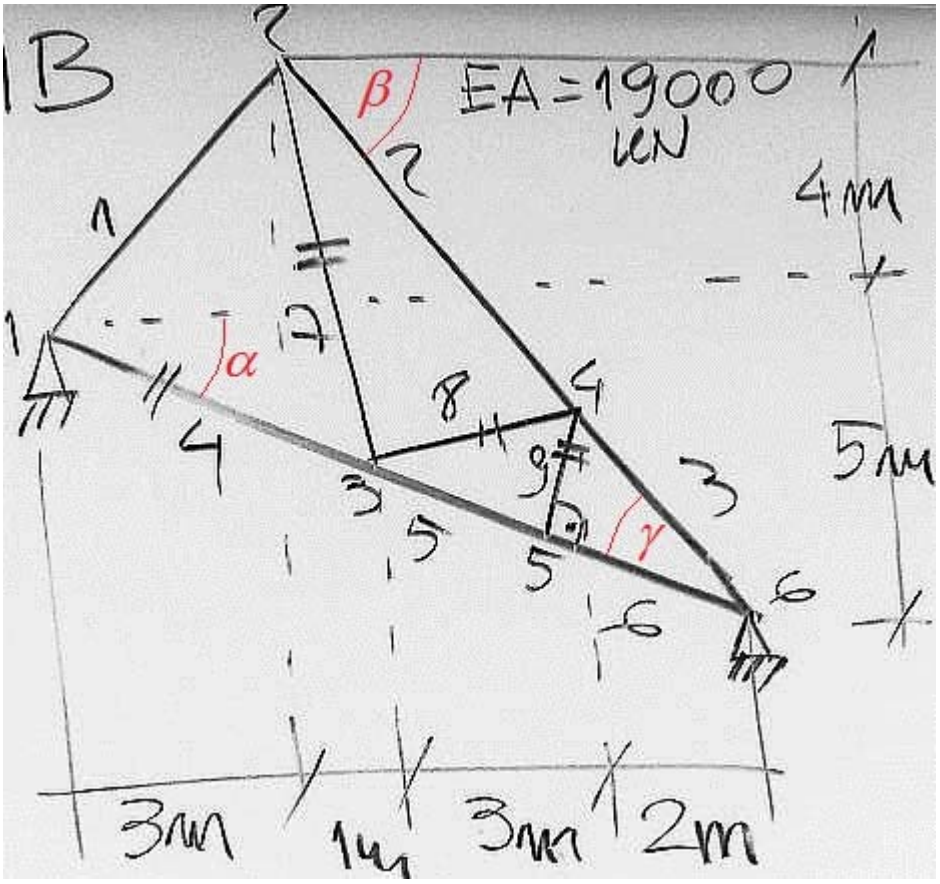
Macierze sztywności elementów kratownicy 1B



$\alpha := \operatorname{atan}\left(\frac{5}{9}\right)$

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

$\gamma := \beta - \alpha = 0.4757$

$\gamma = 27.255 \cdot \text{deg}$

$EA := 19MN$

dokładnść ±0.5kN/m

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

$Y3 := -5m \cdot \frac{4}{9} = -2.22222\ m$ $Y4 := 9m \cdot \frac{2}{6} - 5m = -2\ m$ $Y5 := 3m \cdot \frac{8}{13} = 1.84615\ m$

$L3 := \sqrt{(2m)^2 + (3m)^2} = 3.60555\ m$ $L9 := L3 \cdot \sin(\gamma) = 1.65119\ m$

$\mathbf{K} =$

1	2	3	4	5	6	
J^1+J^4	$-J^1$	$-J^4$				1
	$J^1+J^2+J^7$	$-J^7$	$-J^2$			2
		$J^4+J^5+J^7+J^8$	$-J^8$	$-J^5$		3
			$J^2+J^3 J^7+J^9$	$-J^9$	$-J^3$	4
Symetria	Symetria	Symetria	Symetria	$J^5+J^6+J^9$	$-J^6$	5
					J^3+J^6	6

Element "4" - blok macierzy sztywności

$Lx := 4m = 4\,m$ $\qquad$ $Ly := Y3 = -2.222222\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 4.575836\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 3173 & -1763 \\ -1763 & 979 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "7" - blok macierzy sztywności

$Lx := 1m = 1\,m$ $\qquad$ $Ly := Y3 - 4m = -6.222222\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 6.302067\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 76 & -472 \\ -472 & 2939 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "8" - blok macierzy sztywności

$Lx := 3m$ $\qquad$ $Ly := Y4 - Y3 = 0.222222\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.008219\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 6282 & 465 \\ 465 & 34 \end{pmatrix} \cdot \frac{kN}{m}$$

Element "9" - blok macierzy sztywności

$Lx := L9 \cdot \sin(\alpha) = 0.802\,m$ $\qquad$ $Ly := L9 \cdot \cos(\alpha) = 1.443396\,m$

$L := \sqrt{(Lx)^2 + (Ly)^2} = 1.651186\,m$

$$J := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J = \begin{pmatrix} 2714 & 4885 \\ 4885 & 8793 \end{pmatrix} \cdot \frac{kN}{m}$$