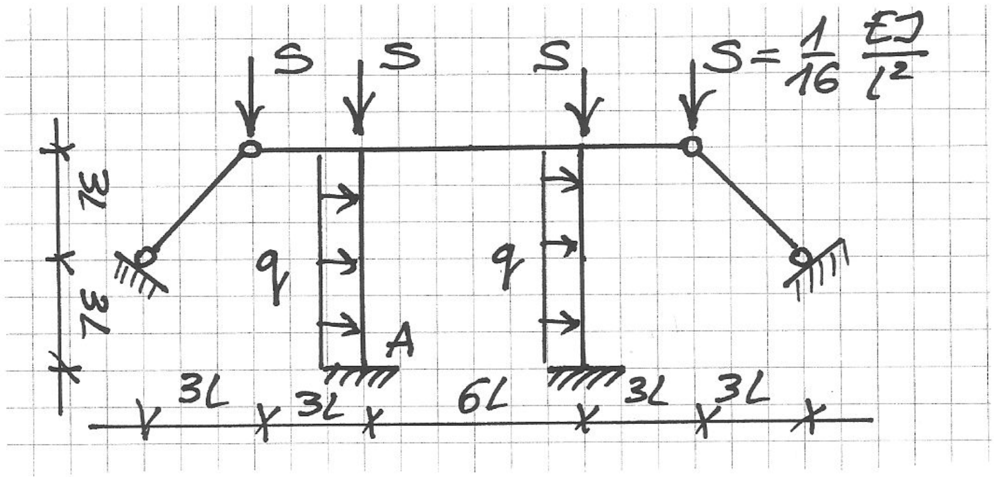
Imię i NAZWISKO				
Nr albumu				
ocena zadania 1	ocena zadania 2	ocena zadania 3	ocena egz. pis.	Ocena Ostateczna
				Data

Zadanie 1

Dana jest rama z prętów nieściśliwych(EJ=const) obciążona dużymi siłami osiowymi S oraz poddana obciążeniu poprzecznemu. Znaleźć moment w utwierdzeniu A.

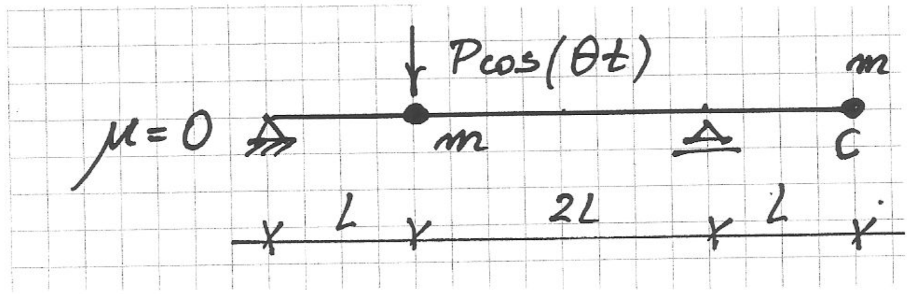
(The given frame (of inextensible bars and EJ=const) is subject to big axial forces S and to a lateral load, as in figure below. Find the bending moment at the support A).



Zadanie 2

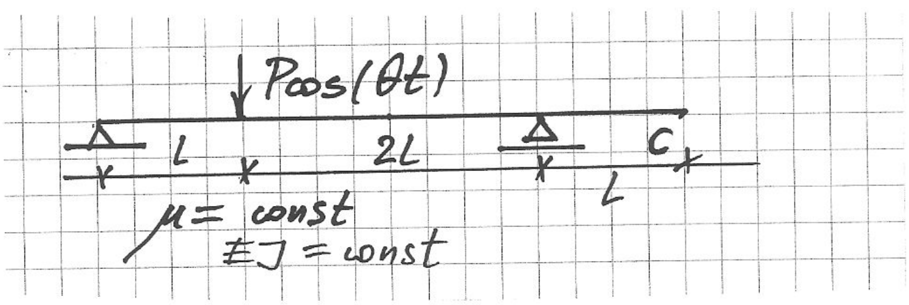
Dana jest nieważka belka z dwiema masami skupionymi; EJ=const, EA=∞ . Belka jest obciążona siłą zmienną harmonicznie z daną częstością $\theta = \sqrt{\dfrac{EJ}{ml^3}}$. Znaleźć amplitudę przemieszczenia masy w C.

(The given weightless beam (EA=∞, EJ=const) with two lumped masses is subject to a given harmonic load of a given frequency θ by the formula above. Find the amplitude of the mass at the node C).



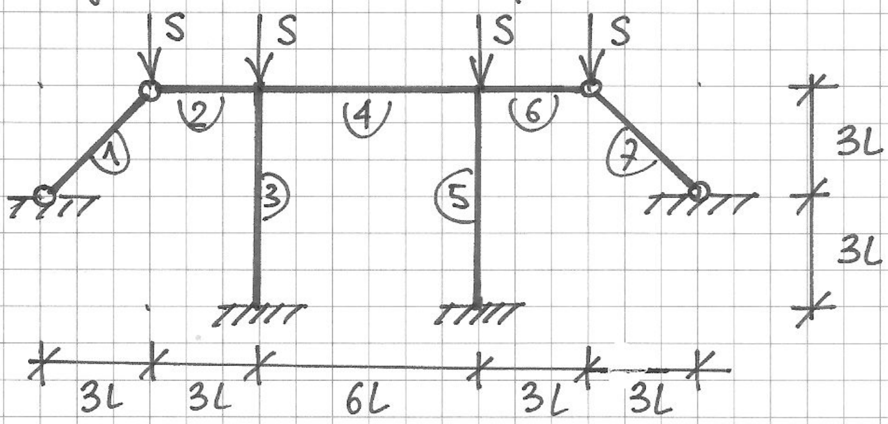
Zadanie 3 Zapisać równania określające amplitudę przemieszczenia masy w C; .
(Write down the equations which make it possible to find the amplitude of the vertical displacement of the node C).

$$\theta = \frac{1}{l^2}\sqrt{\frac{EJ}{\mu}}$$



Egzamin z MK2, 23 VI 2014, zadanie 1

Wyznaczenie DSO w prętach



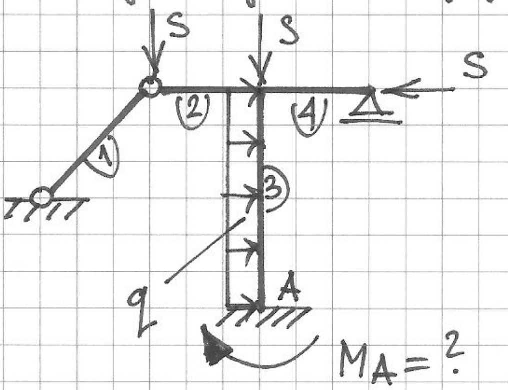
$S_1 = S_7 = \sqrt{2}\,S$

$S_2 = S_6 = S$

$S_3 = S_5 = S$

$S_4 = S$

Korzystamy z antysymetrii obciążenia q



Parametry $\sigma^{(k)}$

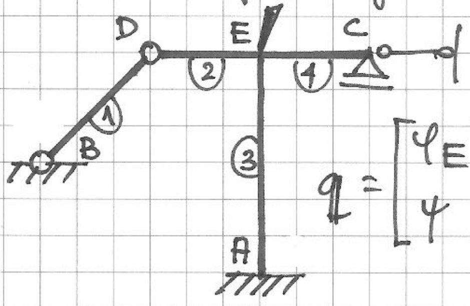
$S_1 = \sqrt{2}\,S \qquad \sigma^{(1)} = 0{,}63$

$S_2 = S \qquad \sigma^{(2)} = 0{,}75$

$S_3 = S \qquad \sigma^{(3)} = 1{,}5$

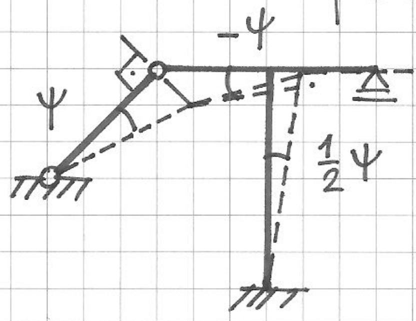
$S_4 = S \qquad \sigma^{(4)} = 0{,}75$

Schemat geometrycznie wyznaczalny



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

Plan przesunięć



Równania równowagi:

$$\Phi_E^{(2)} + \Phi_E^{(3)} + \Phi_E^{(4)} = 0$$

$$\Phi_E^{(2)} \cdot (-\bar{\psi}) + \left[\Phi_A^{(3)} + \Phi_E^{(3)}\right] \cdot \tfrac{1}{2}\bar{\psi} + \sqrt{2}\,S \cdot \sqrt{2} \cdot 3L \cdot \psi \cdot \bar{\psi} + S \cdot 3L \cdot (-\psi) \cdot (-\bar{\psi})$$
$$+ S \cdot 6L \cdot \tfrac{1}{2}\psi \cdot \tfrac{1}{2}\bar{\psi} + q \cdot 6L \cdot 3L \cdot \tfrac{1}{2}\bar{\psi} = 0$$

Wzory transformacyjne:

$$\Phi_E^{(2)} = \frac{EJ}{3l}\left[\alpha'(0{,}75)(\varphi_E + \psi)\right]$$

$$\Phi_E^{(3)} = \frac{EJ}{6l}\left[\alpha(1{,}5)\varphi_E - \vartheta(1{,}5)\cdot\frac{1}{2}\psi\right] + \gamma(1{,}5)\,q\,(6l)^2$$

$$\Phi_A^{(3)} = \frac{EJ}{6l}\left[\beta(1{,}5)\varphi_E - \vartheta(1{,}5)\cdot\frac{1}{2}\psi\right] - \gamma(1{,}5)\,q\,(6l)^2$$

$$\Phi_E^{(4)} = \frac{EJ}{3l}\left[\alpha'(0{,}75)\varphi_E\right]$$

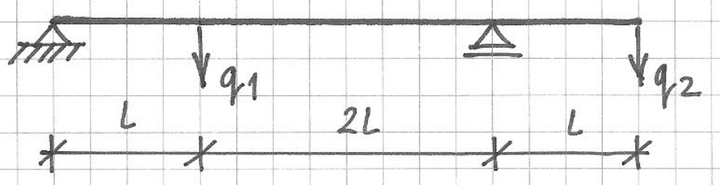
$$\frac{EJ}{l}\begin{bmatrix} 2{,}539 & 0{,}481 \\ 0{,}481 & 0{,}787 \end{bmatrix}\begin{bmatrix} \varphi_E \\ \psi \end{bmatrix} = \begin{bmatrix} -3{,}119 \\ 9 \end{bmatrix} ql^2$$

$$\varphi_E = -3{,}841\,\frac{ql^3}{EJ} \qquad \psi = 13{,}790\,\frac{ql^3}{EJ}$$

$$M_A = \Phi_A^{(3)} = -11{,}083\,ql^2$$

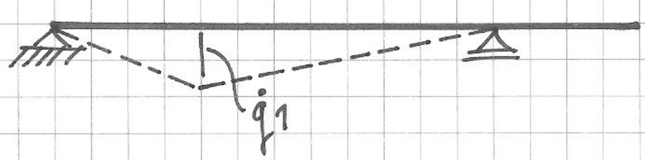
Egzamin z MK2, 23 VI 2016, zadanie 2

Współrzędne Lagrange'a



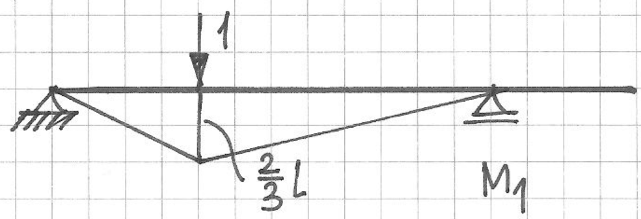
$$\mathbb{q} = \begin{bmatrix} q_1 \\ q_2 \end{bmatrix}$$

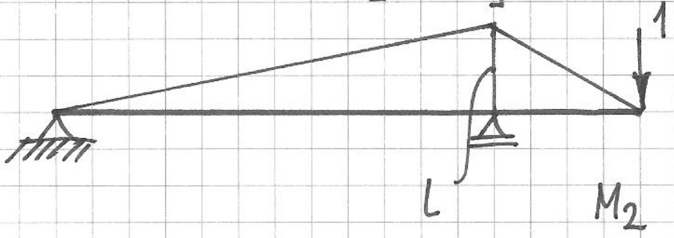
Plany prędkości



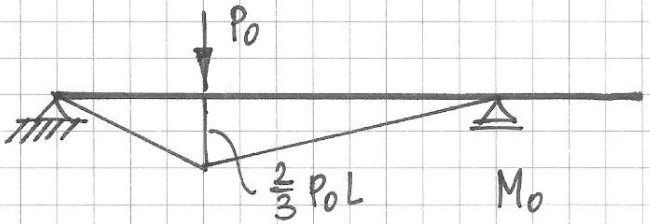
Energia kinetyczna

$$2E_k = m\dot{q}_1^{\,2} + m\dot{q}_2^{\,2} = \dot{\mathbb{q}}^T \mathbb{M} \dot{\mathbb{q}} \qquad \mathbb{M} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} m$$





$$\mathbb{D} = \begin{bmatrix} 0{,}444 & -0{,}444 \\ -0{,}444 & 1{,}333 \end{bmatrix} \frac{L^3}{EJ}$$



$$\mathbb{D}_0 = \begin{bmatrix} 0{,}444 \\ -0{,}444 \end{bmatrix} \frac{P_0 L^3}{EJ}$$

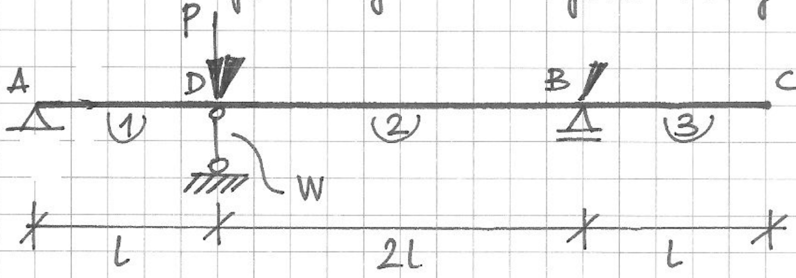
$$\mathbb{I} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\left(\mathbb{I} - \theta^2 \mathbb{D}\mathbb{M}\right)\mathbb{a} = \mathbb{D}_0 \rightarrow \quad \mathbb{a} = \begin{bmatrix} -0{,}129 \\ 1{,}161 \end{bmatrix} \frac{P_0 L^3}{EJ}$$

$\mathbb{a}$ – amplituda $\mathbb{q}$ $\qquad a_2 = 1{,}161 \dfrac{P_0 L^3}{EJ}$

Egzamin z MK 2, 23 VI 2014, zadanie 3

Schemat geometrycznie wyznaczalny $(t=0)$:



$$q = \begin{bmatrix} \varphi_D \\ \varphi_B \\ \frac{W}{L} \end{bmatrix}$$

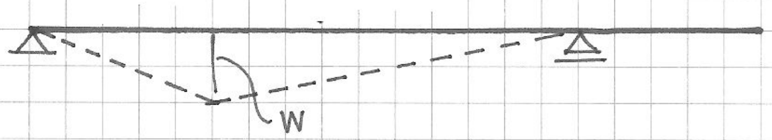
Wartości parametrów $\lambda_K^{\,1}$:

$\lambda_1 = 1$

$\lambda_2 = 2$

$\lambda_3 = 1$

Plan amplitud $(t=0)$:



Równania równowagi:

$$\Phi_D^1 + \Phi_D^2 = 0$$

$$\Phi_B^2 + \Phi_B^3 = 0$$

$$-W_D^1 \cdot \overline{W} - W_D^2 \cdot \overline{W} + P\overline{W} = 0$$

Wzory transformacyjne:

$$\Phi_D^1 = \frac{EJ}{L}\left[\alpha'(1)\varphi_D - \vartheta'(1)\frac{W}{L}\right]$$

$$\Phi_D^2 = \frac{EJ}{2L}\left[\alpha(2)\varphi_D + \beta(2)\varphi_B + \vartheta(2)\frac{W}{2L}\right]$$

$$\Phi_B^2 = \frac{EJ}{2L}\left[\beta(2)\varphi_D + \alpha(2)\varphi_B + \delta(2)\frac{W}{2L}\right]$$

$$\Phi_B^3 = \frac{EJ}{L}\left[\alpha''(1)\varphi_B\right]$$

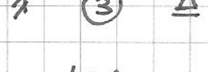
$$W_D^1 = \frac{EJ}{L^2}\left[-\vartheta'(1)\varphi_D + \gamma'(1)\frac{W}{L}\right]$$

$$W_D^2 = \frac{EJ}{4L^2}\left[\vartheta(2)\varphi_D + \delta(2)\varphi_B + \gamma(2)\frac{W}{2L}\right]$$

Amplitudy przemieszczeń (rozwiązanie układu równań równowagi)

$$\varphi_D = -2{,}847\frac{PL^2}{EJ} \qquad \varphi_B = 6{,}481\frac{PL^2}{EJ} \qquad \frac{W}{L} = -4{,}356\frac{PL^2}{EJ}$$

Obliczenie przemieszczenia w_C:

Pręt 3 można analizować przyjmując schemat  i żądając, aby $W_C^3 = 0$.

$$W_C^3 = -\frac{EJ}{L^2}\left[\delta'(1)\varphi_B - \gamma'(1)\frac{w_C}{L}\right] = 0 \longrightarrow w_C = \frac{\delta'(1)}{\gamma'(1)}\varphi_B L = 7{,}128\frac{PL^3}{EJ}$$