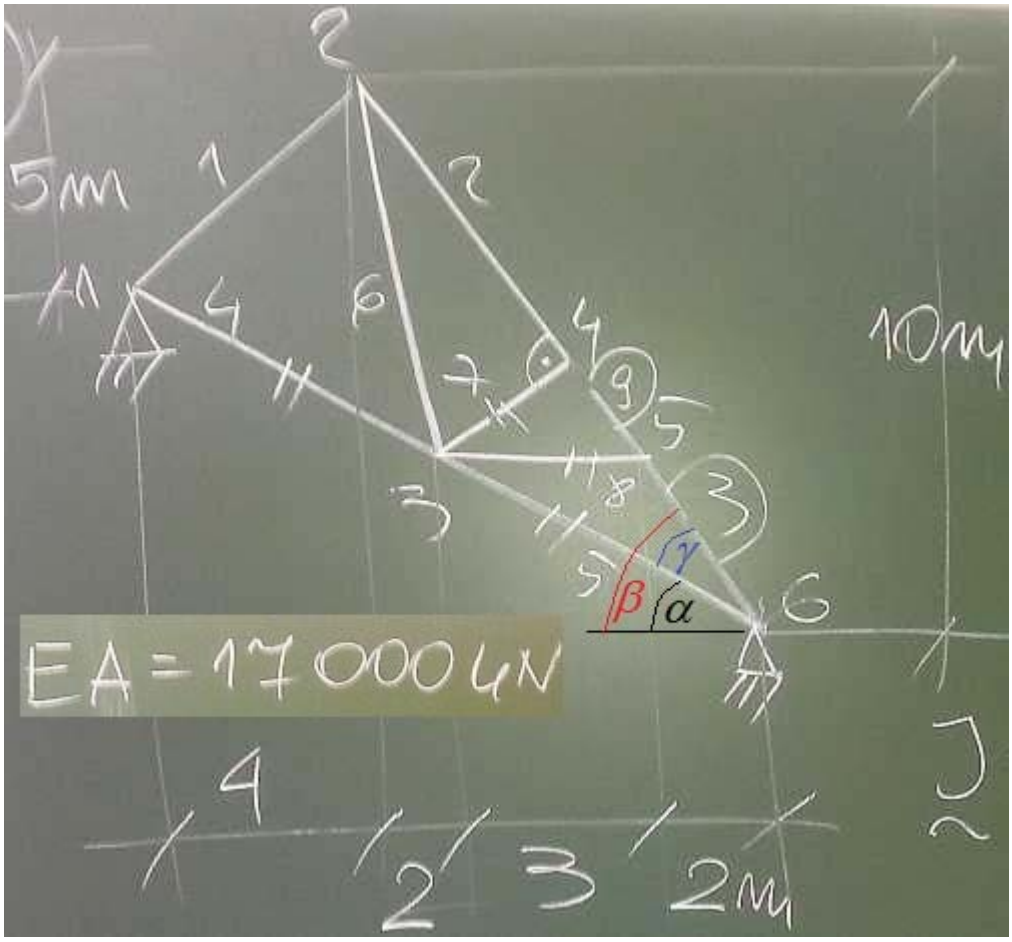
Macierze sztywności elementów kratownicy



$\alpha := \operatorname{atan}\left(\frac{5}{11}\right)$

$\beta := \operatorname{atan}\left(\frac{10}{7}\right)$

$\gamma := \beta - \alpha = 30.564 \cdot \mathrm{deg}$

$EA := 17MN$

$elementy := (4, 5, 7, 8)$

dokładnść ±0.5kN/m

$Y3 := 5m \cdot \frac{5}{11} = 2.27273\,m$

$Y5 := 10m \cdot \frac{2}{7} = 2.85714\,m$

$L5 := \sqrt{(5m)^2 + (Y3)^2} = 5.49229\,m$

$L7 := L5 \cdot \sin(\gamma) = 2.79284\,m$

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

Element "4" - blok macierzy sztywności

$Lx := 6m = 6\,m$ $\qquad Ly := Y3 - 5m = -2.727273\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.590752\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 2138 & -972 \\ -972 & 442 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "5" - blok macierzy sztywności

$Lx := 5m = 5\,m$ $\qquad Ly := -Y3 = -2.272727\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.492294\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 2565 & -1166 \\ -1166 & 530 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "7" - blok macierzy sztywności

$Lx := L7 \cdot \sin(\beta) = 2.28798\,m$ $\qquad Ly := L7 \cdot \cos(\beta) = 1.601586\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.792836\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 4085 & 2860 \\ 2860 & 2002 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "8" - blok macierzy sztywności

$Lx := 3m = 3\,m$ $\qquad Ly := Y5 - Y3 = 0.584416\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.056394\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 5359 & 1044 \\ 1044 & 203 \end{pmatrix} \cdot \frac{kN}{m}$$