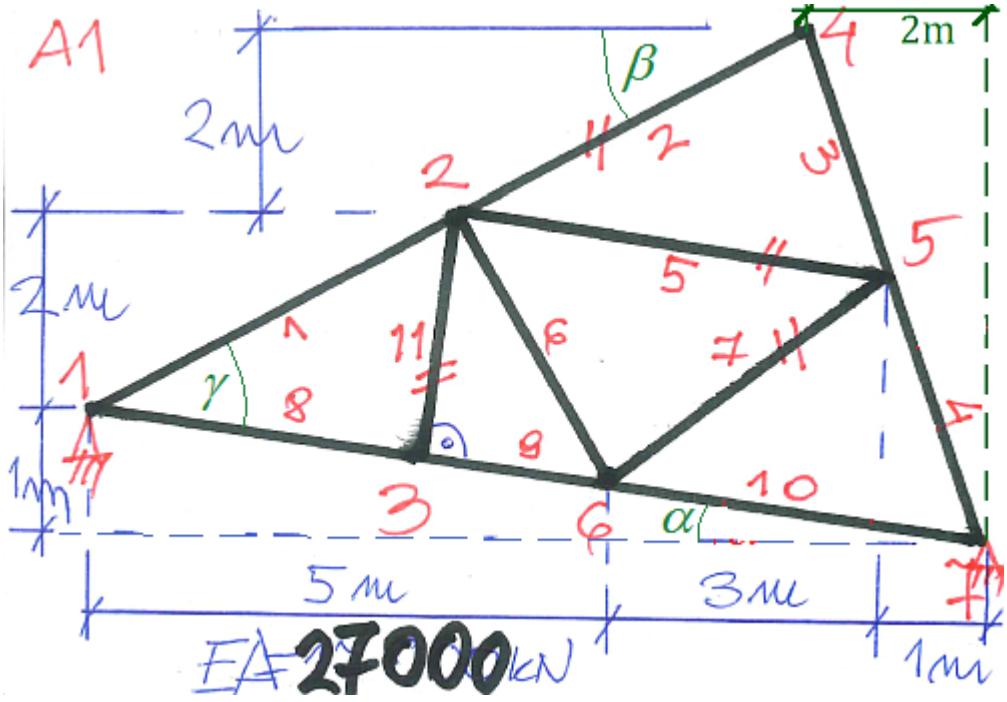
Macierze sztywności elementów kratownicy



$\alpha := \operatorname{atan}\left(\frac{1}{9}\right)$

$\beta := \operatorname{atan}\left(\frac{4}{7}\right)$

$\gamma := \alpha + \beta$

$\gamma = 36.085 \cdot \mathrm{deg}$

$EA := 27\,MN$

elementy := (2 , 5 , 7 , 11) *dokładnść ±0.5kN/m*

$Y5 := \frac{5m}{2} - 1m = 1.50000\ m$ $Y6 := 1m \cdot \frac{4}{9} - 1m = -0.555556\ m$

$X2 := \frac{7m}{2} = 3.5\ m$

$L1 := \sqrt{(X2)^2 + (2m)^2} = 4.03113\ m$ $L11 := L1 \cdot \sin(\gamma) = 2.37428\ m$

Element "2" - blok macierzy sztywności

$Lx := 3.5m = 3.5\,m$ $\qquad$ $Ly := 2m = 2.000000\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.031129\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 5049 & 2885 \\ 2885 & 1649 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "5" - blok macierzy sztywności

$Lx := 8m - 3.5m = 4.5\,m$ $\qquad$ $Ly := Y5 - 2m = -0.500000\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.527693\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 5891 & -655 \\ -655 & 73 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "7" - blok macierzy sztywności

$Lx := 3m$ $\qquad$ $Ly := Y5 - Y6 = 2.055556\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.636662\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 5052 & 3462 \\ 3462 & 2372 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "11" - blok macierzy sztywności

$Lx := L11 \cdot \sin(\alpha) = 0.262\,m$ $\qquad$ $Ly := L11 \cdot \cos(\alpha) = 2.359756\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.374278\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 139 & 1248 \\ 1248 & 11233 \end{pmatrix} \cdot \frac{kN}{m}$$