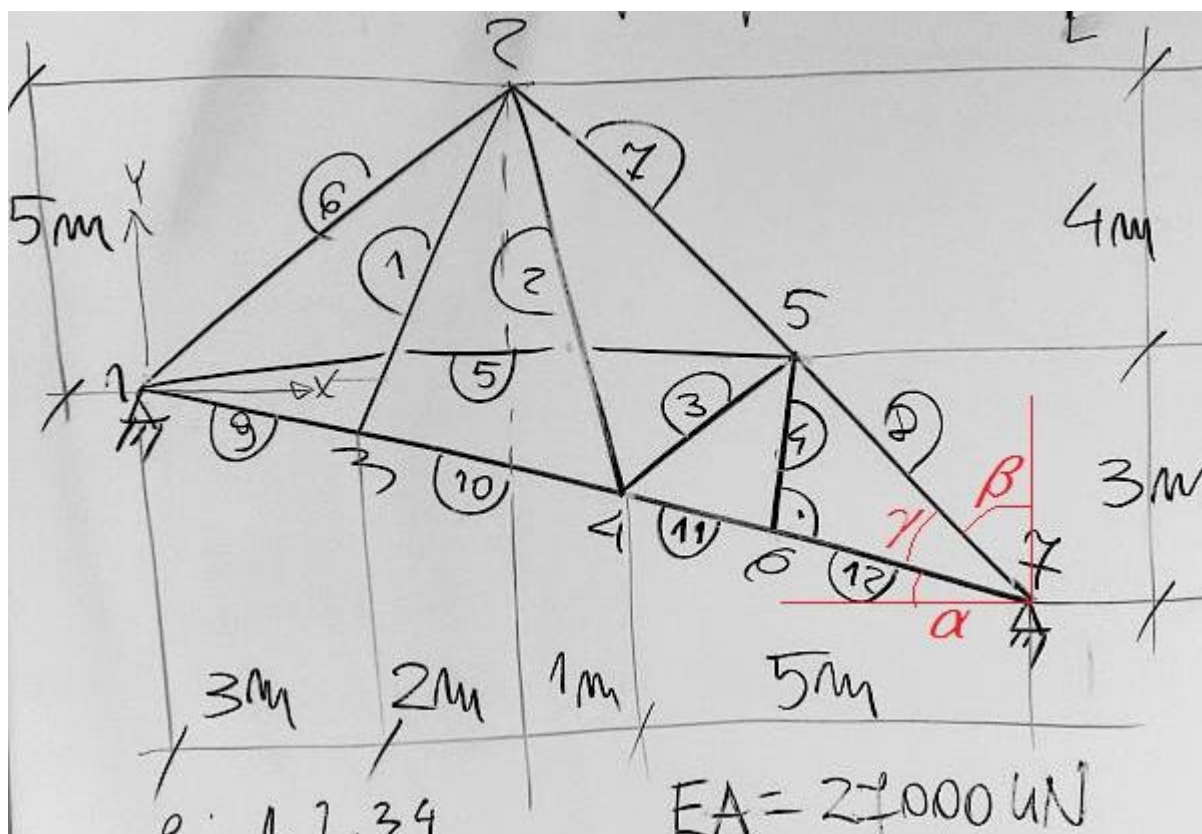


## Macierze sztywności elementów kratownicy



elementy := (1, 2, 3, 4)

EA := 27MN

dokładność  $\pm 0.5 \text{ kN/m}$

$$\alpha := \text{atan}\left(\frac{2}{11}\right) = 10.305 \cdot \text{deg}$$

$$\beta := \text{atan}\left(\frac{6}{7}\right) = 40.601 \cdot \text{deg}$$

$$\gamma := \frac{\pi}{2} - \alpha - \beta = 39.09386 \cdot \text{deg}$$

$$Y3 := -2\text{m} \cdot \frac{3}{11} \quad Y4 := -2\text{m} \cdot \frac{6}{11} \quad Y5 := 1\text{m} \quad X5 := 11\text{m} - 6\text{m} \cdot \frac{3}{7} = 8.429\text{m}$$

$$L8 := \sqrt{(3\text{m})^2 + \left(\frac{18\text{m}}{7}\right)^2} = 3.95123\text{m}$$

$$L12 := L8 \cdot \cos(\gamma) = 3.06661\text{m}$$

$$Y6 := L12 \cdot \sin(\alpha) - 2\text{m} = -1.45143\text{m}$$

$$X6 := 11\text{m} - L12 \cdot \cos(\alpha) = 7.98286\text{m}$$

### *Element "1" - blok macierzy sztywności*

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

$$L_y := 5\text{m} - Y_3 = 5.545455\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 5.895088\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{bmatrix} 527 & 1462 \\ (1462) & 4053 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

### *Element "2" - blok macierzy sztywności*

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

$$L_y := Y_4 - 5\text{m} = -6.090909\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 6.172453\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{bmatrix} 115 & -699 \\ (-699) & 4259 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

### *Element "3" - blok macierzy sztywności*

$$L_x := X_5 - 6\text{m} = 2.428571\text{m}$$

$$L_y := Y_5 - Y_4 = 2.090909\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 3.204662\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{bmatrix} 4839 & 4166 \\ (4166) & 3587 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$

### *Element "4" - blok macierzy sztywności*

$$L_x := X_5 - X_6 = 0.445714\text{m}$$

$$L_y := Y_5 - Y_6 = 2.451429\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 2.491619\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{bmatrix} 347 & 1907 \\ (1907) & 10490 \end{bmatrix} \frac{\text{kN}}{\text{m}}$$