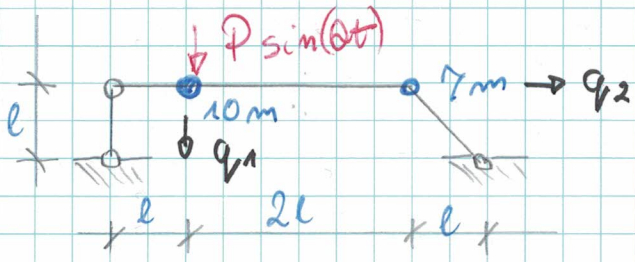
Kolokwium 2.1. MK2 r.a. 2023/24

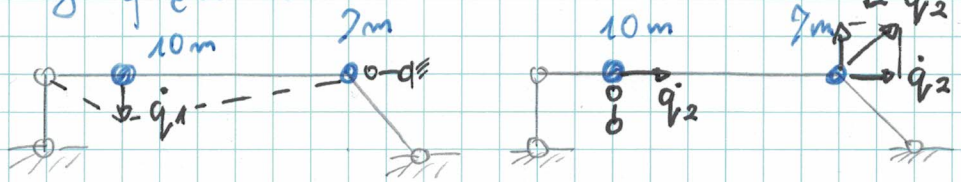
$EA \to \infty$ $EJ = const$ 2 st. sw. dyn.



Macierz mas

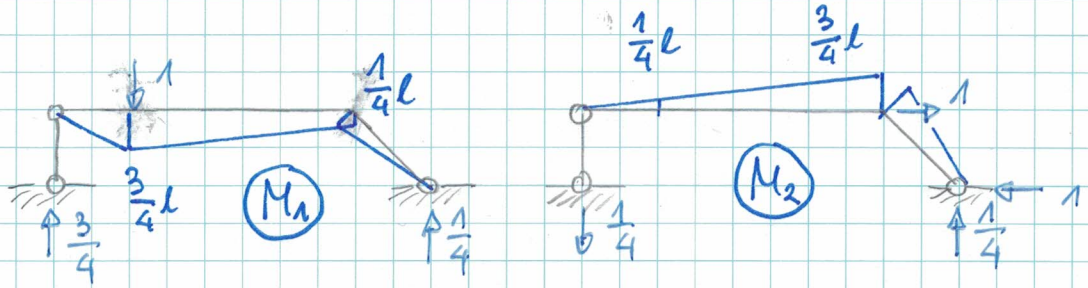
$$E_k = \frac{1}{2}\left[10m\cdot(\dot{q}_1^2 + \dot{q}_2^2) + 7m\cdot 2\dot{q}_2^2\right] = \frac{1}{2}\left[10m\,\dot{q}_1^2 + 24\,\dot{q}_2^2\right]$$

Plany prędkości



$$M = \begin{bmatrix} 10\,m & 0 \\ 0 & 24\,m \end{bmatrix}$$

Macierz podatności



$$\delta_{11} = \frac{1}{EJ}\left[\frac{1}{2}\frac{3}{4}l\cdot l\cdot\frac{2}{3}\frac{3}{4}l + \frac{1}{2}\frac{3}{4}l\cdot 2l\cdot\left(\frac{2}{3}\frac{3}{4}l + \frac{1}{3}\frac{1}{4}l\right) + \frac{1}{2}\frac{1}{4}l\cdot 2l\cdot\left(\frac{2}{3}\frac{1}{4}l + \frac{1}{3}\frac{3}{4}l\right) + \frac{1}{2}\frac{1}{4}l\cdot 2l\cdot\frac{2}{3}\frac{1}{4}l\right] = 0{,}759\,\frac{l^3}{EJ}$$

$$\delta_{12} = \frac{1}{EJ}\left[\frac{1}{2}\frac{3}{4}l\cdot\left(-\frac{2}{3}\frac{1}{4}l\right) + \frac{1}{2}\frac{3}{4}l\cdot 2l\cdot\left(-\frac{2}{3}\frac{1}{4}l - \frac{1}{3}\frac{3}{4}l\right) + \frac{1}{2}\frac{1}{4}l\cdot 2l\cdot\left(-\frac{2}{3}\frac{3}{4}l - \frac{1}{3}\frac{1}{4}l\right) + \frac{1}{2}\frac{1}{4}l\cdot 2l\cdot\left(-\frac{2}{3}\frac{3}{4}l\right)\right] = -0{,}609\,\frac{l^3}{EJ}$$

$$\delta_{22} = \frac{1}{EJ}\left[\frac{1}{2}\frac{3}{4}l\cdot 3l\cdot\frac{2}{3}\frac{3}{4}l + \frac{1}{2}\frac{3}{4}l\cdot 2l\cdot\frac{2}{3}\frac{3}{4}l\right] = 0{,}828\,\frac{l^3}{EJ}$$

$$D = \frac{l^3}{EJ}\begin{bmatrix} 0{,}759 & -0{,}609 \\ -0{,}609 & 0{,}828 \end{bmatrix}$$

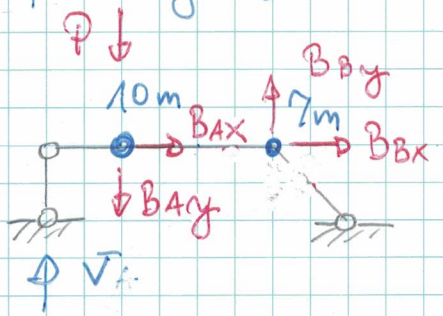
Wektor amplitud obciążeń $Q = [P \quad 0]^T$

Równanie ruchu

$$(\underline{\underline{I}} - \Theta^2 \mathbb{D} M) q_0 = \mathbb{D} Q$$

$$q_0 = \begin{bmatrix} -0,154 \\ -0,0173 \end{bmatrix} \frac{P l^3}{EJ}$$ – wektor amplitud przemieszczeń

Amplitudy sił bezwładności



$$B_{Ax} = 10m \cdot \Theta^2 \cdot q_{,2} = -0,173\,P$$
$$B_{Ay} = 10m \cdot \Theta^2 \cdot q_{,1} = -1,536\,P$$
$$B_{Bx} = 7m \cdot \Theta^2 \cdot q_{,2} = -0,121\,P$$
$$B_{By} = B_{Bx} = -0,121\,P$$

$$V = \frac{3}{4}(P + B_{Ay}) - \frac{1}{4} B_{By} - \frac{1}{4}(B_{Ax} + B_{Bx}) = -0,298P$$