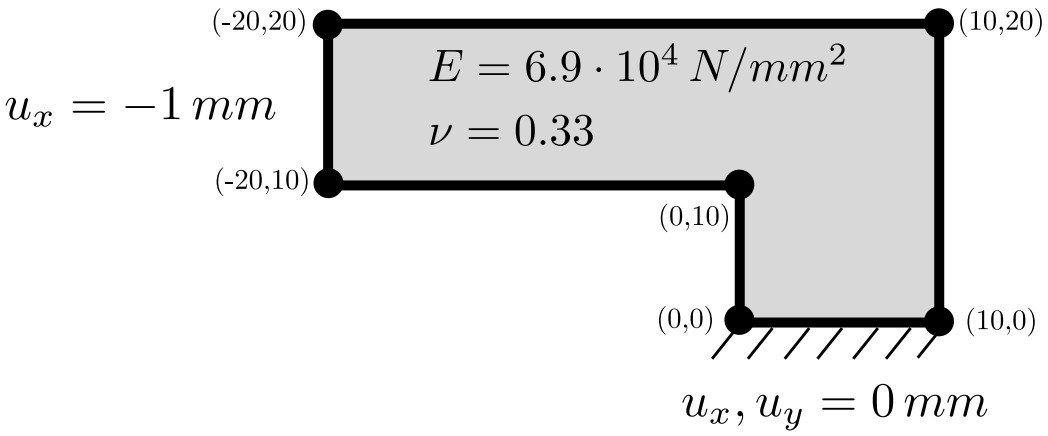

Figure 1: Geometry, properties and boundary conditions.