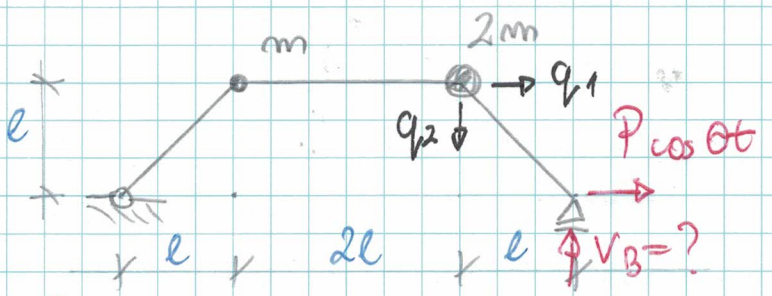
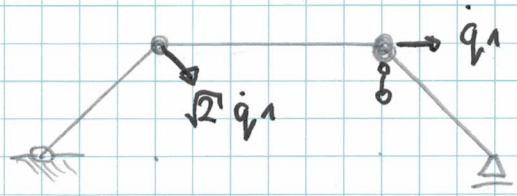
MK 2 Kolokwium 2.3. r.a. 2023/24

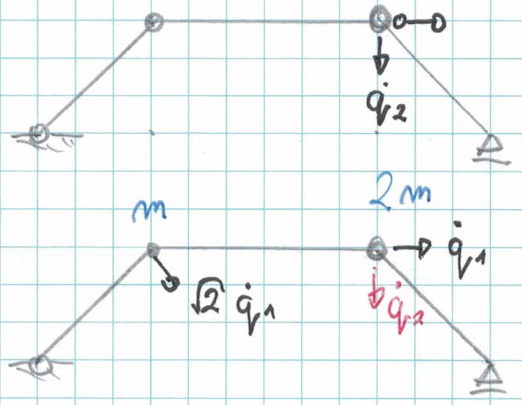
$EA \to \infty$ $EJ = const.$ $\Theta = \sqrt{\frac{EJ}{ml^3}}$



2 st. sw. dyn.

Plany predkosci

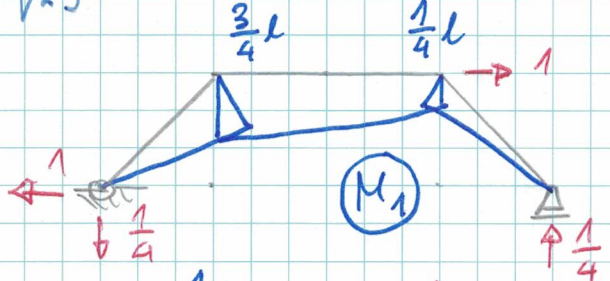




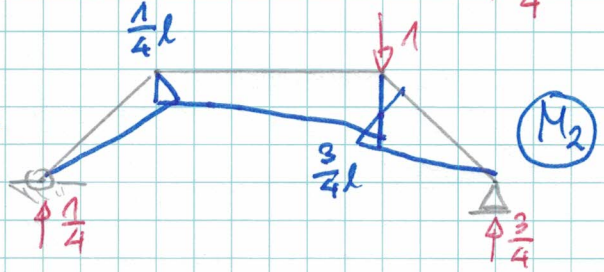
Macierz mas $E_k = \frac{1}{2}[m\,2\,\dot{q}_1^2 + 2m(\dot{q}_1^2 + \dot{q}_2^2)] =$

$= \frac{1}{2}[4m\,\dot{q}_1^2 + 2m\,\dot{q}_2^2]$

$$M = m\left[\begin{array}{c|c} 4 & 0 \\ \hline 0 & 2 \end{array}\right]$$



Macierz podatnosci



$$d_{11} = \frac{1}{EJ}\left[\frac{1}{2}\frac{3}{4}l \cdot \Omega l \cdot \frac{2}{3}\frac{3}{4}l + \right.$$

$$+ \frac{1}{2}\frac{3}{4}l \cdot 2l \cdot \left(\frac{2}{3}\frac{3}{4}\frac{l}{2} + \frac{1}{3}\frac{1}{4}l\right) +$$

$$\left. + \frac{1}{2}\frac{1}{4}l \cdot 2l\left(\frac{2}{3}\frac{1}{4}\frac{l}{2} + \frac{1}{3}\frac{3}{4}l\right) + \frac{1}{2}\frac{1}{4}l \cdot \Omega l \cdot \frac{2}{3}\frac{1}{4}\frac{l}{2}\right] = 0{,}836\,\frac{l^3}{EJ}$$

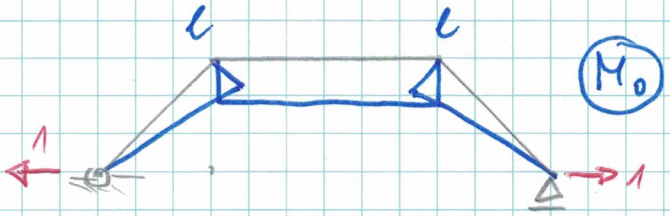
$$d_{12} = \frac{1}{EJ}\left[\frac{1}{2}\frac{3}{4}l\,\Omega l\,\frac{2}{3}\frac{1}{4}l + \frac{1}{2}\frac{3}{4}l \cdot 2l \cdot \left(\frac{2}{3}\frac{1}{4}\frac{l}{2} + \frac{1}{3}\frac{3}{4}l\right) + \right.$$

$$\left. + \frac{1}{2}\frac{1}{4}l \cdot 2l \cdot \left(\frac{2}{3}\frac{3}{4}\frac{l}{2} + \frac{1}{3}\frac{1}{4}l\right) + \frac{1}{2}\frac{3}{4}l \cdot \Omega l \cdot \frac{2}{3}\frac{1}{4}l\right] = 0{,}635\,\frac{l^3}{EJ}$$

$d_{22} = d_{11} = 0{,}836\,\frac{l^3}{EJ}$

$$D = \frac{l^3}{EJ}\left[\begin{array}{c|c} 0{,}836 & 0{,}635 \\ \hline 0{,}635 & 0{,}836 \end{array}\right]$$

Wektor $\mathbb{D}_0$



$$d_{10} = \frac{1}{EJ}\left[\frac{1}{2} l \cdot \sqrt{2}l \cdot \frac{2}{3}\frac{3}{4}l + l \cdot 2l \cdot \left(\frac{1}{2}\frac{3}{4}l + \frac{1}{2}\frac{1}{4}l\right) + \right.$$

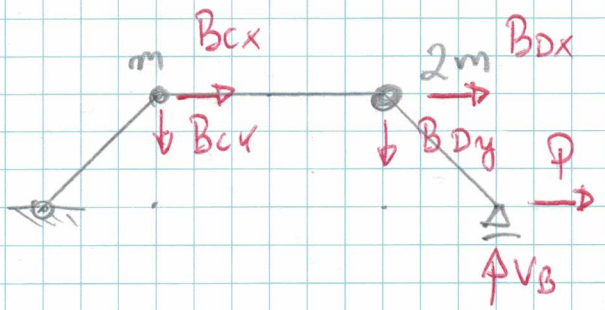
$$\left. + \frac{1}{2} l \cdot \sqrt{2}\, l \, \frac{2}{3}\frac{1}{4}l\right] = 1{,}471 \frac{l^3}{EJ} \qquad \mathbb{D}_0 = \frac{l^3}{EJ}\begin{bmatrix} 1{,}471 \\ 1{,}471 \end{bmatrix}$$

$$d_{20} = d_{10} = 1{,}471 \frac{l^3}{EJ}$$

Równanie ruchu $(\mathbb{1} - \theta^2 \mathbb{D} M)\, q_0 = \mathbb{D}_0 P$

Wektor amplitud przemieszczeń $q_0 = \begin{bmatrix} -0{,}533 \\ -0{,}174 \end{bmatrix} \frac{Pl^3}{EJ}$

Amplitudy sił bezwładności



$B_{Cx} = m \cdot \theta^2 q_{0,1} = -0{,}533P$

$B_{Cy} = m\,\theta^2 q_{0,1} = -0{,}533P$

$B_{Dx} = 2m\,\theta^2 q_{0,1} = -1{,}066P$

$B_{Dy} = 2m\,\theta^2 q_{0,2} = -0{,}348P$

$$V_B = \frac{1}{4}(B_{Cx} + B_{Dx}) + \frac{3}{4} B_{Dy} + \frac{1}{4} B_{Cy} = -0{,}794\,P$$