

$$E=30 \cdot 10^6 \text{ kN / m}^2 \quad I=0.01706667 \text{ m}^4 \quad G=12.5 \cdot 10^6 \text{ kN / m}^2 \quad J_t=0.457 \cdot 0.4^4=0.0117 \text{ m}^4$$

$$EI=512 \cdot 10^3 \text{ kNm}^2$$

Štap 1

Matrica krutosti u lokalnom i globalnom koordinatnom sistemu, $T_1=I$:

$$K_1 = K_1^* = EI \begin{pmatrix} 4 & 5 & 6 & 1 & 2 & 3 \\ 0.07141 & 0 & 0 & -0.07141 & 0 & 0 \\ 0 & 0.1875 & -0.375 & 0 & -0.1875 & -0.375 \\ 0 & -0.375 & 1 & 0 & 0.375 & 0.5 \\ -0.07141 & 0 & 0 & 0.07141 & 0 & 0 \\ 0 & -0.1875 & 0.375 & 0 & 0.1875 & 0.375 \\ 0 & -0.375 & 0.5 & 0 & 0.375 & 1 \end{pmatrix} \begin{matrix} 4 \\ 5 \\ 6 \\ 1 \\ 2 \\ 3 \end{matrix}$$

Štap 2

Matrica krutosti u lokalnom koordinatnom sistemu:

$$K_2 = EI \begin{pmatrix} 6.25 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0.33333 \end{pmatrix}$$

Matrica transformacija

$$T_2 = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$$

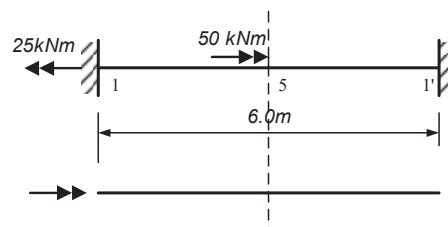
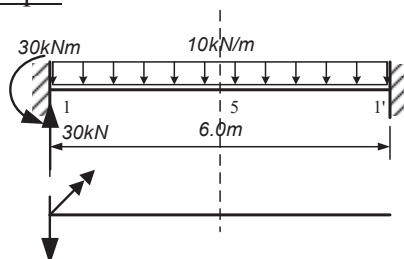
Matrica krutosti u globalnom koordinatnom sistemu:

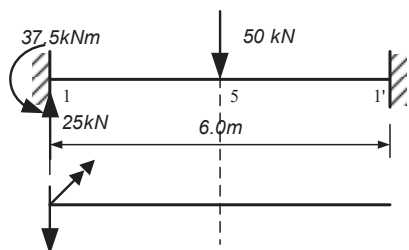
$$K_2^* = EI \begin{pmatrix} 1 & 2 & 3 \\ 0.33333 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

Podmatrica krutosti sistema uz nepoznata pomeranja u globalnom koordinatnom sistemu:

$$K_{ss} = EI \begin{pmatrix} 1 & 2 & 3 \\ 0.40474 & 0 & 0 \\ 0 & 0.1875 & 0.375 \\ 0 & 0.375 & 1 \end{pmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

Vektor ekvivalentnog čvornog opterećenja:

Štap 2



$$Q_2 = \begin{pmatrix} 25 \\ -55 \\ 67.5 \end{pmatrix}$$

$$Q_2^* = T_2^T \cdot Q_2 = \begin{pmatrix} -67.5 \\ -55 \\ 25 \end{pmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

Vektor slobodnih članova uz nepoznata pomeranja $S_s = Q_s + P_s$

$$Q_s = Q_2^* \quad P_s = 0$$

$$S_s = \begin{pmatrix} -67.5 \\ -55 \\ 25 \end{pmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

Vektor nepoznatih pomeranja

$$q_s = K_{ss}^{-1} \cdot S_s = (EI)^{-1} \begin{pmatrix} -166.7739 \\ -1373.33333 \\ 540 \end{pmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

Vektor sila na krajevima štapa:

Štap 1

$$R_1 = R_1^* = K_1 \cdot q_1 - Q_1$$

$$q_1^* = q_1 = (EI)^{-1} \begin{pmatrix} 0 \\ 0 \\ 0 \\ -166.7739 \\ -1373.33333 \\ 540 \end{pmatrix} \begin{matrix} 4 \\ 5 \\ 6 \\ 1 \\ 2 \\ 3 \end{matrix}$$

$$R_1 = R_1^* = \begin{pmatrix} 11.9087 \\ 55 \\ -245 \\ -11.9087 \\ -55 \\ 25 \end{pmatrix} \begin{matrix} Mt3 \\ T3 \\ Ms3 \\ Mt1 \\ T1 \\ Ms1 \end{matrix}$$

Štap 2

$$R_2 = K_2 \cdot q_2 - Q_2 \quad q_2 = T_2 \cdot q_1^*$$

$$q_2^* = (EI)^{-1} \begin{pmatrix} -166.7739 \\ -1373.33333 \\ 540 \end{pmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

$$R_2 = \begin{pmatrix} -25 \\ 55 \\ -11.9087 \end{pmatrix} \begin{matrix} Mt1 \\ T1 \\ Ms1 \end{matrix}$$

