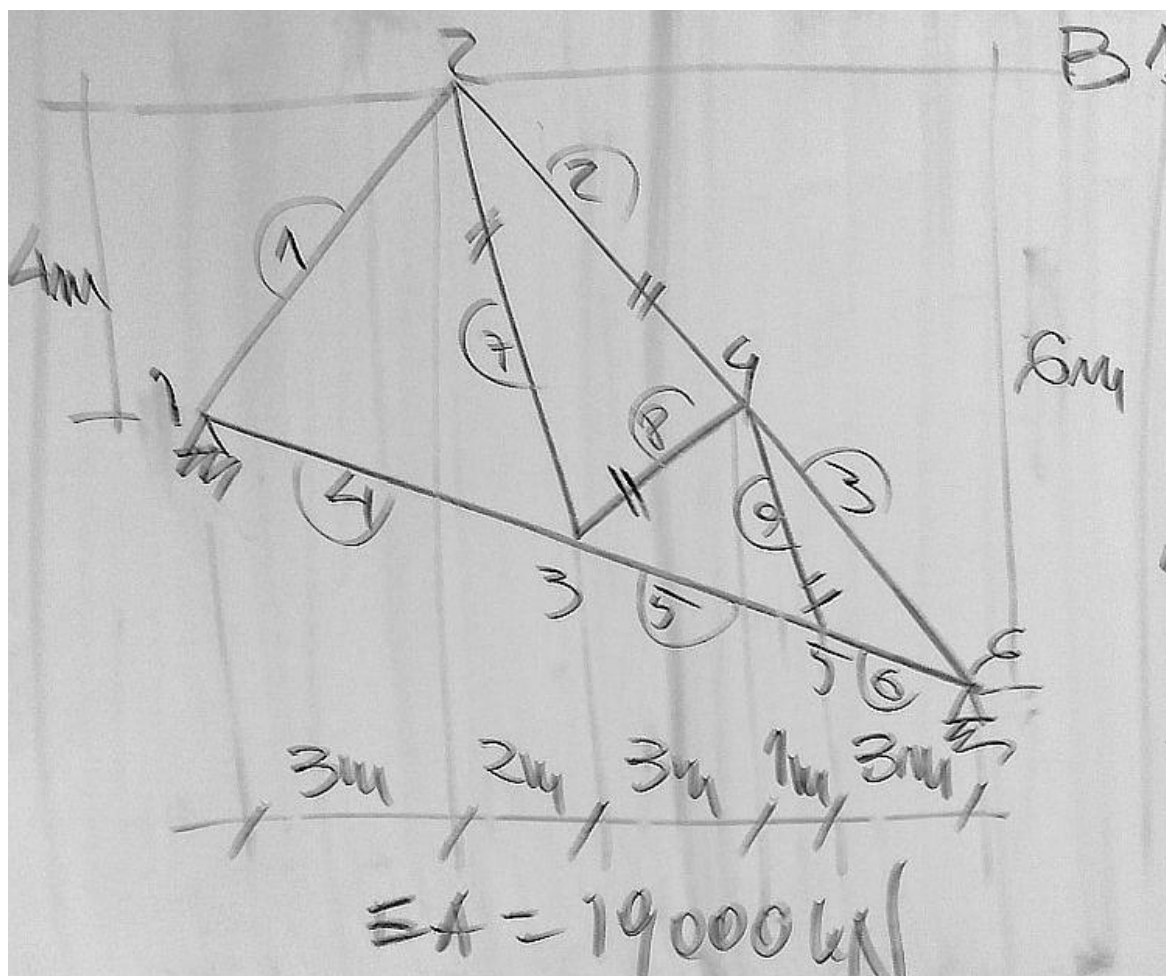


Macierze sztywności elementów kratownicy

Grupa B1



elementy = (2, 7, 8, 9)

EA := 19MN

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

Element "2" - blok macierzy sztywności

$$L_x := 5\text{m} \quad L_y := -6\text{m} \cdot \frac{5}{9}$$

$$L_a := \sqrt{(L_x)^2 + (L_y)^2} = 6.009252\text{m}$$

$$J_a := \frac{EA}{(L_a)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_a = \begin{pmatrix} 2188.9 & -1459.3 \\ -1459.3 & 972.9 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "7" - blok macierzy sztywności

$$\underline{L_x} := 2\text{m} \quad \underline{L_y} := -\left(4\text{m} + 2\text{m} \cdot \frac{5}{12}\right) = -4.833333\text{m}$$

$$L_b := \sqrt{(L_x)^2 + (L_y)^2} = 5.230785\text{m}$$

$$J_b := \frac{EA}{(L_b)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_b = \begin{pmatrix} 531.0 & -1283.3 \\ -1283.3 & 3101.3 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "8" - blok macierzy sztywności

$$\underline{L_x} := 3\text{m} \quad \underline{L_y} := 6\text{m} \cdot \frac{4}{9} - 2\text{m} \cdot \frac{7}{12} = 1.5\text{m}$$

$$L_c := \sqrt{(L_x)^2 + (L_y)^2} = 3.354102\text{m}$$

$$J_c := \frac{EA}{(L_c)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_c = \begin{pmatrix} 4531.8 & 2265.9 \\ 2265.9 & 1132.9 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "9" - blok macierzy sztywności

$$\underline{L_x} := 1\text{m} \quad \underline{L_y} := -\left(6\text{m} \cdot \frac{4}{9} - 2\text{m} \cdot \frac{3}{12}\right) = -2.166667\text{m}$$

$$L_d := \sqrt{(L_x)^2 + (L_y)^2} = 2.386304\text{m}$$

$$J_d := \frac{EA}{(L_d)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_d = \begin{pmatrix} 1398.2 & -3029.5 \\ -3029.5 & 6563.9 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$