

FE Models for Nonlinear Analysis of Solids and Structures

Exercise: Nonlinear response of a simple portal frame

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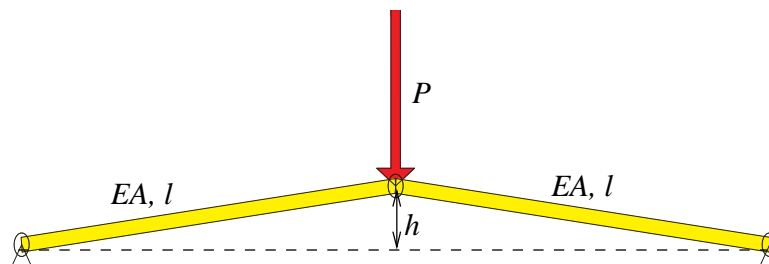
Contents

1 Statement of problem	1
2 Input files provided	2
3 Report due	2

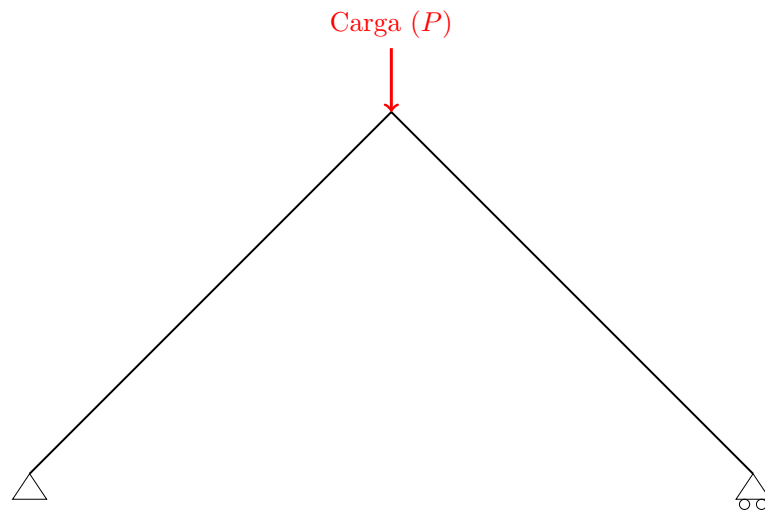
1 Statement of problem

Complete the calculations for the two following portal frames:

1. Shallow portal frame with articulated rods (truss elements, axial stiffness EA), subject to vertical load P and with initial height h .



2. Portal frame with elastic beams and rigid connection at apex (frame elements with bending stiffness EI , axial stiffness EA), subject to vertical load P



2 Input files provided

- shallow frame with articulated trusses (1 dof): [Iportb0](#)
- frame with beams (several dof): [Iport0](#)
- analytical solutions (maple): [311doct_2014.pdf](#)

The files provided include all the model definition (nodes, elements, boundary conditions, material properties, and loads).

3 Report due

Produce graphs showing the deformed structure, as well as the evolution of the load versus displacement. For the case of the shallow frame (iportb) compute also the analytical result (see the presentation document and the provided maple file) and ensure the results from the FEAP model agree with analytical results.

The student must complete the files for the solution of the problem:

- Commands for problem solution, including the two usual nested loops in nonlinear problems: a) load increment (time or pseudo-time) loop, b) Newton loop
- Plots for figures of deformed mesh during the solution
- Gather and plot the time-histories of output variables
- Perform a full discussion of the results including all relevant mechanical and numerical features