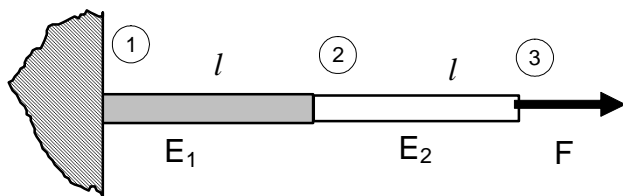


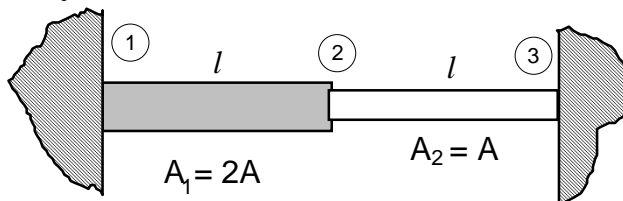
FEM II - problems

1. Consider the rod shown below and its model made of 2 finite elements. Find the condition number of the matrix of the FE equations for the structure for $E_1/E_2=1000$ and $E_1/E_2=2$



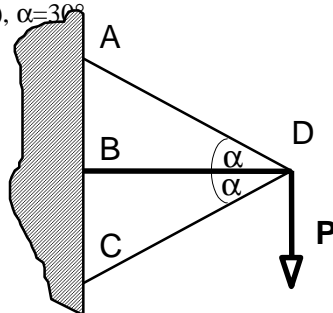
2. Left rod (with the cross-section A_1) has been heated by ΔT .

Find the displacement of the node 2 and stresses in the both elements. Young's modulus E , thermal exp. coef. α_T .



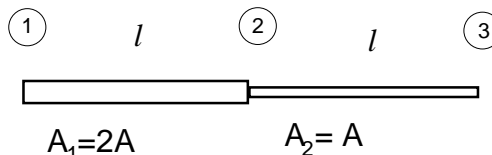
3. Determine the displacement of the joint D of the truss where the member CD is heated by $\Delta T = 50^\circ\text{C}$ and the joint D is loaded by $P = 1\text{kN}$.

BD $l = 1\text{m}$, diameter of the rods' cross-sections $d = 20\text{mm}$ (steel), $\alpha = 30^\circ$



4. Find the natural frequencies and mode shapes for the rod constrained at:

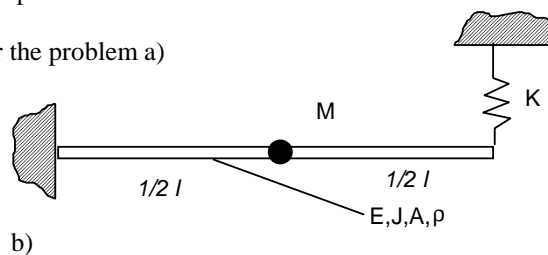
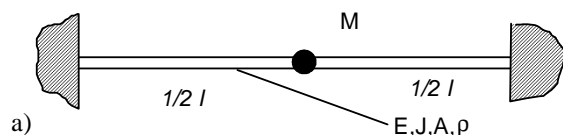
- a) both ends
- b) node 1
- c) node 3



5. Build the set of free vibrations equations for the presented problems.

Use the model consisted of 2 beam elements.

Find the natural frequencies for the case a. $M = \rho A l$ (only for the problem a)



6. Describe the most important factors having impact on accuracy of finite element static stress analysis.

7. What factors influence the frequencies of free vibrations? What information about the dynamic behaviour of the structure can be provided by performing modal analysis of vibrations.

8. Describe the specific features of nonlinear FEM analysis (in comparison to linear)