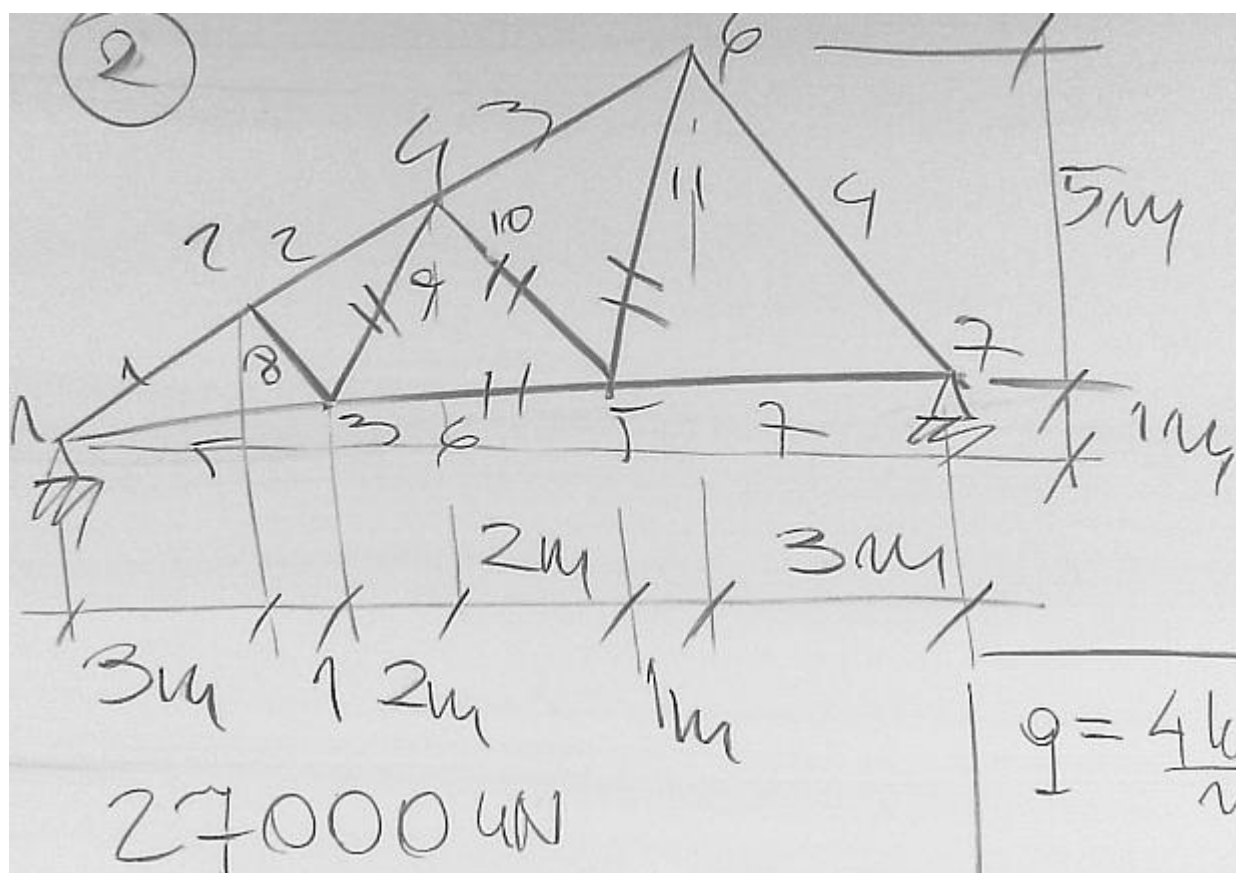


# Macierze sztywności elementów kratownicy

## Grupa 2



elementy := (6, 9, 10, 11)       $EA := 27 \text{ MN}$

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

### *Element "6" - blok macierzy sztywności*

$$L_x := 4\text{m} \quad L_y := \frac{4}{12} \cdot 1\text{m} = 0.333333\text{m}$$

$$L_a := \sqrt{(L_x)^2 + (L_y)^2} = 4.013865\text{m}$$

$$J_a := \frac{EA}{(L_a)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_a = \begin{pmatrix} 6680.3 & 556.7 \\ 556.7 & 46.4 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

### *Element "9" - blok macierzy sztywności*

$$\underline{L_x} := 2\text{m} \quad \underline{L_y} := \frac{6}{9} \cdot 6\text{m} - \frac{4}{12} \cdot 1\text{m} = 3.666667\text{m}$$

$$L_b := \sqrt{(L_x)^2 + (L_y)^2} = 4.176655\text{m}$$

$$J_b := \frac{EA}{(L_b)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J_b = \begin{pmatrix} 1482.3 & 2717.6 \\ 2717.6 & 4982.2 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

### *Element "10" - blok macierzy sztywności*

$$\underline{Lx} := 2\text{m} \quad \underline{Ly} := -\left(\frac{6}{9} \cdot 6\text{m} - \frac{8}{12} \cdot 1\text{m}\right) = -3.333333\text{m}$$

$$Lc := \sqrt{(Lx)^2 + (Ly)^2} = 3.887301\text{m}$$

$$Jc := \frac{EA}{(Lc)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \quad Jc = \begin{pmatrix} 1838.6 & -3064.3 \\ -3064.3 & 5107.1 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

### *Element "11" - blok macierzy sztywności*

$$\underline{Lx} := 1\text{m} \quad \underline{Ly} := 6\text{m} - \frac{8}{12} \cdot 1\text{m} = 5.333333\text{m}$$

$$Ld := \sqrt{(Lx)^2 + (Ly)^2} = 5.426274\text{m}$$

$$Jd := \frac{EA}{(Ld)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \quad Jd = \begin{pmatrix} 169.0 & 901.3 \\ 901.3 & 4806.8 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$