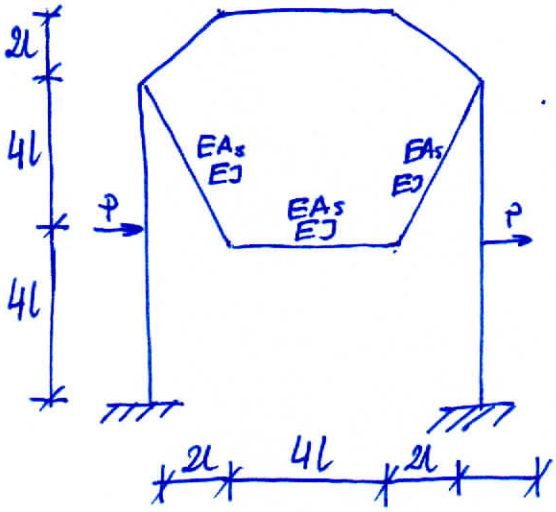
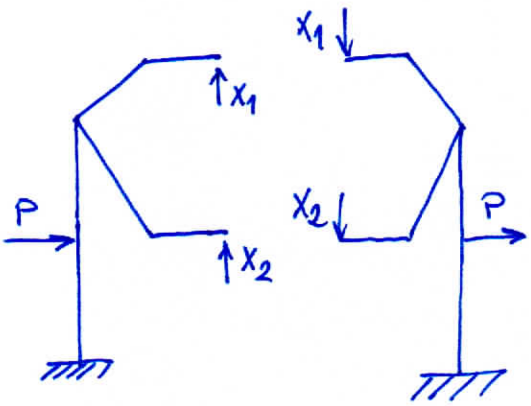
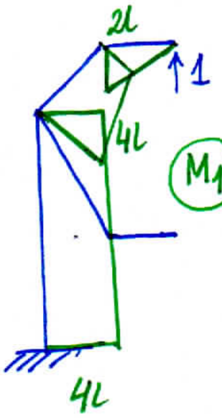
MK1 kol 1.2 2023/2024 środa

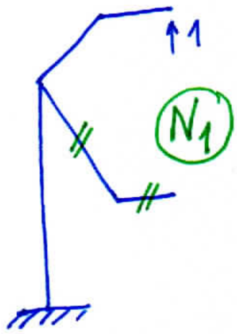


pozostałe pręty
2EJ
EA = ∞

$$\frac{EJ}{l^2 EA_s} = \frac{1}{10}$$







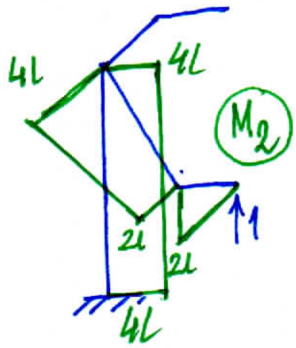
$$\delta_{11} = \frac{56}{3}\left(7+\sqrt{2}\right)\frac{l^3}{EJ}$$

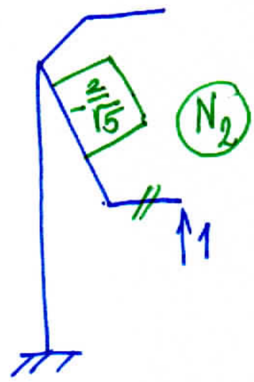
$$\delta_{22} = \left(\frac{400}{3} + \frac{2824}{75}\sqrt{5}\right)\frac{l^3}{EJ}$$

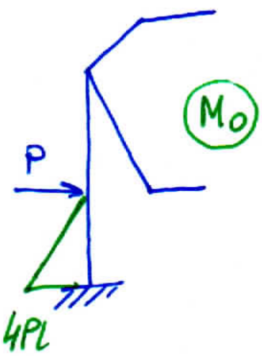
$$\delta_{12} = 128\frac{l^3}{EJ}$$

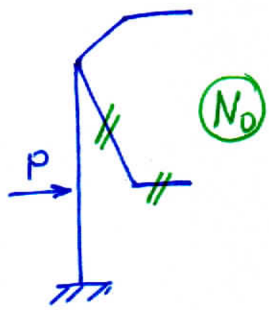
$$\delta_{10} = -32\frac{Pl^3}{EJ}$$

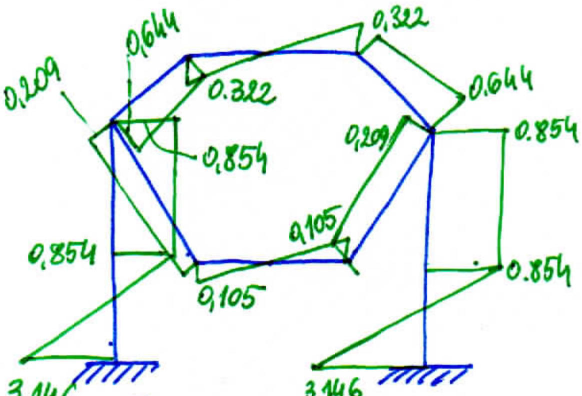
$$\delta_{20} = -32\frac{Pl^3}{EJ}$$







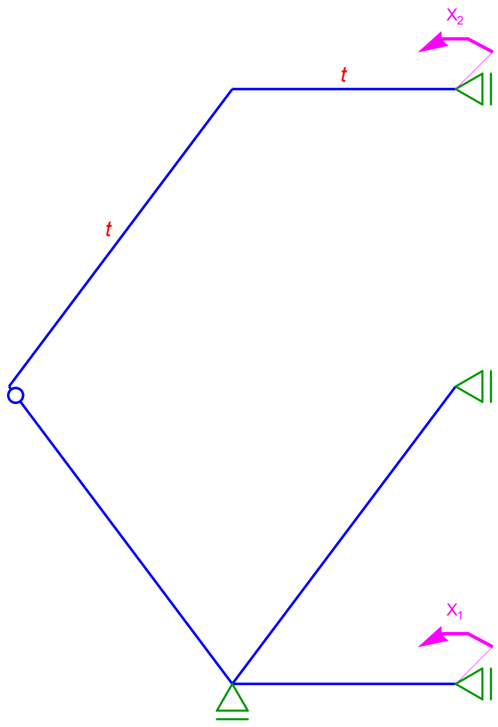




M [Pl]

opracował Jan Pieczyński

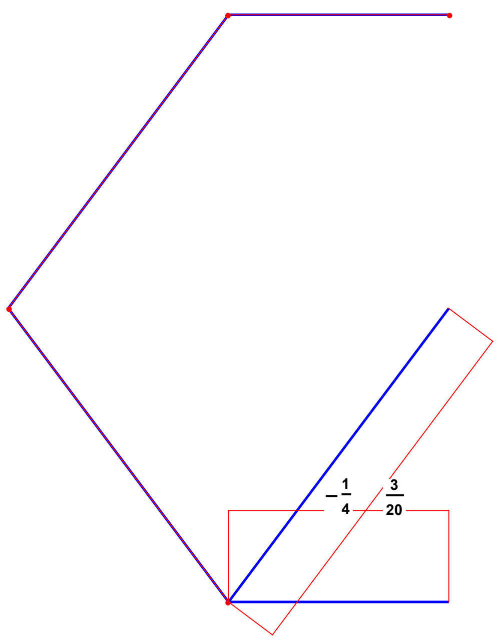
Uk‡ad zastŒpczy:



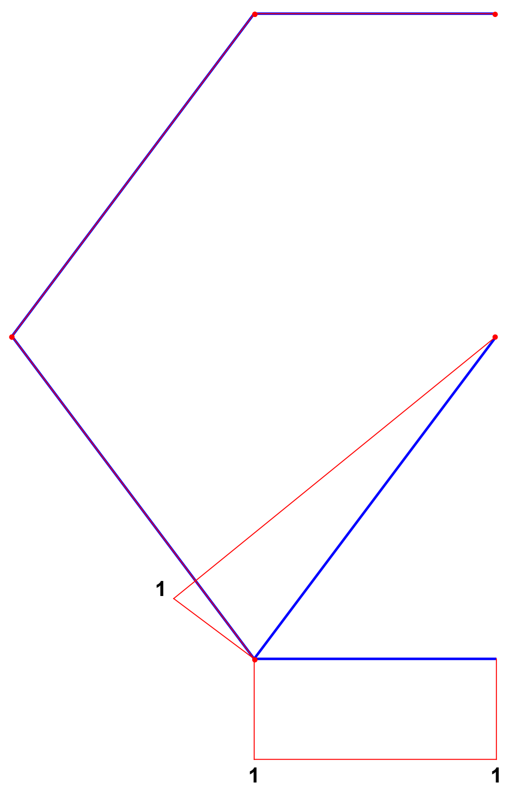
Wykresy si‡ wewnŒtrznych od jednostkowych si‡ nadliczbowych:

- od si‡y X_1 = 1:

$N_1[\frac{1}{1}]$:

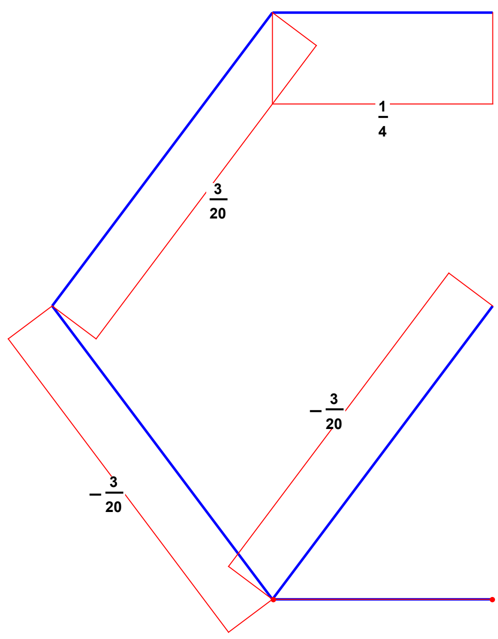


$M_1[1]$:

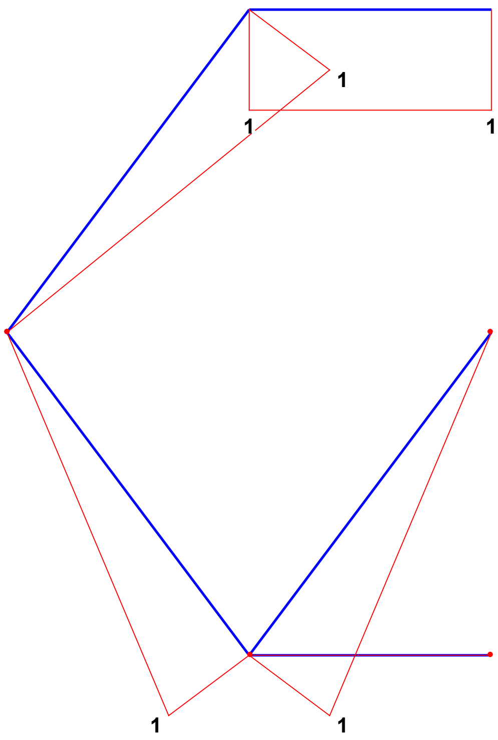


- od si‡y X_2 = 1:

$N_2[\frac{l}{l}]$:



$M_2[l]$:



Przemieszczenia od obci„¿enia temperatur„:

$$\delta_{10}^{t} = 0$$

$$\delta_{20}^{t} = \left(\frac{3}{20}\frac{l}{l}\right)(t\,\alpha)(5\,l) + \left(\frac{1}{4}\frac{l}{l}\right)(t\,\alpha)(3\,l) = \frac{3}{2}t\,\alpha$$

Przemieszczenia od jednostkowych si‡ nadliczbowych:

$$\delta_{11} = \frac{1}{EJ}[(1\cdot 3\,l)(1)] + \frac{1}{EJ}\left[\left(\frac{1}{2}\cdot 1\cdot 5\,l\right)\left(\frac{2}{3}\cdot 1\right)\right] = \frac{14}{3}\frac{l}{EJ}$$

$$\delta_{12} = \delta_{21} = \frac{1}{EJ}\left[\left(\frac{1}{2}\cdot 1\cdot 5\,l\right)\left(\frac{2}{3}\cdot(-1)\right)\right] = -\frac{5}{3}\frac{l}{EJ}$$

$$\delta_{22} = \frac{1}{EJ}\left[\left(\frac{1}{2}\cdot 1\cdot 5\,l\right)\left(\frac{2}{3}\cdot 1\right)\right] + \frac{1}{EJ}\left[\left(\frac{1}{2}\cdot 1\cdot 5\,l\right)\left(\frac{2}{3}\cdot 1\right)\right] + \frac{1}{EJ}\left[\left(\frac{1}{2}\cdot 1\cdot 5\,l\right)\left(\frac{2}{3}\cdot 1\right)\right] + \frac{1}{EJ}[(1\cdot 3\,l)(1)] = 8\frac{l}{EJ}$$

Równania nierozdzielno□ci:

$$\begin{pmatrix}\delta_{11} & \delta_{12}\\ \delta_{21} & \delta_{22}\end{pmatrix}\begin{pmatrix}X_1\\ X_2\end{pmatrix} + \begin{pmatrix}\delta_{10}^{t}\\ \delta_{20}^{t}\end{pmatrix} = \begin{pmatrix}0\\ 0\end{pmatrix}$$

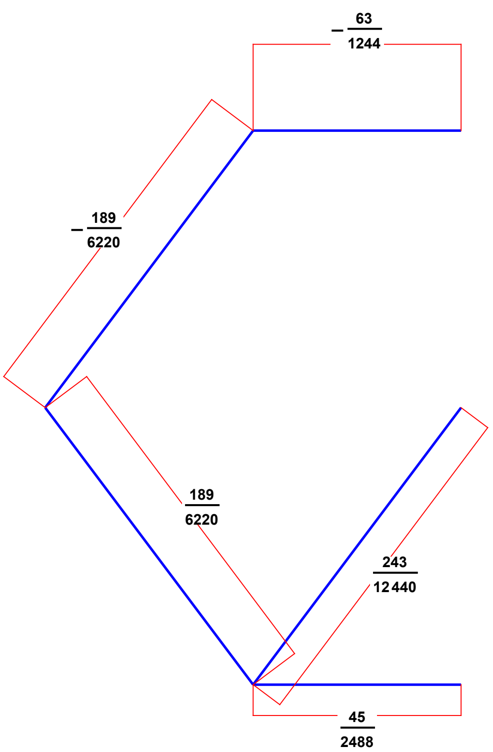
$$\begin{pmatrix}\frac{14\,l}{3\,EJ} & -\frac{5\,l}{3\,EJ}\\ -\frac{5\,l}{3\,EJ} & \frac{8\,l}{EJ}\end{pmatrix}\begin{pmatrix}X_1\\ X_2\end{pmatrix} + \begin{pmatrix}0\\ \frac{3\,t\,\alpha}{2}\end{pmatrix} = \begin{pmatrix}0\\ 0\end{pmatrix}$$

Rozwi„zanie metody si‡:

$$\begin{pmatrix}X_1\\ X_2\end{pmatrix} = \begin{pmatrix}-\frac{45\,EJ\,t\,\alpha}{622\,l}\\ -\frac{63\,EJ\,t\,\alpha}{311\,l}\end{pmatrix}$$

Wykresy si‡ wewnŒtrznych:

$N[\frac{EJt\alpha}{l^2}]$:



$M[\frac{EJt\alpha}{l}]$: