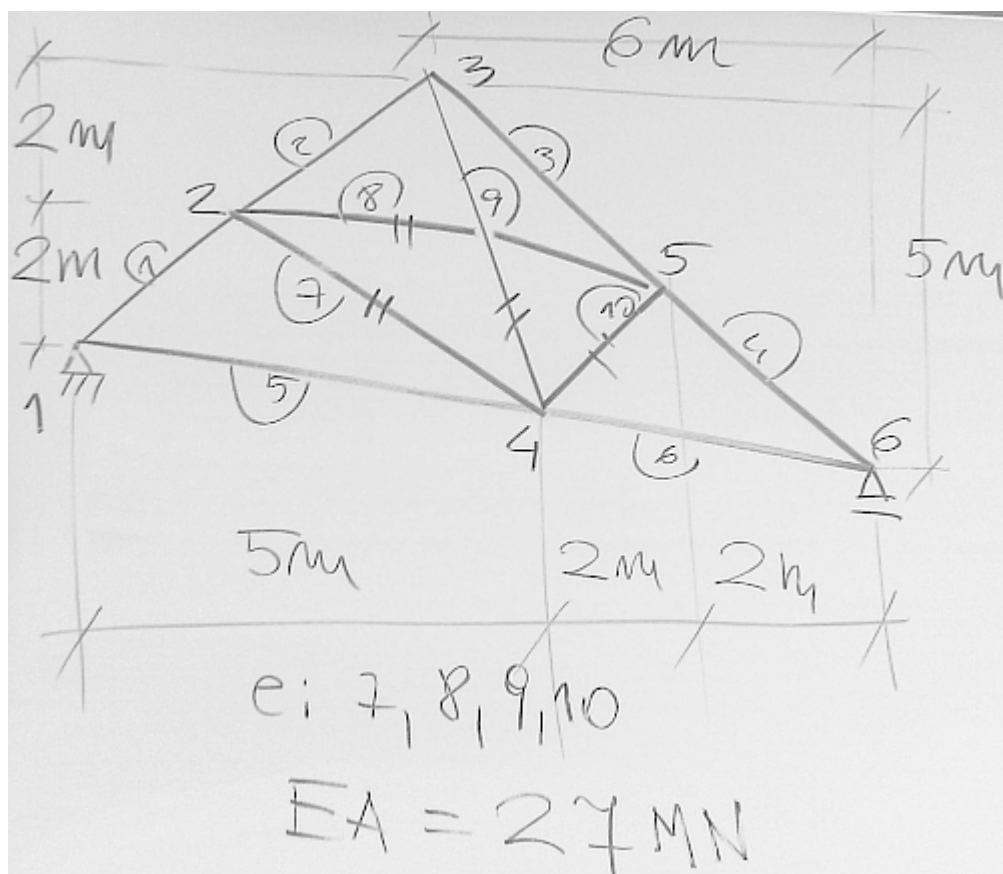


## Macierze sztywności elementów kratownicy



elementy := (7, 8, 9, 10)

EA := 27MN

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

### Element "7" - blok macierzy sztywności

$$L_x := 5\text{m} - 3\text{m} \cdot \frac{2}{4} = 3.5\text{m} \quad L_y := -1\text{m} \cdot \frac{5}{9} - 2\text{m} = -2.555556\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 4.333689\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 4064 & -2967 \\ -2967 & 2167 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

### Element "8" - blok macierzy sztywności

$$L_x := 7\text{m} - 3\text{m} \cdot \frac{2}{4} = 5.5\text{m} \quad L_y := 5\text{m} \cdot \frac{2}{6} - 1\text{m} - 2\text{m} = -1.333333\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 5.659309\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 4506 & -1092 \\ -1092 & 265 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

### Element "9" - blok macierzy sztywności

$$L_x := 5\text{m} - 3\text{m} = 2\text{m} \quad L_y := -1\text{m} \cdot \frac{5}{9} - 4\text{m} = -4.555556\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 4.975247\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 877 & -1998 \\ -1998 & 4550 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

### Element "10" - blok macierzy sztywności

$$L_x := 2\text{m} = 2\text{m} \quad L_y := 5\text{m} \cdot \frac{2}{6} - 1\text{m} + 1\text{m} \cdot \frac{5}{9} = 1.222222\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 2.343891\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 8387 & 5125 \\ 5125 & 3132 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$