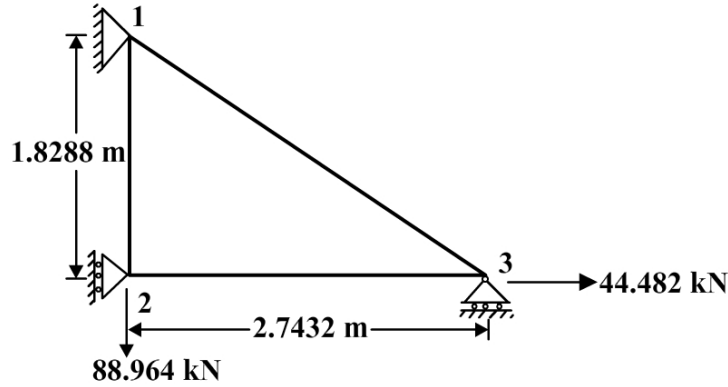


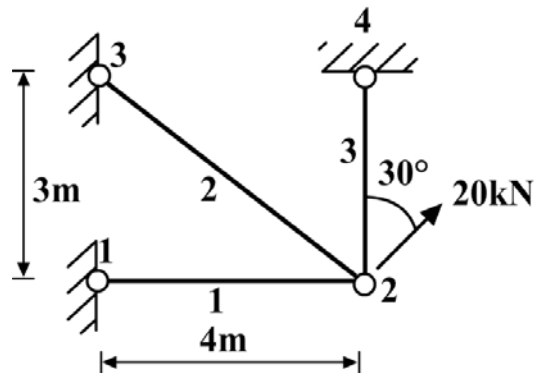
Finite Element Analysis

Assignment 3

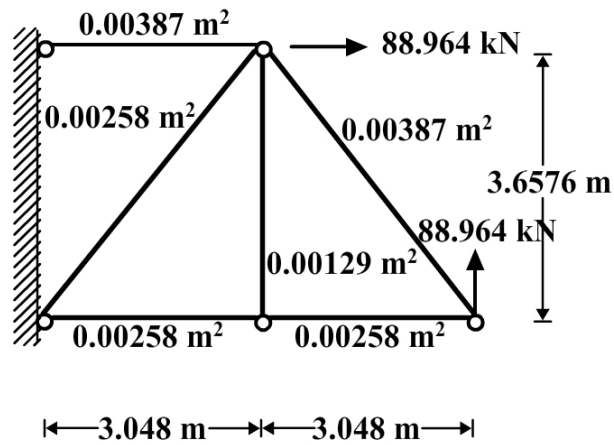
- Find joint displacement and axial forces in a plane truss shown in the following figure. Area of cross section of all members is 0.00129 m^2 . Assume $E = 206.842 \text{ GPa}$.



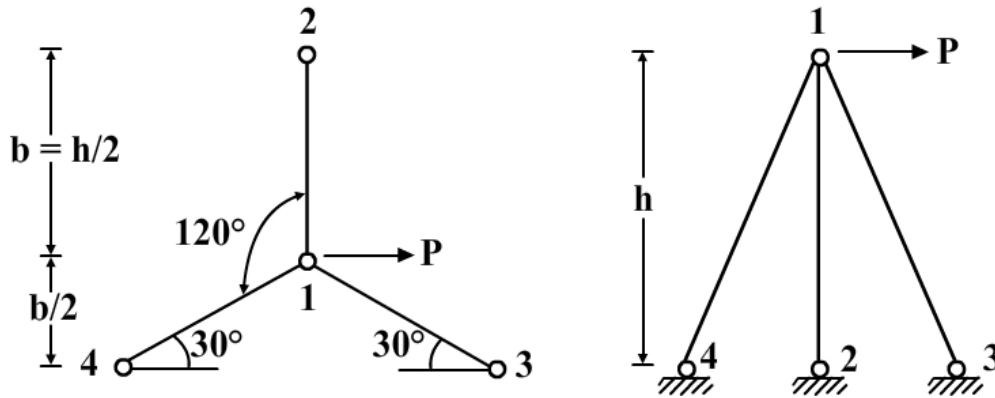
- Find joint displacements and axial forces in a plane truss shown in the figure of Problem 1 due to vertical support settlement of 0.0254 m at support 3. Assume no external forces.
- Find joint displacements and axial forces in a plane truss shown in the following figure. Area of cross section of all members is 10^{-3} m^2 , $E = 210 \text{ GPa}$.



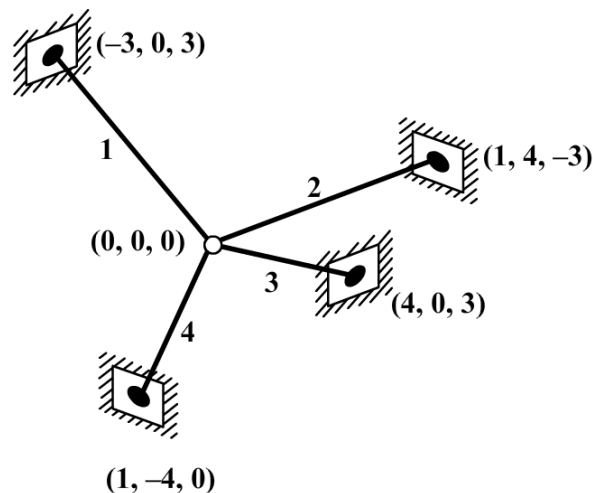
- Find joint displacement and axial forces in a plane truss shown in the figure of Problem 3, if in addition to the applied force the support at joint 1 moves towards right by 50 mm .
- Find joint displacements and axial forces in the plane truss shown in the following figure. Assume $E = 206.842 \text{ GPa}$. Element areas are shown in the figure. $20 \text{ k} = 88.964 \text{ kN}$, $2 \text{ in}^2 = 0.00129 \text{ m}^2$, $4 \text{ in}^2 = 0.00258 \text{ m}^2$, $6 \text{ in}^2 = 0.00387 \text{ m}^2$, $10 \text{ ft} = 3.048 \text{ m}$, $12 \text{ ft} = 3.6576 \text{ m}$.



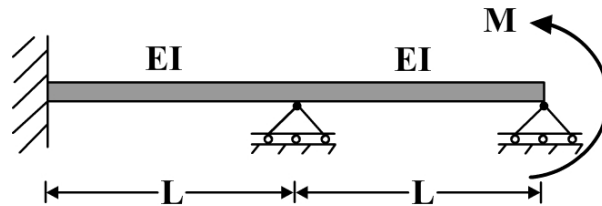
6. Find joint displacements and axial forces in a space truss shown in the following figure. All members have the same cross sectional area. Use the following numerical values. $A = 0.003225 \text{ m}^2$, $h = 4.572 \text{ m}$, $P = 88.964 \text{ kN}$, $E = 206.842 \text{ GPa}$.



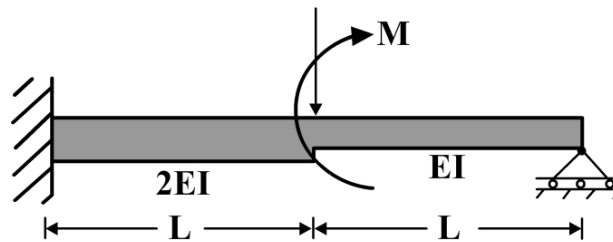
7. Find joint displacements and axial forces in four element space truss shown in the following figure. All members have the same cross sectional area, $A = 2 \times 10^{-3} \text{ m}^2$. Use $E = 210 \text{ GPa}$. Coordinates of each joint (in meters) are shown in the figure. A load of 10 kN is applied in the global y direction at the junction of three members.



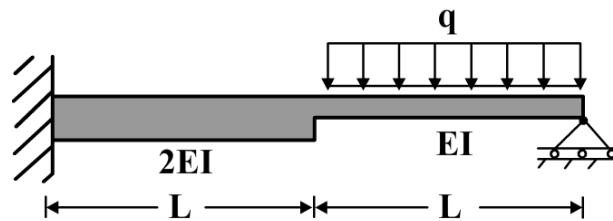
8. Find joint displacements and axial forces in the plane truss of problem 1 due to a temperature rise of $26.67\text{ }^{\circ}\text{C}$ in element 1–3. Assume no external loads and $\alpha = 0.148 \times 10^{-6}$.
9. Assume that the top member in the plane truss of problem 5 is fabricated 0.00635 m too long and is forced to fit during construction. Find joint displacement and axial forces in the elements. Assume no external loads.
10. Find joint displacements and axial forces in the space truss of problem 7 element 1 is fabricated 1 cm too short and is forced to fit during construction. Assume no external load.
11. A two span beam is subjected to a moment as shown in the following figure. Find resulting displacements and draw shear force and bending moment diagrams for the beam. Assume $E = 206.842\text{ GPa}$, $I = 8.3246 \times 10^{-5}\text{ m}^4$, $L = 4.572\text{ m}$, $M = 113\text{ kN-m}$.



12. Find displacements and draw shear force and bending moment diagrams for the beam as shown in the following figure. Assume $E = 210\text{ GPa}$, $I = 4 \times 10^{-4}\text{ m}^4$, $L = 2\text{ m}$, $P = 10\text{ kN}$, $M = 20\text{ kN-m}$.



13. Find displacements and draw shear force and bending moment diagrams for the beam as shown in the following figure. Assume $E = 210\text{ GPa}$, $I = 4 \times 10^{-4}\text{ m}^4$, $L = 2\text{ m}$, $q = 10\text{ kN/m}$.



14. Find tip deflection for the beam as shown in the following figure. Assume $E = 210\text{ GPa}$, $I = 4 \times 10^{-4}\text{ m}^4$, $L = 2\text{ m}$, $q = 10\text{ kN/m}$.

