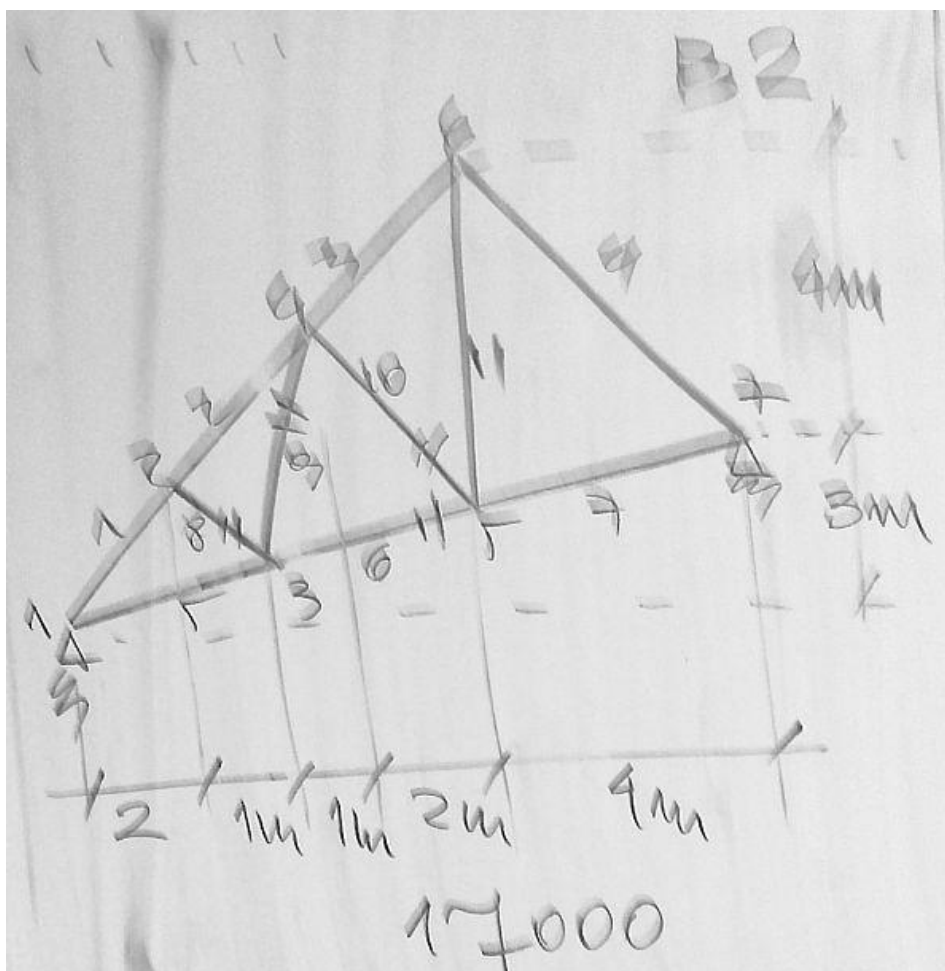


Macierze sztywności elementów kratownicy

Grupa B2



elementy := (6, 8, 9, 10) EA := 17MN

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

Element "6" - blok macierzy sztywności

$$L_x := 3\text{m} \quad L_y := 3\text{m} \cdot \frac{3}{10} = 0.9\text{m}$$

$$L_a := \sqrt{(L_x)^2 + (L_y)^2} = 3.132092\text{m}$$

$$J_a := \frac{EA}{(L_a)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_a = \begin{pmatrix} 4979.5 & 1493.9 \\ 1493.9 & 448.2 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "8" - blok macierzy sztywności

$$\underline{L_x} := 1\text{m} \quad \underline{L_y} := 3\text{m} \cdot \frac{3}{10} - 7\text{m} \cdot \frac{2}{6} = -1.433333\text{m}$$

$$L_b := \sqrt{(L_x)^2 + (L_y)^2} = 1.747697\text{m}$$

$$J_b := \frac{EA}{(L_b)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_b = \begin{pmatrix} 3184.6 & -4564.5 \\ -4564.5 & 6542.5 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "9" - blok macierzy sztywności

$$\underline{Lx} := 1\text{m} \quad \underline{Ly} := 7\text{m} \cdot \frac{4}{6} - 3\text{m} \cdot \frac{3}{10} = 3.766667\text{m}$$

$$Lc := \sqrt{(Lx)^2 + (Ly)^2} = 3.89715\text{m}$$

$$Jc := \frac{EA}{(Lc)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \quad Jc = \begin{pmatrix} 287.2 & 1081.8 \\ 1081.8 & 4074.9 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "10" - blok macierzy sztywności

$$\underline{Lx} := 2\text{m} \quad \underline{Ly} := 3\text{m} \cdot \frac{6}{10} - 7\text{m} \cdot \frac{4}{6} = -2.866667\text{m}$$

$$Ld := \sqrt{(Lx)^2 + (Ly)^2} = 3.495394\text{m}$$

$$Jd := \frac{EA}{(Ld)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \quad Jd = \begin{pmatrix} 1592.3 & -2282.3 \\ -2282.3 & 3271.3 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$