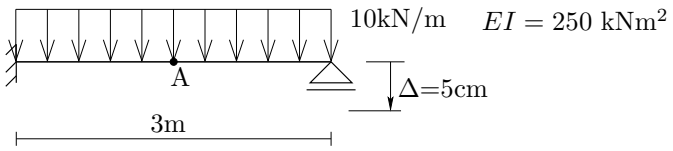
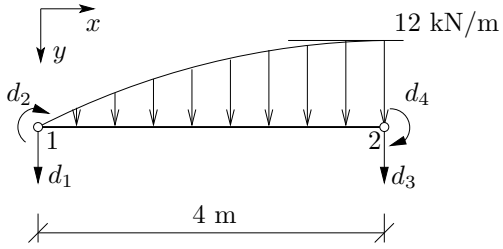
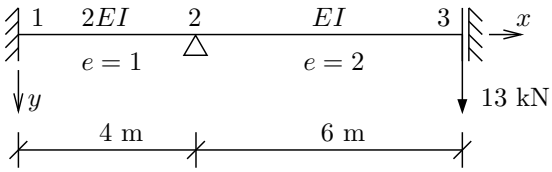
Problem 1. Solve the beam using FEM (compute the vectors of dofs and reactions, draw cross-section force diagrams). Compute the deflection at point A.



Problem 2.
Knowing Hermite interpolation functions determine substitute nodal force z_4 for the two-noded beam element and the parabolic loading.

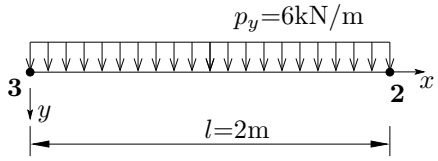


Problem 3. Use the FEM algorithm to solve the beam shown, i.e. calculate the vectors of nodal displacements and reactions, and make diagrams of cross-section force distributions.



EI=18000 kNm^2

Problem 4. For the beam element compute nodal forces on the basis of the global dof vector (mind the global node numbers) and draw diagrams of section forces.



$E = 20 \cdot 10^6$kPa $\qquad$ $I = 3 \cdot 10^{-4}$m^4

$\mathbf{d} = \{0\ 0\ 0\ 2\ 0\ -2\ 0\ 2\ -1\ 2\ 0\ -3\} \cdot 10^{-3}$m

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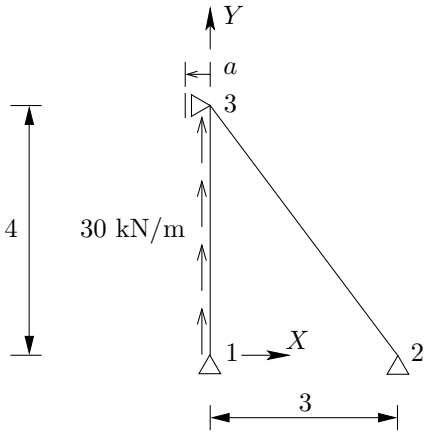
Problem 5. Solve the truss using FEM.

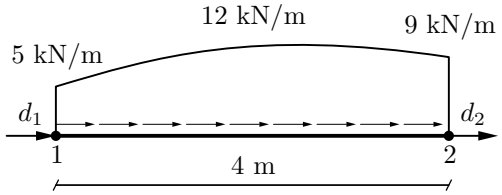


a=5 cm – horizontal support translation

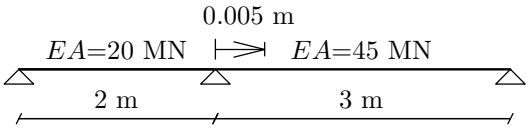
EA=10^4 kN

a) Compute nodal displacements
b) Compute forces in elements
c) Compute constraint reactions
d) Check equilibrium at node 3

Problem 6. Find the second component of the substitute nodal force vector for the truss element loaded as shown in the figure. The values of distributed load intensity are given at element ends and at its centre.



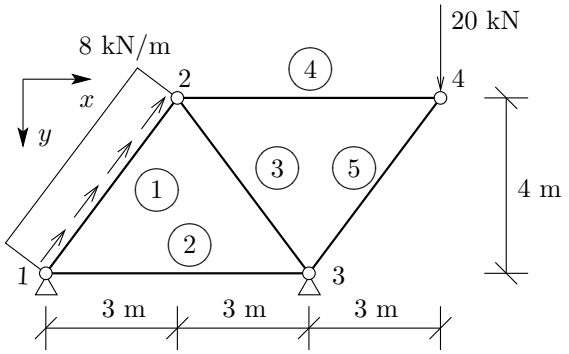
Problem 7. Solve the truss using FEM. Compute the vectors of nodal forces for each element using the FEM procedure. Draw the cross-section force diagram. Adopt 1 dof at each node.



X

$$\bar{\mathbf{K}}^e = \frac{E^e A^e}{l^e} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$$

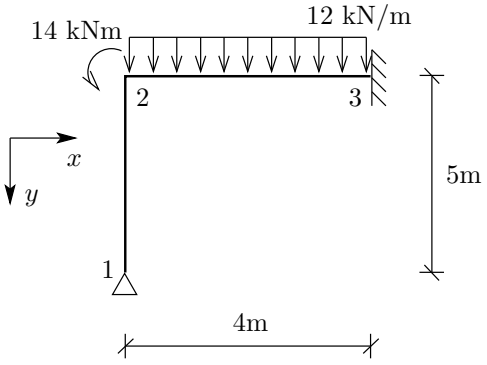
Problem 8. Compute the nodal forces for elements no 1 and 4, i.e. perform the "return to element" procedure. Draw diagrams of force N^e for these elements.



$$\mathbf{d} = \begin{bmatrix} 0 \\ 0 \\ 0.7500 \\ -0.2500 \\ 0 \\ 0 \\ 1.1100 \\ 1.4575 \end{bmatrix} \cdot 10^{-2} \text{ m}$$

EA=25·10^3 kN

Problem 9. Determine the right-hand side vector in FEM equation set for the frame shown.



Problem 10. Present in a graphical manner the assembly of stiffness matrices for elements 2 and 3 of the frame shown below. Determine the global right-hand side vector **f** in FEM equation set.