Programming for Engineers and Scientists

Homework 1 **Year 2015 - 2016**

Matlab and FE **Due date: 1st of March**

This assignment is to be done in groups of 3 people. Please note that $1 \neq 3$ *and* $2 \neq 3$.

In the initial classes of PES we extended an existing Matlab code implementing FE for a Poisson equation,

$$\begin{cases} \nabla \cdot (\nu \nabla u) = s & \text{in } \Omega, \\ u = 1 & \text{on } \Gamma_{Inlet}, \\ u = 0 & \text{on } \Gamma_{Outlet}, \\ (\nu \nabla u) \cdot \mathbf{n} = 0 & \text{otherwise} \end{cases} \tag{1}$$

where the source term $s = 0$ and the diffusivity $\nu = 1$ are given. The domain Ω is shown in Figure 1

This assignment consist in further extending that code. We ask you to develop one single Matlab code able to solve the Poisson problem, accounting for the following options and features[1]:

- Read a general mesh and boundary condition from input files.
- Solve 2D/3D and steady state problems
- Use triangular/tetrahedral, quad/hexahedral using linear or quadratic elements.

The code must be versioned in git. Please enclose a report describing your code, how to use it, how you tested it, etc. Take into account that the structure, presentation, readability, etc. of the program will be evaluated (not only correctness) together with the report. Eight meshes are provided to test your code. Boundary conditions for each case are described within the input files. The eight meshes corresponds to the same problem. You can make comparisons of the solutions, running time, accuracy, etc.

[1] In order to get the maximum mark you have to develop all the requested features. In case that some are missing the mark will be calculated accordingly. The minimum features that you have to implement are a transient 2D code using triangles/quadrilaterals and linear/quadratic elements

Figure 1: Scheme of the geometry and boundary conditions