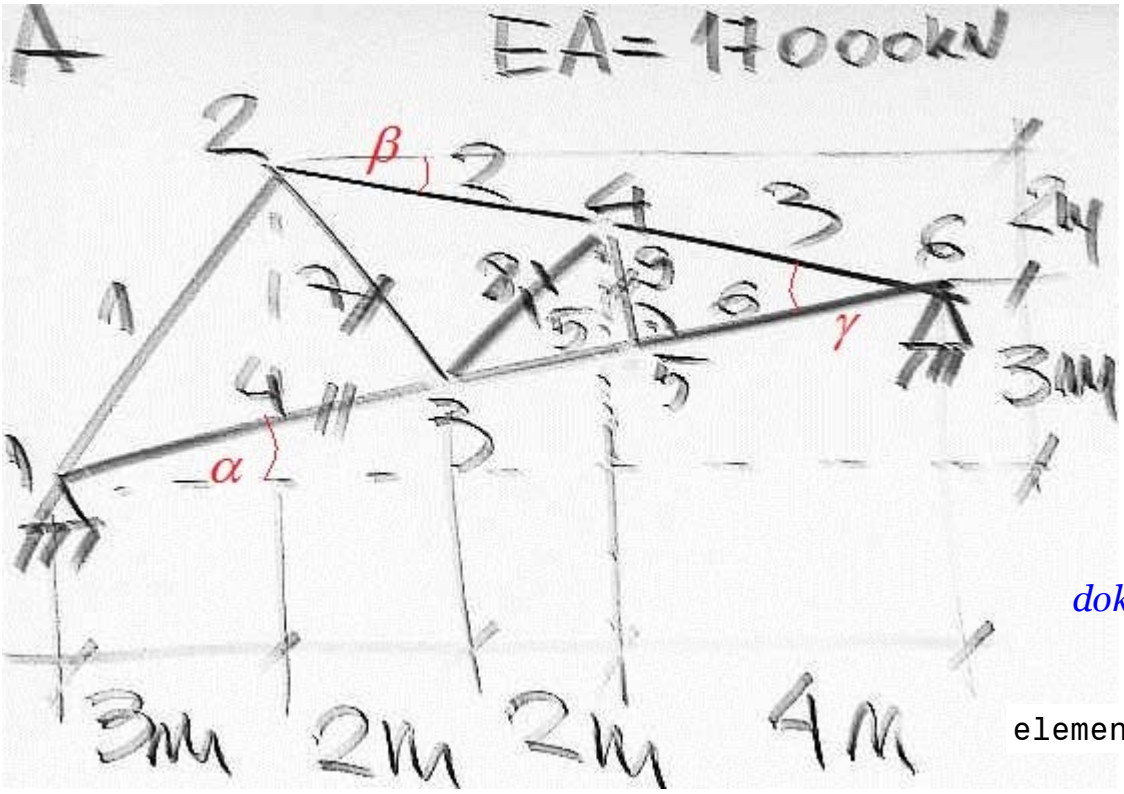
Macierze sztywności elementów kratownicy 1A



$\alpha := \operatorname{atan}\left(\frac{3}{11}\right)$

$\beta := \operatorname{atan}\left(\frac{2}{8}\right)$

EA := 17MN

dokładnść ±0.5kN/m

elementy := (4 , 7 , 8 , 9)

$\gamma := \beta + \alpha = 29.29136 \cdot \text{deg}$

$Y3 := 3\text{m} \cdot \frac{5}{11} = 1.36364\,\text{m}$ $\quad Y4 := 3\text{m} + 2\text{m} \cdot \frac{4}{8} = 4\,\text{m}$

$L3 := \sqrt{(4\text{m})^2 + (1\text{m})^2} = 4.12311\,\text{m}$ $\quad L9 := L3 \cdot \sin(\gamma) = 2.01723\,\text{m}$

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

Element "4" - blok macierzy sztywności

$Lx := 5m = 5\,m$ $\qquad$ $Ly := Y3 = 1.363636\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.182616\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 3053 & 833 \\ 833 & 227 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "7" - blok macierzy sztywności

$Lx := 2m = 2\,m$ $\qquad$ $Ly := Y3 - 5m = -3.636364\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.150077\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 951 & -1730 \\ -1730 & 3145 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "8" - blok macierzy sztywności

$Lx := 2m$ $\qquad$ $Ly := Y4 - Y3 = 2.636364\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.309141\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 1877 & 2474 \\ 2474 & 3261 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "9" - blok macierzy sztywności

$Lx := L9 \cdot \sin(\alpha) = 0.531\,m$ $\qquad$ $Ly := -L9 \cdot \cos(\alpha) = -1.946154\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.017233\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 583 & -2139 \\ -2139 & 7844 \end{pmatrix} \cdot \frac{kN}{m}$$