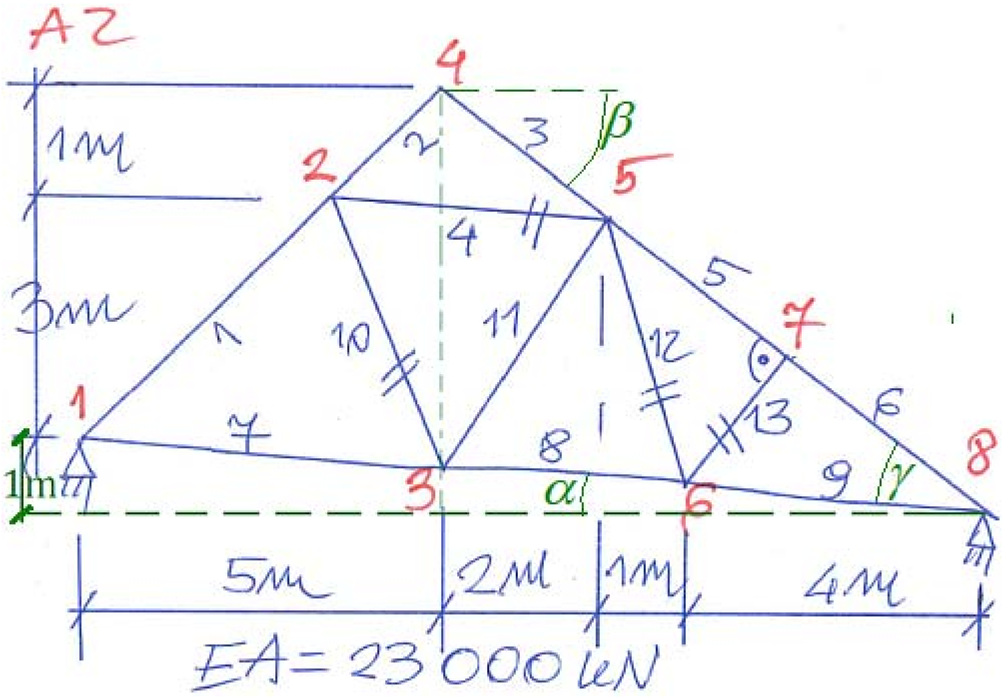
Macierze sztywności elementów kratownicy



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

$\beta := \operatorname{atan}\left(\frac{5}{7}\right)$

$\gamma := \beta - \alpha = 0.53711$

$\gamma = 30.774 \cdot deg$

$EA := 23MN$

dokładnść ±0.5kN/m

elementy := (4 , 10 , 11 , 12)

$X2 := 5m \cdot \frac{3}{4} = 3.75000\ m$ $\qquad$ $Y3 := -1m \cdot \frac{5}{12} = -0.41667\ m$

$Y5 := 5m \cdot \frac{5}{7} - 1m = 2.57143\ m$ $\qquad$ $Y6 := -1m \cdot \frac{8}{12} = -0.66667\ m$

$L9 := \sqrt{(4m)^2 + (1m + Y6)^2} = 4.01386\ m$ $\qquad$ $L13 := L9 \cdot \sin(\gamma) = 2.05371\ m$

Element "4" - blok macierzy sztywności

$Lx := 7m - X2 = 3.25000\,m$ $\quad$ $Ly := Y5 - 3m = -0.428571\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.278136\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 6896 & -909 \\ -909 & 120 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "10" - blok macierzy sztywności

$Lx := 5m - X2 = 1.250000\,m$ $\quad$ $Ly := Y3 - 3m = -3.416667\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.638147\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 746 & -2040 \\ -2040 & 5576 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "12" - blok macierzy sztywności

$Lx := 1m$ $\quad$ $Ly := Y6 - Y5 = -3.238095\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.388991\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 591 & -1913 \\ -1913 & 6196 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "13" - blok macierzy sztywności

$Lx := L13 \cdot \sin(\beta) = 1.19369\,m$ $\quad$ $Ly := L13 \cdot \cos(\beta) = 1.67117\,m$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.053708\,m$$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 3784 & 5297 \\ 5297 & 7416 \end{pmatrix} \cdot \frac{kN}{m}$$