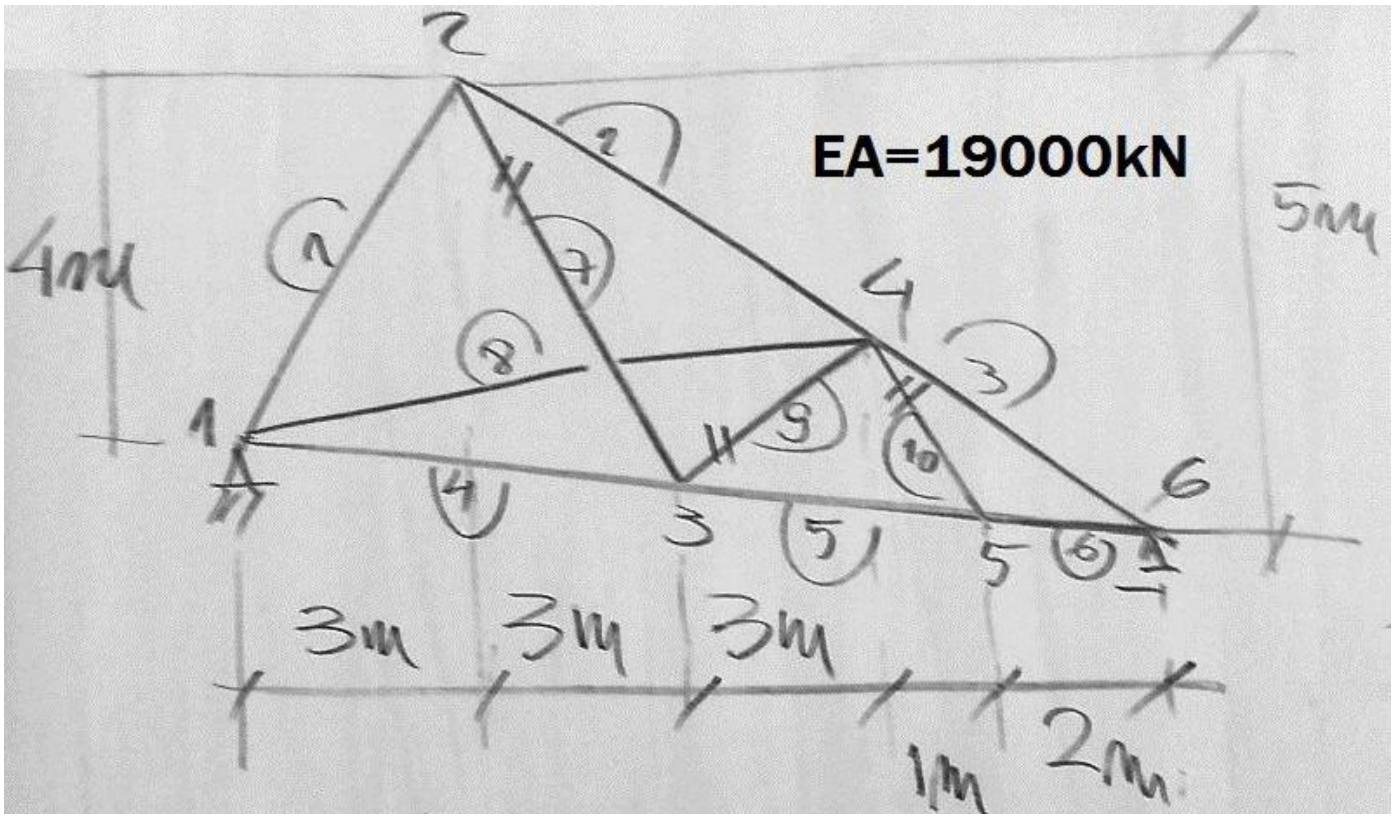
# *Macierze sztywności elementów kratownicy*

## *Grupa IBN8*




elementy = (7 , 9 , 10)  EA := 19MN

$$\mathbf{K} = \begin{array}{c} \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 \end{matrix} \\ \begin{bmatrix} \mathbf{J}^1+\mathbf{J}^4+\mathbf{J}^8 & -\mathbf{J}^1 & -\mathbf{J}^4 & -\mathbf{J}^8 & & \\ -\mathbf{J}^1 & \mathbf{J}^1+\mathbf{J}^2+\mathbf{J}^7 & -\mathbf{J}^7 & -\mathbf{J}^2 & & \\ -\mathbf{J}^4 & -\mathbf{J}^7 & \mathbf{J}^4+\mathbf{J}^5+ \\ & & +\mathbf{J}^7+\mathbf{J}^9 & -\mathbf{J}^9 & -\mathbf{J}^5 & \\ -\mathbf{J}^8 & -\mathbf{J}^2 & -\mathbf{J}^9 & \mathbf{J}^2+\mathbf{J}^3+\mathbf{J}^8+ \\ & & & \mathbf{J}^9+\mathbf{J}^{10} & -\mathbf{J}^{10} & -\mathbf{J}^3 \\ & & -\mathbf{J}^5 & -\mathbf{J}^{10} & \mathbf{J}^5+\mathbf{J}^6+\mathbf{J}^{10} & -\mathbf{J}^6 \\ & & & -\mathbf{J}^3 & -\mathbf{J}^6 & \mathbf{J}^3+\mathbf{J}^6 \end{bmatrix} \end{array} \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{matrix}$$

## *Element "7" - blok macierzy sztywności*

$$Lx := 3m \qquad Ly := -\left(4m + 1m \cdot \frac{6}{12}\right) = -4.5\,m$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 5.408327\,m$$

$$J_7 := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J_7 = \begin{pmatrix} 1081.0 & -1621.4 \\ -1621.4 & 2432.1 \end{pmatrix} \cdot \frac{kN}{m}$$

## *Element "9" - blok macierzy sztywności*

$$Lx := 3m \qquad Ly := 5m \cdot \frac{3}{9} - 1m \cdot \frac{6}{12} = 1.166667\,m$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 3.218868\,m$$

$$J_9 := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J_9 = \begin{pmatrix} 5127.3 & 1993.9 \\ 1993.9 & 775.4 \end{pmatrix} \cdot \frac{kN}{m}$$

## *Element "10" - blok macierzy sztywności*

$$Lx := 1m \qquad Ly := -\left(5m \cdot \frac{3}{9} - 1m \cdot \frac{2}{12}\right) = -1.5\,m$$

$$L := \sqrt{(Lx)^2 + (Ly)^2} = 1.802776\,m$$

$$J_{10} := \frac{EA}{(L)^3} \cdot \begin{bmatrix} (Lx)^2 & Lx \cdot Ly \\ Lx \cdot Ly & (Ly)^2 \end{bmatrix} \qquad J_{10} = \begin{pmatrix} 3242.9 & -4864.3 \\ -4864.3 & 7296.4 \end{pmatrix} \cdot \frac{kN}{m}$$