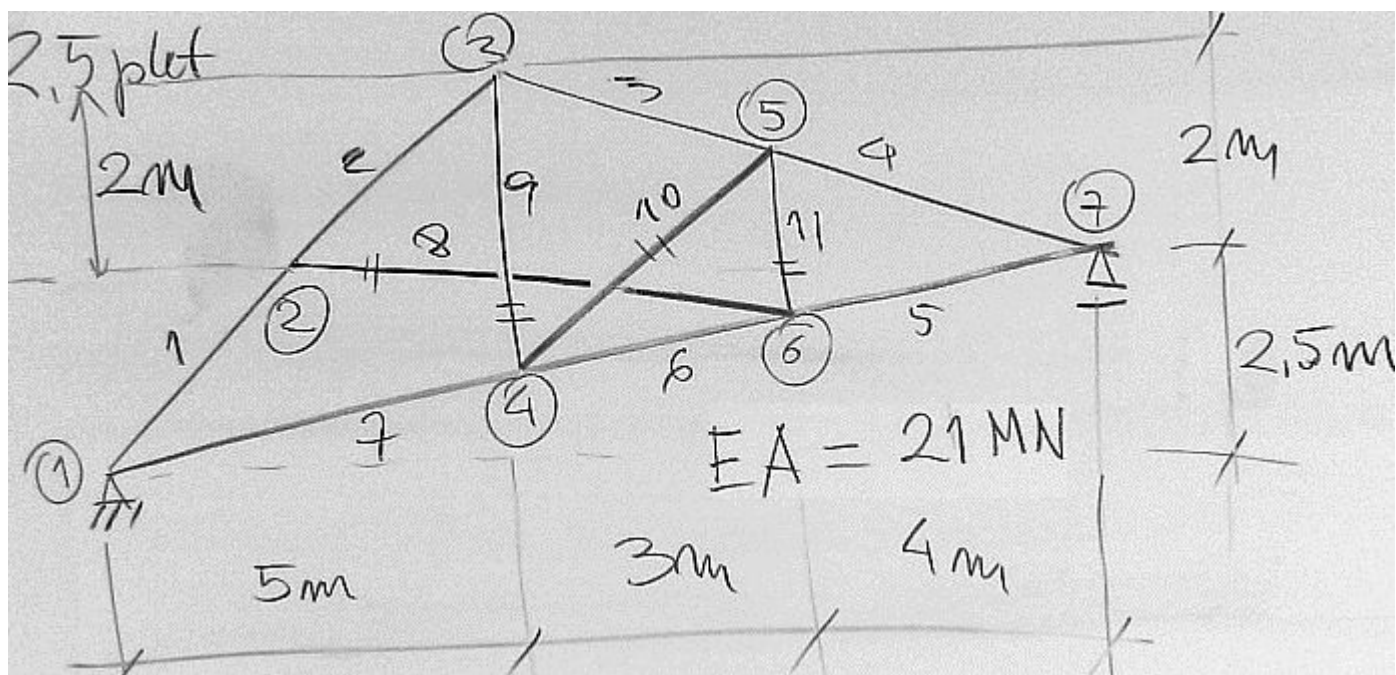


Macierze sztywności elementów kratownicy



elementy := (8, 9, 10, 11)

EA := 21 MN

dokładność $\pm 0.5 \text{ kN/m}$

$$X2 := 5\text{m} \cdot \frac{2.5}{4.5} = 2.77778\text{m}$$

$$Y4 := 2.5\text{m} \cdot \frac{5}{12} = 1.04167\text{m}$$

$$Y5 := 2.5\text{m} + 2\text{m} \cdot \frac{4}{7} = 3.64286\text{m}$$

$$Y6 := 2.5\text{m} \cdot \frac{8}{12} = 1.66667\text{m}$$

$$K = \begin{bmatrix} \mathbf{J^1 + J^7} & -\mathbf{J^1} & & -\mathbf{J^7} & & & \\ & \mathbf{J^1 + J^2 + J^8} & -\mathbf{J^2} & & & -\mathbf{J^8} & \\ & & \mathbf{J^2 + J^3 + J^9} & -\mathbf{J^9} & -\mathbf{J^3} & & \\ & & & \mathbf{J^7 + J^6 + J^9 + J^{10}} & -\mathbf{J^{10}} & -\mathbf{J^6} & \\ \text{Symetria} & \text{Symetria} & \text{Symetria} & \text{Symetria} & \mathbf{J^3 + J^4 + J^{10} + J^{11}} & -\mathbf{J^{11}} & -\mathbf{J^4} \\ & & & & & \mathbf{J^5 + J^6 + J^8 + J^{11}} & -\mathbf{J^5} \\ & & & & & & \mathbf{J^4 + J^5} \end{bmatrix} \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \end{matrix}$$

Element "8" - blok macierzy sztywności

$$L_x := 8\text{m} - X_2 = 5.22222\text{m}$$

$$L_y := Y_6 - 2.5\text{m} = -0.833333\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 5.288294\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 3872 & -618 \\ -618 & 99 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "9" - blok macierzy sztywności

$$L_x := 0\text{m} = 0$$

$$L_y := 4.5\text{m} - Y_4 = 3.458333\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 3.458333\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 0 & 0 \\ 0 & 6072 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "10" - blok macierzy sztywności

$$L_x := 3\text{m} = 3\text{m}$$

$$L_y := Y_5 - Y_4 = 2.601190\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 3.970666\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 3019 & 2618 \\ 2618 & 2270 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "11" - blok macierzy sztywności

$$L_x := 0\text{m}$$

$$L_y := Y_5 - Y_6 = 1.976190\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 1.97619\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 0 & 0 \\ 0 & 10627 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$