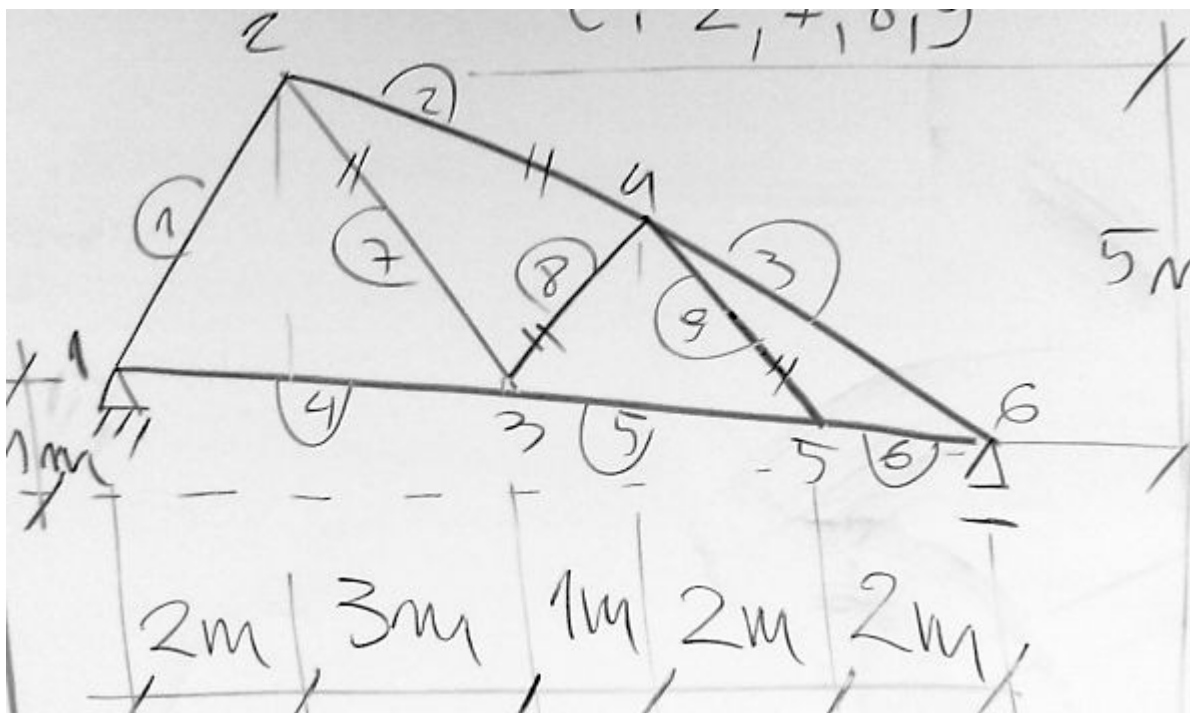


Macierze sztywności elementów kratownicy



elementy := (2, 7, 8, 9)

EA := 21MN

dokładność $\pm 0.5 \text{ kN/m}$

$$Y3 := -1\text{m} \cdot \frac{5}{10} = -0.50000\text{m}$$

$$Y4 := \frac{4}{8} \cdot 5\text{m} - 1\text{m} = 1.50000\text{m}$$

$$Y5 := -1\text{m} \cdot \frac{8}{10} = -0.80000\text{m}$$

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

Symetria

Element "2" - blok macierzy sztywności

$$L_x := 4\text{m} = 4\text{m}$$

$$L_y := Y_4 - 4\text{m} = -2.500000\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 4.716991\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix}$$

$$J = \begin{pmatrix} 3201 & -2001 \\ -2001 & 1251 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "7" - blok macierzy sztywności

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

$$L_y := Y_3 - 4\text{m} = -4.500000\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 5.408327\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix}$$

$$J = \begin{pmatrix} 1195 & -1792 \\ -1792 & 2688 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "8" - blok macierzy sztywności

$$L_x := 1\text{m} = 1\text{m}$$

$$L_y := Y_4 - Y_3 = 2.000000\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 2.236068\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix}$$

$$J = \begin{pmatrix} 1878 & 3757 \\ 3757 & 7513 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "9" - blok macierzy sztywności

$$L_x := 2\text{m}$$

$$L_y := Y_5 - Y_4 = -2.300000\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 3.04795\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix}$$

$$J = \begin{pmatrix} 2967 & -3412 \\ -3412 & 3923 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$