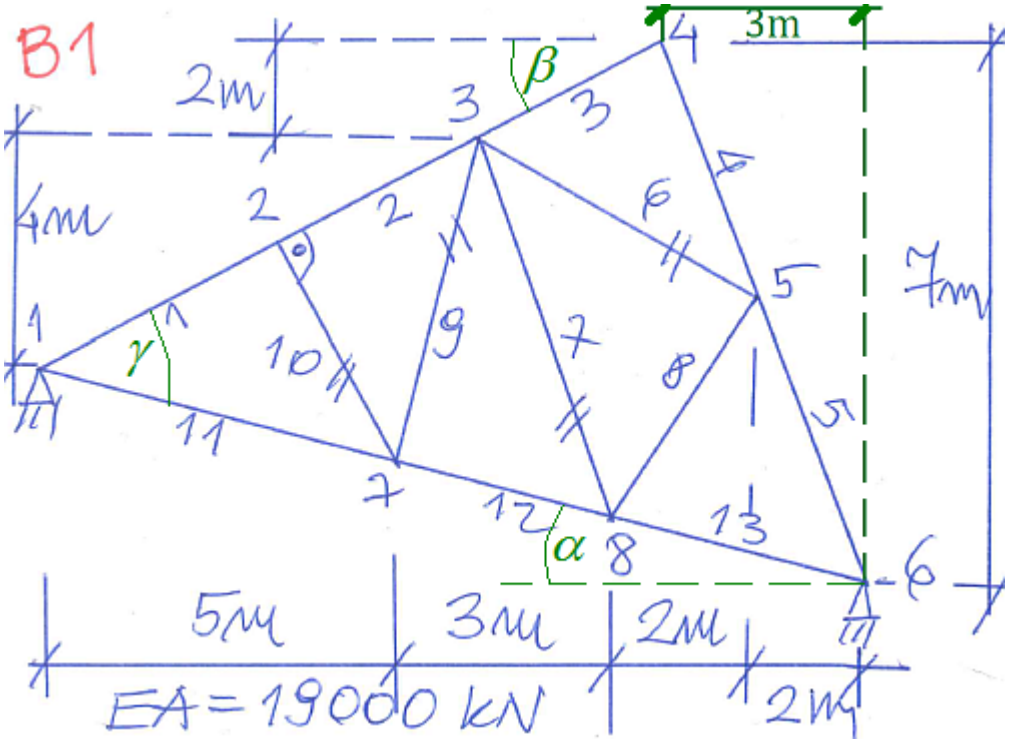
Macierze sztywności elementów kratownicy



$\alpha := \operatorname{atan}\left(\frac{1}{12}\right)$

$\beta := \operatorname{atan}\left(\frac{6}{9}\right)$

$\gamma := \beta + \alpha = 0.67114$

$\gamma = 38.454 \cdot \mathrm{deg}$

$EA := 19MN$

dokładnść ±0.5kN/m

elementy := (6 , 7 , 9 , 10)

$X3 := 9m \cdot \frac{4}{6} = 6.00000\,m$ $\qquad$ $Y5 := 7m \cdot \frac{2}{3} - 1m = 3.66667\,m$

$Y7 := -1m \cdot \frac{5}{12} = -0.41667\,m$ $\qquad$ $Y8 := -1m \cdot \frac{8}{12} = -0.66667\,m$

$L11 := \sqrt{(5m)^2 + (Y7)^2} = 5.01733\,m$ $\qquad$ $L10 := L11 \cdot \sin(\gamma) = 3.12019\,m$

Element "6" - blok macierzy sztywności

$Lx := 10m - X3 = 4.00000\,m$ $\qquad$ $Ly := Y5 - 4m = -0.333333\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.013865\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 4701 & -392 \\ -392 & 33 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "7" - blok macierzy sztywności

$Lx := 8m - X3 = 2.000000\,m$ $\qquad$ $Ly := Y8 - 4m = -4.666667\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.077182\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 581 & -1355 \\ -1355 & 3162 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "9" - blok macierzy sztywności

$Lx := X3 - 5m = 1.000000\,m$ $\qquad$ $Ly := 4m - Y7 = 4.416667\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.528459\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 205 & 904 \\ 904 & 3991 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "10" - blok macierzy sztywności

$Lx := L10 \cdot \sin(\beta) = 1.73077\,m$ $\qquad$ $Ly := -L10 \cdot \cos(\beta) = -2.59615\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.120189\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 1874 & -2810 \\ -2810 & 4216 \end{pmatrix} \cdot \frac{kN}{m}$$