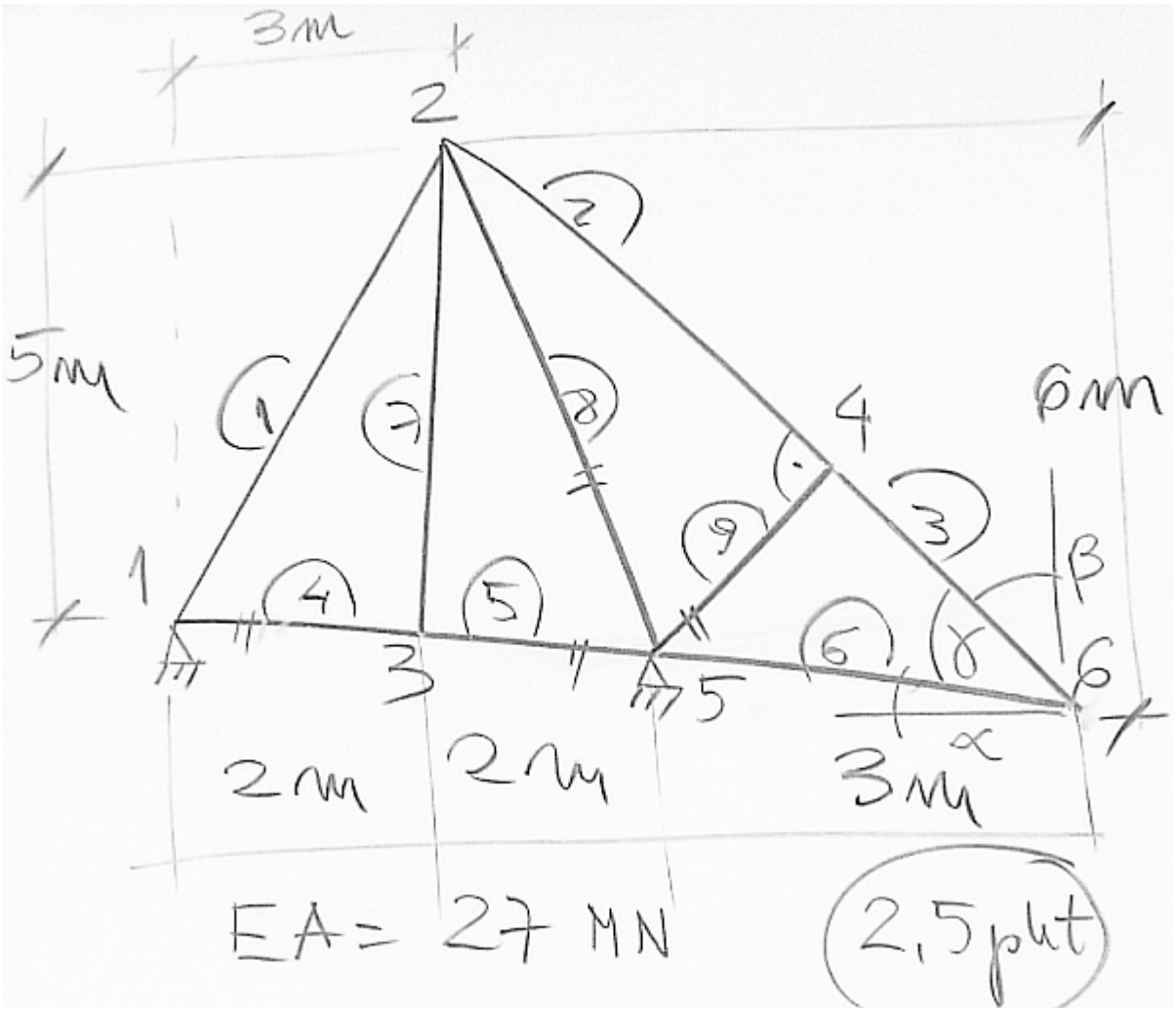
Macierze sztywności elementów kratownicy



elementy := (4 , 5 , 8 , 9) EA := 27MN *dokładnść ±0.5kN/m*

$\alpha := \operatorname{atan}\left(\frac{1}{7}\right)$ $\beta := \operatorname{atan}\left(\frac{4}{6}\right)$ $\gamma := \frac{\pi}{2} - \alpha - \beta$

$Y3 := \frac{-2}{7} \cdot 1m = -0.28571\ m$ $Y5 := \frac{-4}{7} \cdot 1m = -0.57143\ m$

$L6 := \sqrt{(3m)^2 + (-1m - Y5)^2} = 3.03046\ m$ $L3 := L6 \cdot \cos(\gamma) = 2.02069\ m$

$Y4 := L3 \cdot \cos(\beta) - 1m = 0.68132\ m$ $X4 := 7m - L3 \cdot \sin(\beta) = 5.87912\ m$

$$
\mathbf{K} = \begin{array}{c|cccccc}
 & 1 & 2 & 3 & 4 & 5 & 6 \\
\hline
1 & J^1+J^4 & -J^1 & -J^4 & & & \\
2 & & J^1+J^2+J^7+J^8 & -J^7 & -J^2 & -J^8 & \\
3 & & & J^4+J^5+J^7 & & -J^5 & \\
4 & & & & J^2+J^3+J^9 & -J^9 & -J^3 \\
5 & \text{Symetria} & \text{Symetria} & \text{Symetria} & \text{Symetria} & J^5+J^6+J^8+J^9 & -J^6 \\
6 & & & & & & J^3+J^6
\end{array}
$$

Element "4" - blok macierzy sztywności

$Lx := 2m = 2.00000\,m$ $\qquad$ $Ly := Y3 = -0.285714\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.020305\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 13097 & -1871 \\ -1871 & 267 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "5" - blok macierzy sztywności

$Lx := 2m = 2.00000\,m$ $\qquad$ $Ly := Y5 - Y3 = -0.285714\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.020305\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 13097 & -1871 \\ -1871 & 267 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "8" - blok macierzy sztywności

$Lx := 1m = 1.00000\,m$ $\qquad$ $Ly := (Y5 - 5m) = -5.571429\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.660461\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 149 & -829 \\ -829 & 4621 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "9" - blok macierzy sztywności

$Lx := X4 - 4m = 1.879121\,m$ $\qquad$ $Ly := Y4 - Y5 = 1.252747\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.258422\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 8277 & 5518 \\ 5518 & 3679 \end{pmatrix} \cdot \frac{kN}{m}$$