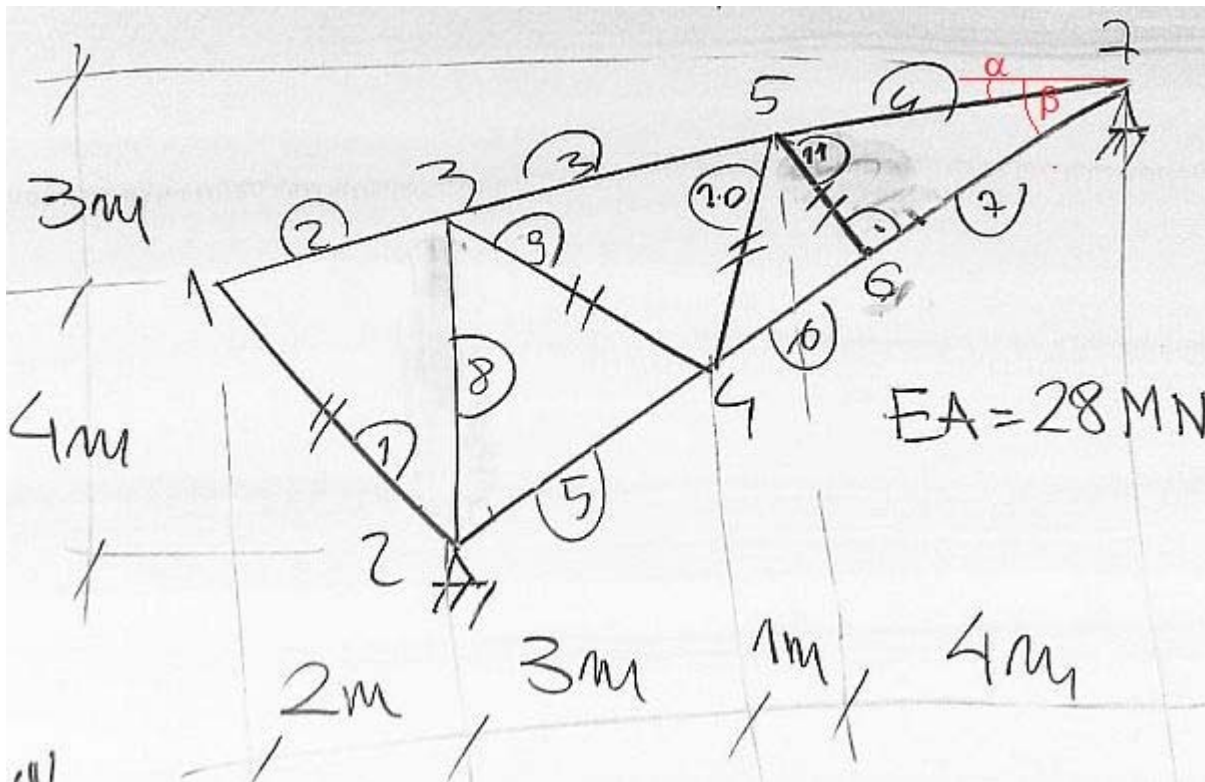


Macierze sztywności elementów kratownicy



elementy := (1, 9, 10, 11) EA := 28MN

$$\alpha := \operatorname{atan}\left(\frac{3}{10}\right) = 16.699244 \cdot \text{deg} \quad \beta := \operatorname{atan}\left(\frac{7}{8}\right) = 41.185925 \cdot \text{deg}$$

$$\gamma := \beta - \alpha = 24.486681 \cdot \text{deg}$$

$$L4 := \sqrt{(4\text{m})^2 + (0.4 \cdot 3\text{m})^2} = 4.176123 \text{ m}$$

$$L7 := L4 \cdot \cos(\gamma) = 3.800512 \text{ m}$$

$$L11 := L4 \cdot \sin(\gamma) = 1.730926 \text{ m}$$

$$X6 := 8\text{m} - L7 \cdot \cos(\beta) = 5.139823 \text{ m}$$

$$Y6 := 7\text{m} - L7 \cdot \sin(\beta) = 4.497345 \text{ m}$$

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

Element "1" - blok macierzy sztywności

$$L_x := 2\text{m} \quad L_y := -4\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 4.472136\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 1252 & -2504 \\ -2504 & 5009 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "9" - blok macierzy sztywności

$$L_x := 3\text{m} \quad L_y := 0.8 \cdot 3\text{m} - \frac{5}{8} \cdot 7\text{m} = -1.975000\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 3.591744\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 5439 & -3580 \\ -3580 & 2357 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "10" - blok macierzy sztywności

$$L_x := 1\text{m} \quad L_y := -0.4 \cdot 3\text{m} + \frac{5}{8} \cdot 7\text{m} = 3.175000\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 3.328757\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 759 & 2410 \\ 2410 & 7652 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$

Element "11" - blok macierzy sztywności

$$L_x := X6 - 4\text{m} = 1.139823\text{m} \quad L_y := Y6 - (7\text{m} - 0.4 \cdot 3\text{m}) = -1.302655\text{m}$$

$$L := \sqrt{(L_x)^2 + (L_y)^2} = 1.730926\text{m}$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (L_x)^2 & L_x \cdot L_y \\ L_x \cdot L_y & (L_y)^2 \end{bmatrix} \quad J = \begin{pmatrix} 7015 & -8017 \\ -8017 & 9162 \end{pmatrix} \cdot \frac{\text{kN}}{\text{m}}$$