Nonlinear analysis – Assignment 6

**Problem 1:**

The modelization of the frame is done accordingly to assignment 5, with an introduced bi-linear behavior in the columns. The beam is modelized as an elastic element with two zero-length elements at its extremities with a tri-linear constitutive law.

**Column elements discretization**

In order to capture the inelastic behavior of the steel columns, composed of HEA450 cross section, the cross section is discretized into a set number of fibers.

As it is assumed that the column will be stressed not only in the axial direction, but also in bending and in shear, it appears that a minimum of 3 elements in each direction is required. In order to mitigate the computation time, it is decided to discretize the section into 9 fibers as a first approach. The discretization is the following (unit : [mm]) :

Une image contenant diagramme, Dessin technique, ligne, texte

Description générée automatiquement

The columns are implemented in OpenSees as displacement-based beam column elements with Steel01 material, and discretized cross section as defined.

Une image contenant capture d’écran, diagramme, ligne

Description générée automatiquement

Figure 1: Elements defined in OpenSeesNavigator for the steel MRF

Displacement controlled incrementation is applied on the frame, at the node corresponding to the top left corner of the frame.

A total displacement of 600 mm is applied, with 1mm increments.

The final deformed shape is obtained:

Une image contenant capture d’écran, ligne

Description générée automatiquement

Figure 2: Deformed shape, total displacement incrementation

**Problem 2:**