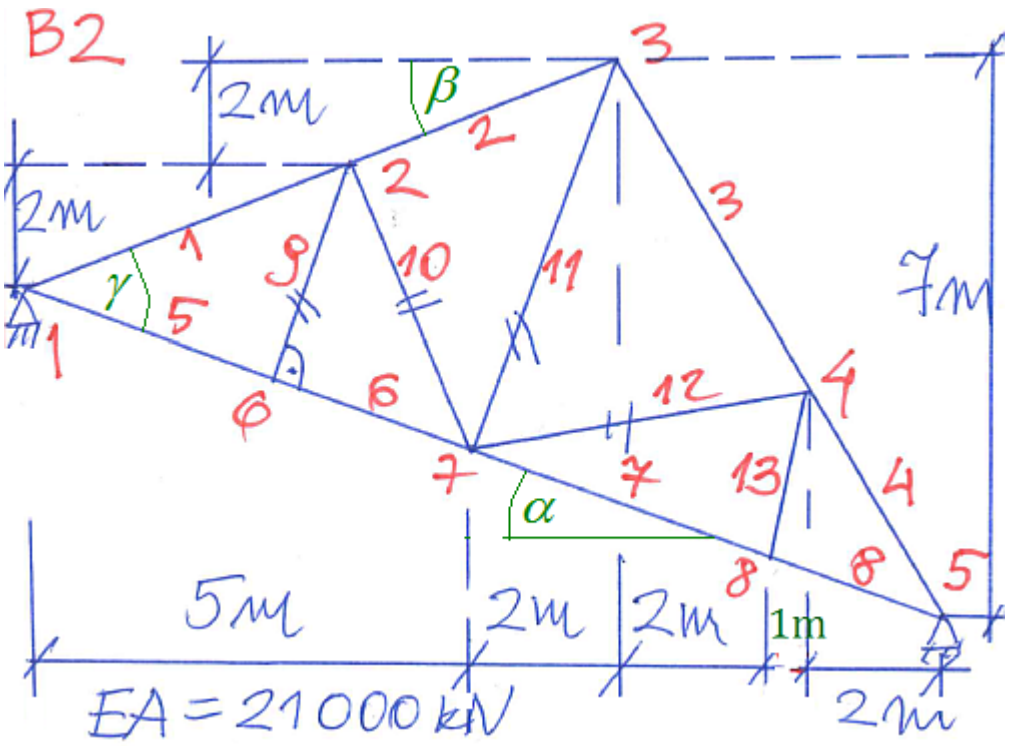
Macierze sztywności elementów kratownicy



$\alpha := \operatorname{atan}\left(\frac{3}{12}\right)$

$\beta := \operatorname{atan}\left(\frac{4}{7}\right)$

$\gamma := \beta + \alpha = 0.76412$

$\gamma = 43.781 \cdot \mathrm{deg}$

$EA := 21MN$

dokładnść ±0.5kN/m

$elementy := (9, 10, 11, 12)$

$X2 := 7m \cdot \frac{2}{4} = 3.50000\,m$ $\qquad$ $Y7 := -3m \cdot \frac{5}{12} = -1.25000\,m$

$Y4 := 7m \cdot \frac{2}{5} - 3m = -0.20000\,m$

$L1 := \sqrt{(X2)^2 + (2m)^2} = 4.03113\,m$ $\qquad$ $L9 := L1 \cdot \sin(\gamma) = 2.78916\,m$

Element "9" - blok macierzy sztywności

$Lx := L9 \cdot \sin(\alpha) = 0.67647\,m$ $\quad$ $Ly := L9 \cdot \cos(\alpha) = 2.705882\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 2.78916\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 443 & 1772 \\ 1772 & 7086 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "10" - blok macierzy sztywności

$Lx := 5m - X2 = 1.500000\,m$ $\quad$ $Ly := Y7 - 2m = -3.250000\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.579455\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 1030 & -2232 \\ -2232 & 4837 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "11" - blok macierzy sztywności

$Lx := 2m$ $\quad$ $Ly := 4m - Y7 = 5.250000\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.618051\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 474 & 1244 \\ 1244 & 3264 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "12" - blok macierzy sztywności

$Lx := 5m = 5.00000\,m$ $\quad$ $Ly := Y4 - Y7 = 1.05000\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.109061\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 3937 & 827 \\ 827 & 174 \end{pmatrix} \cdot \frac{kN}{m}$$