

# Project

## Finite Element Method

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## Problem 34: Pipe holder

Let us consider the following structure:

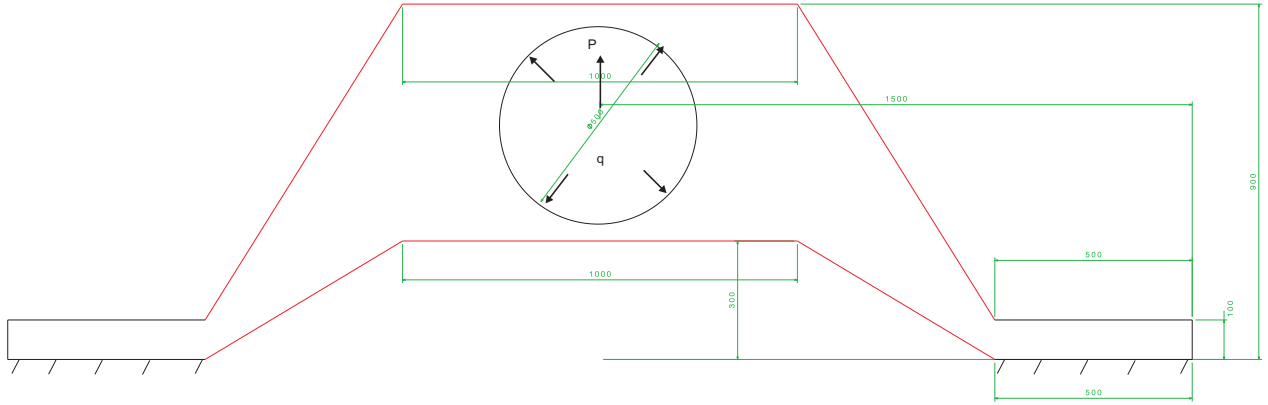


Figure 1: Pipe holder (Dimensions: *mm*)

It is submitted to a resultant load  $P$  (not a concentrated load) applied on a circular hole and an internal pressure  $q$  of  $10 \text{ bar}$ , as indicated in Figure (34). The weight of the support must be taken into consideration ( $g = 9.81 \text{ m/s}^2$ ). The support is fixed as indicated in Figure (34).

- Analysis hypotheses: Plane stress (thickness:  $30 \text{ mm}$ )
- Material properties:

$$E = 210000 \text{ MPa}, \quad \nu = 0.3, \quad \sigma_y^0 = 250 \text{ MPa}, \quad \rho = 7850 \text{ kg/m}^3$$

- Project objectives:
  - Determine the maximum load  $P_{max}$  to apply to this structure above which it goes out of the elastic domain.
  - Optimize the shape of the region indicated in red in Figure (34)) in order to increase the maximum load  $P_{max}$  determined before, while remaining in the elastic domain.
  - A volume increase of 25% at most is allowed and the effective Von Mises stress should be made as uniform as possible in the optimisation area.