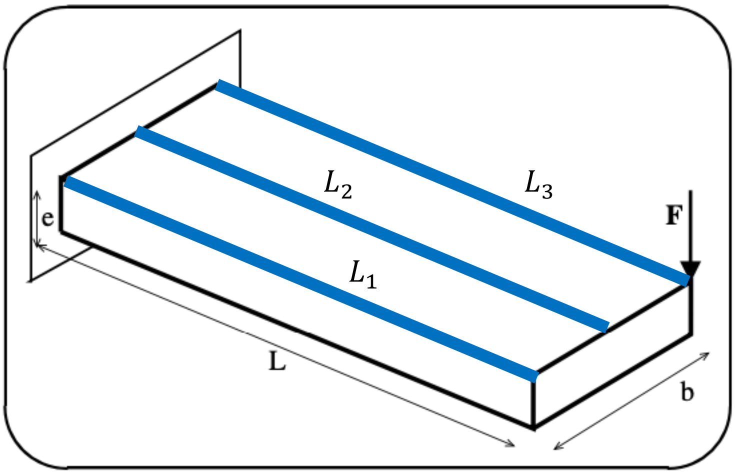
Thank you to L. CHAMPANEY for these practical exercises from which I was more than inspired.

TP 0 – Weight dam of the course ;-)

You will make a 2D model of the weight dam problem studied in class.

Lab 1 – Choice of modeling



$L = 10cm$, $b = 4cm$, $e = 10mm$ $F = 1000N$

Matériau élastique : $E = 210000MPa$ et $\nu = 0.3$.

You will make a beam, plate and 3D modeling of this problem.

Determine the maximum deflection?

Studying the convergence to the meshes.

Studying cross-section deformations according to the chosen models?

Compare the stresses σ_{xx}obtained on the top side along the three lines L_i

Redo the study for e=20mm, 40mm and 60mm.

Ref : Vincent Manet — 2014 (Finite element method - Popularization of mathematical aspects and illustration of the method -)

Lab 2 – Study of singularities

Exo 1 Case of Geometry

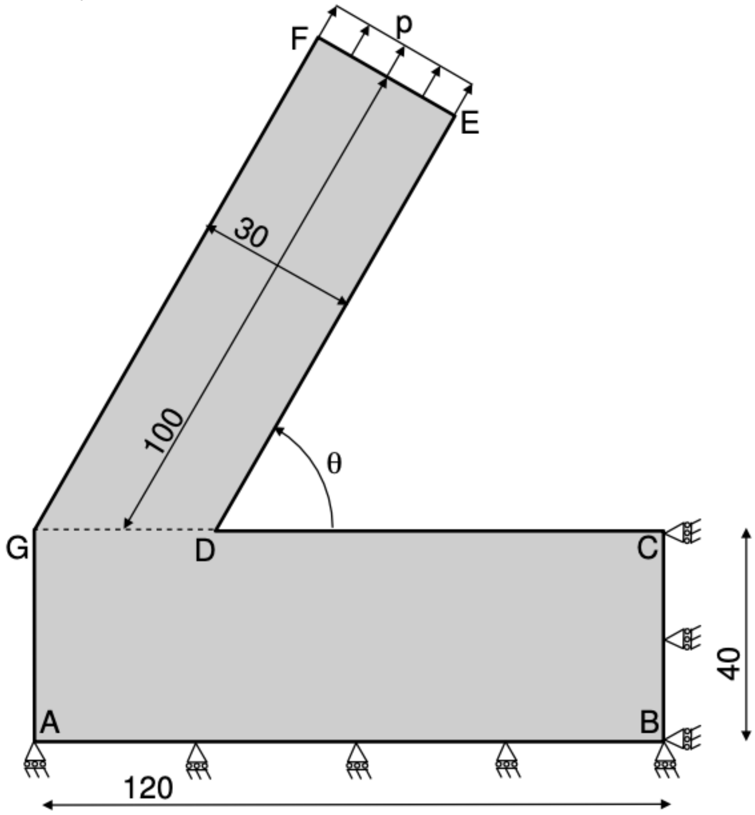


Fig2 Unit in mm

In this study the material is assumed to be isotropic elastic: E= 2.1E11 Pa, p = 100 Mpa and $\nu = 0.3$

For this study, we consider the imaginary problem presented in Figure 2. The structure has two particular points D and G:

– In D there is a recessed wedge characterized by an angle θ.

– At G there is an outgoing corner characterized by an angle (270 - θ).

What can be said about the conditions imposed on the AB and BC line?

Case 1 $\theta = 60°$

Plot the evolution of the Von Mises stress along GD for different meshes.

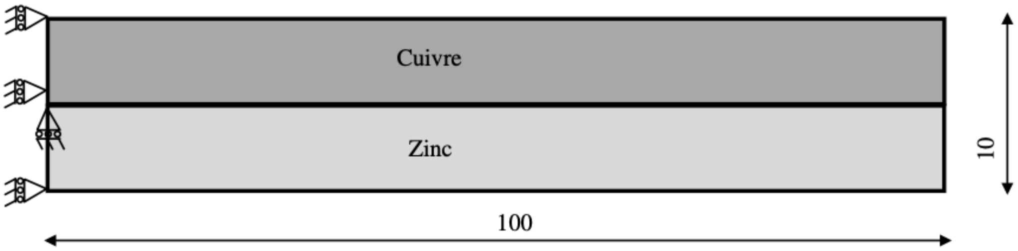
Determine the value of the maximum displacement for different meshes.

Determine the influence of radius of curvature in D and G on these quantities.

Redo the calculation with a material with a Young's modulus that is 106 times lower.

Redo the calculations for structures without fillet radii for $\theta = 20°$ à $90°$ by a step of 10° for E = 2.1 E11 Pa

Exo 2: The case of thermal



Zinc : $E = 80000MPa$, $\nu = 0.3$ et $\alpha = 2.9E - 5K^{-1}$

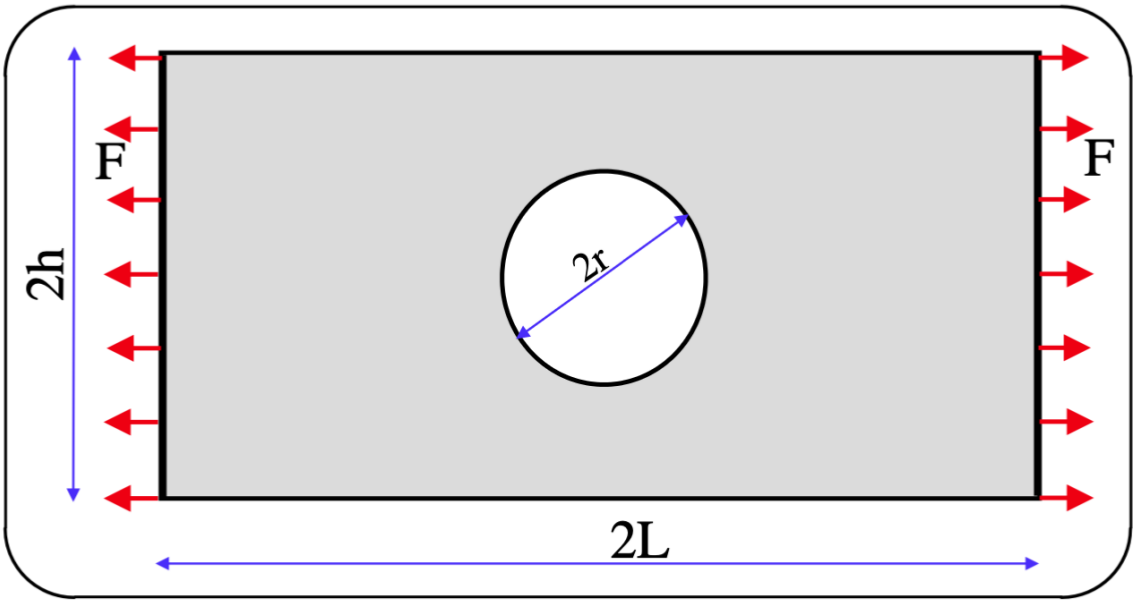
Cuivre : $E = 125000MPa$, $\nu = 0.3$ et $\alpha = 1.7E - 5K^{-1}$

Elévation de température 100 ° C

Fig 3: dimension in mm

Determine stress fields, strain fields, and displacements. comment.

TP3 : Plate with holes



$L = 100mm$, $h = 50m$ et $r = 20mm$

$E = 210000MPa$ et $\nu = 0.3$ $\qquad F = 100N/mm^2$.

We are trying to model a thin thickness plate. The problem is therefore treated in dimension two under the assumption of plane constraints.

On this example will be studied:

- the convergence of the solution in displacement and stress for linear or quadratic meshes (uniform or not),
- the graphical representation of constraints,
- the strategy to adopt when faced with a problem of concentration of constraint.
- The value of the over-stress coefficient conventionally used.

You will do this study for ranging from 10 to 40 mm with a 10 mm pitch r

For the initial case, you will compare the results with an aluminum plate.