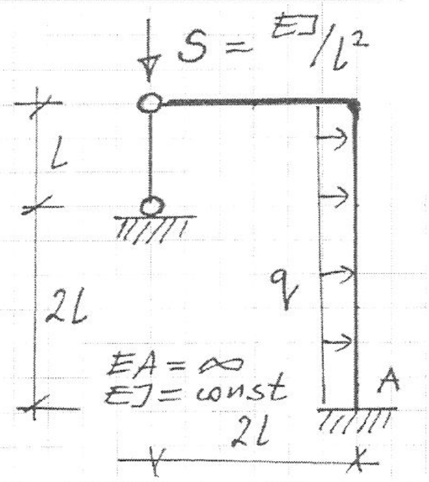
Egzamin pisemny Mechanika Konstrukcji II, 11 IX 2014 r.

NAZWISKO Imię:				
ocena zadania 1	ocena zadania 2	ocena zadania 3	ocena egz. pis.	Ocena Ostateczna
				Ocena łączna Data

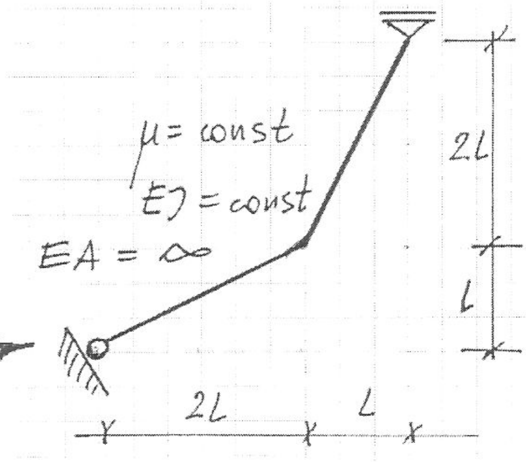
Problem 1
Dana jest rama obciążona dużą siłą osiową i poddana obciążeniu q. Znaleźć moment w utwierdzeniu A.

(Find the bending moment at the clamped node A of the given plane frame subjected to the lateral load of intensity q and subjected to the given big axial force.)



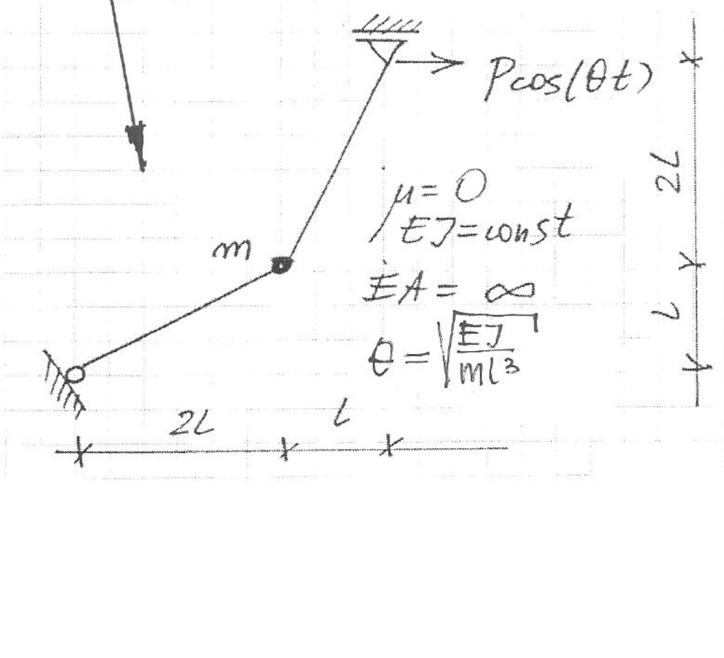
Problem 2
Dana jest rama nieważka z masą skupioną, poddana obciążeniu harmonicznemu. Znaleźć amplitudę przemieszczenia masy.

(The given frame of weightless bars, with one concentrated mass, is subject to the harmonic load. Find the amplitude of the displacement of the mass.)



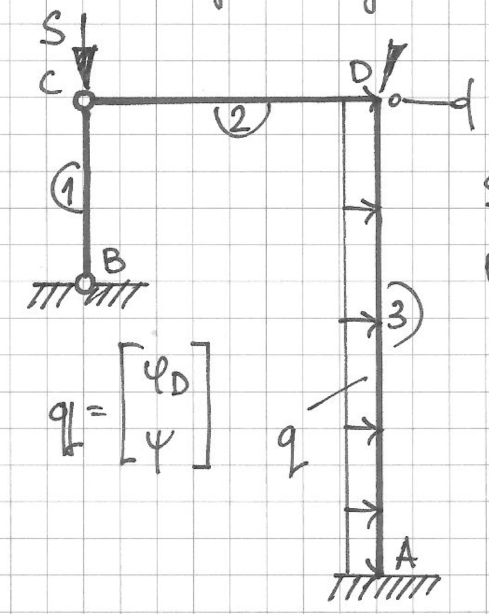
Problem 3
Zapisać równania określające częstości drgań własnych danej ramy płaskiej o ciągłym rozkładzie masy.

(Find the equations which determine the eigenfrequencies of the given plane frame of a continuous mass distribution.)



Egzamin z MK2, 11 IX 2014, zadanie 1

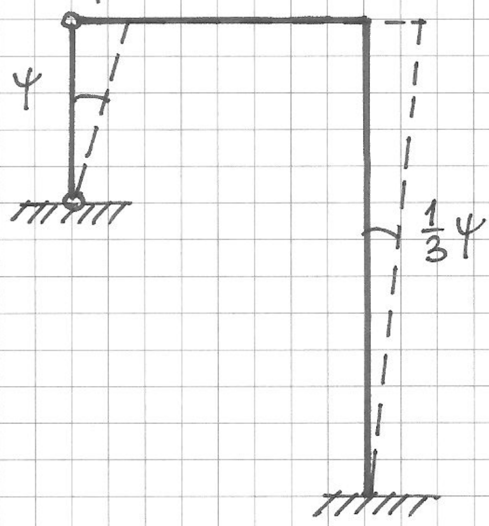
Schemat geometrycznie wyznaczalny



$$q = \begin{bmatrix} \varphi_D \\ \psi \end{bmatrix}$$

$$S^{(1)} = S$$
$$\sigma^{(1)} = 1$$

Plan przesunięć:



Równania równowagi

$$\Phi_D^{(2)} + \Phi_D^{(3)} = 0$$

$$\left[\Phi_A^{(3)} + \Phi_D^{(3)}\right] \cdot \frac{1}{3}\bar{\psi} + S \cdot l \cdot \psi \cdot \bar{\psi} + q \cdot 3l \cdot \frac{3}{2} l \cdot \frac{1}{3}\bar{\psi} = 0$$

Wzory transformacyjne i siły brzegowe wyjściowe

$$\Phi_D^{(2)} = \frac{3EJ}{2l}\left[\varphi_D\right]$$

$$\Phi_A^{(3)} = \frac{2EJ}{3l}\left[\varphi_D - 3 \cdot \frac{1}{3}\psi\right] - \frac{1}{12} q (3l)^2$$

$$\Phi_D^{(3)} = \frac{2EJ}{3l}\left[2\varphi_D - 3 \cdot \frac{1}{3}\psi\right] + \frac{1}{12} q (3l)^2$$

$$\varphi_D = -0{,}702 \frac{ql^3}{EJ}$$

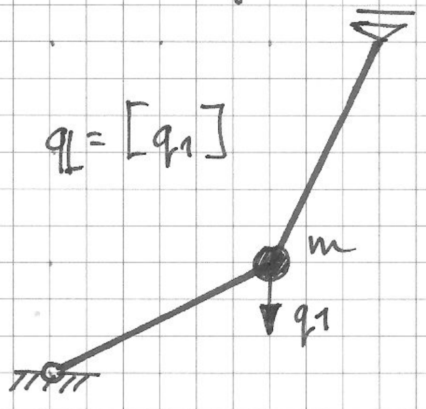
$$\psi = -1{,}858 \frac{ql^3}{EJ}$$

$$\longrightarrow \Phi_A^{(3)} = 0{,}0206\, ql^2$$

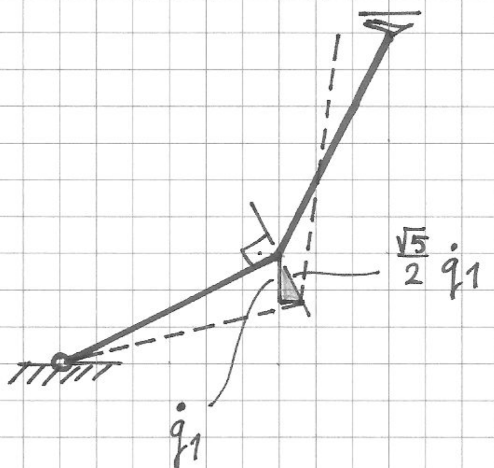
Egzamin z MK 2, 11 IX 2014, zadanie 2

Współrzędna Lagrange'a

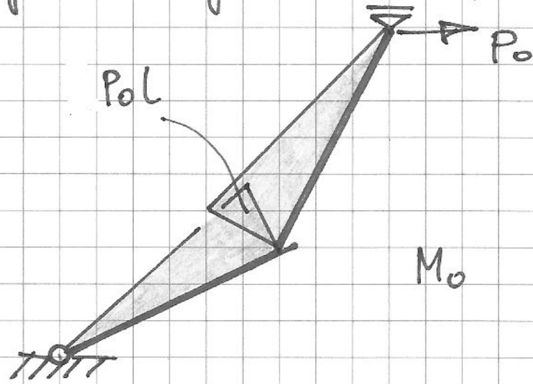
$q_L = [q_1]$

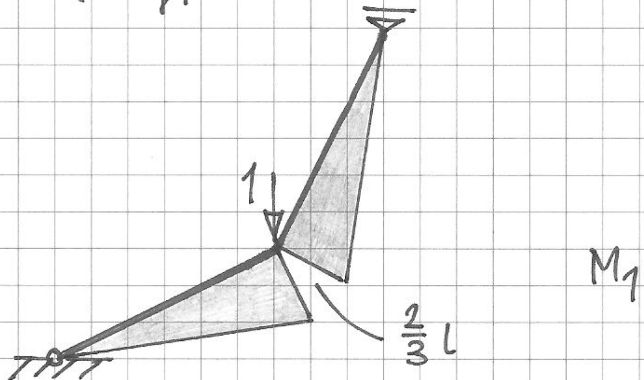


Plan prędkości



Energia kinetyczna: $2E_K = m\left(\frac{\sqrt{5}}{2}\dot{q}_1\right)^2 \rightarrow \mathbb{M} = \left[\frac{5}{4}m\right]$





$$d_{11} = 0{,}663\,\frac{l^3}{EJ} \qquad d_{10} = -0{,}994\,\frac{P_o l^3}{EJ}$$

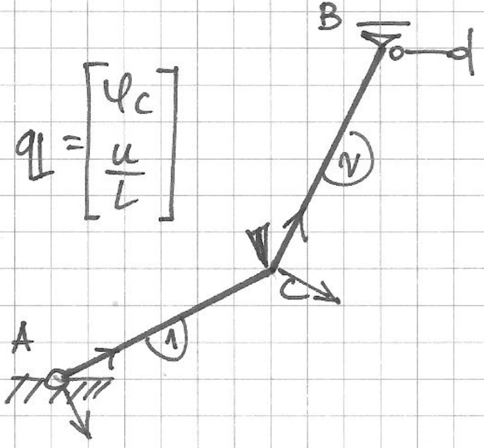
$$\left(1 - \theta^2 d_{11} \cdot \frac{5}{4}m\right) a_1 = d_{10} \qquad a_1 - \text{amplituda } q_1$$

$$a_1 = -5{,}784\,\frac{P_o l^3}{EJ}$$

Egzamin z MK2, 11 IX 2014, zadanie 3

Schemat geometrycznie wyznaczalny

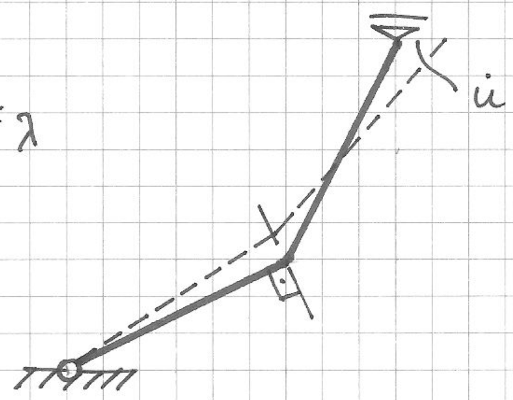
Plan prędkości



$$\mathbf{q} = \begin{bmatrix} \varphi_C \\ \frac{u}{L} \end{bmatrix}$$

$$\lambda^{(1)} = \lambda^{(2)} = \sqrt{5}\,\lambda$$

$$\lambda = L\sqrt[4]{\frac{\mu\omega^2}{EJ}}$$



$$w_A^{(1)} = 0 \qquad w_C^{(1)} = -\frac{\sqrt{5}}{3}u \qquad u^{(1)} = 0$$

$$w_1^{(2)} = -\frac{4}{3\sqrt{5}}u \qquad w_B^{(2)} = \frac{2}{\sqrt{5}}u \qquad u^{(2)} = \frac{1}{\sqrt{5}}u$$

Równania równowagi:

$$\Phi_C^{(1)} + \Phi_C^{(2)} = 0$$

$$W_C^{(1)} \cdot w_C^{(1)} + W_C^{(2)} \cdot w_C^{(2)} + W_B^{(2)} \cdot w_B^{(2)} - B_{\parallel}^{(2)} \cdot u^{(2)} = 0$$

Wzory transformacyjne i siły bezwładności:

$$\Phi_C^{(1)} = \frac{EJ}{\sqrt{5}L}\left[\alpha'(\sqrt{5}\lambda)\varphi_C + \vartheta'(\sqrt{5}\lambda)\frac{u}{3L}\right]$$

$$\Phi_C^{(2)} = \frac{EJ}{\sqrt{5}L}\left[\alpha'(\sqrt{5}\lambda)\varphi_C - \vartheta'(\sqrt{5}\lambda)\frac{4u}{15L} - \delta'(\sqrt{5}\lambda)\frac{2u}{5L}\right]$$

$$W_C^{(1)} = -\frac{EJ}{5L^2}\left[\vartheta'(\sqrt{5}\lambda)\varphi_C + \gamma'(\sqrt{5}\lambda)\frac{u}{3L}\right]$$

$$W_C^{(2)} = \frac{EJ}{5L^2}\left[\vartheta'(\sqrt{5}\lambda)\varphi_C - \gamma'(\sqrt{5}\lambda)\frac{4u}{15L} - \varepsilon'(\sqrt{5}\lambda)\frac{2u}{5L}\right]$$

$$W_B^{(2)} = -\frac{EJ}{5L^2}\left[\delta'(\sqrt{5}\lambda)\varphi_C - \varepsilon'(\sqrt{5}\lambda)\frac{4u}{15L} - \chi'(\sqrt{5}\lambda)\frac{2u}{5L}\right]$$

$$B_{\parallel}^{(2)} = \omega^2 \cdot \mu \cdot \sqrt{5}L \cdot \frac{1}{\sqrt{5}}u = \frac{EJ}{L^2}\lambda^4\frac{u}{L}$$