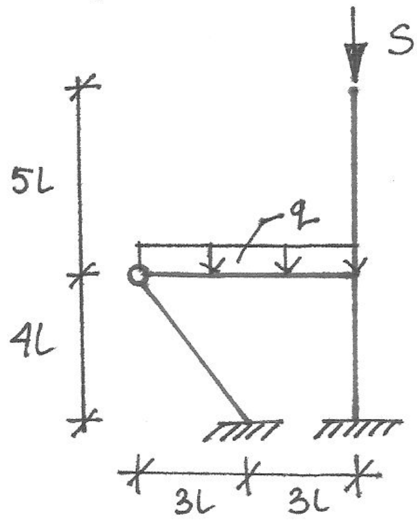
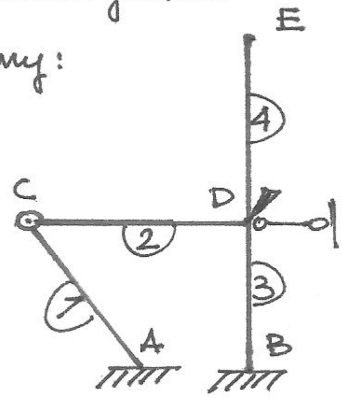
Kolokwium z MK2, 1.3a, r.ak. 2013/2014

Obliczyć moment M_A. $EJ = const.$ $S = \frac{1}{100}\frac{EJ}{L^2}$



Układ geometrycznie wyznaczalny:

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

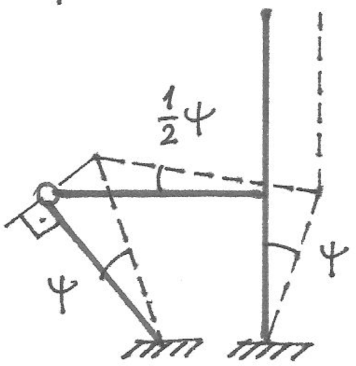


Siły osiowe $S^{(k)}$ i parametry $\sigma^{(k)}$:

$S^{(3)} = S \qquad \sigma^{(3)} = \frac{2}{5}$

$S^{(4)} = S \qquad \sigma^{(4)} = \frac{1}{2}$

Plan przesunięć:



Równania równowagi:

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

$$\Phi_A^{(1)} \cdot \overline{\psi} + \Phi_D^{(2)} \cdot \left(\tfrac{1}{2}\overline{\psi}\right) + \left[\Phi_B^{(3)} + \Phi_D^{(3)}\right]\overline{\psi} + S\psi \cdot 4L \cdot \overline{\psi} - q \cdot 6L \cdot 3L \cdot \tfrac{1}{2}\overline{\psi} = 0$$

Wzory transformacyjne:

$$\Phi_A^{(1)} = \frac{3EJ}{5L}\left[-\psi\right]$$

$$\Phi_D^{(2)} = \frac{3EJ}{6L}\left[\varphi_D - \tfrac{1}{2}\psi\right] + \frac{1}{8}q(6L)^2$$

$$\Phi_B^{(3)} = \frac{EJ}{4L}\left[\beta\left(\tfrac{2}{5}\right)\varphi_D - \vartheta\left(\tfrac{2}{5}\right)\psi\right]$$

$$\Phi_D^{(3)} = \frac{EJ}{4L}\left[\alpha\left(\tfrac{2}{5}\right)\varphi_D - \vartheta\left(\tfrac{2}{5}\right)\psi\right]$$

$$\Phi_D^{(4)} = \frac{EJ}{5L}\left[\alpha^{III}\left(\tfrac{1}{2}\right)\varphi_D\right]$$

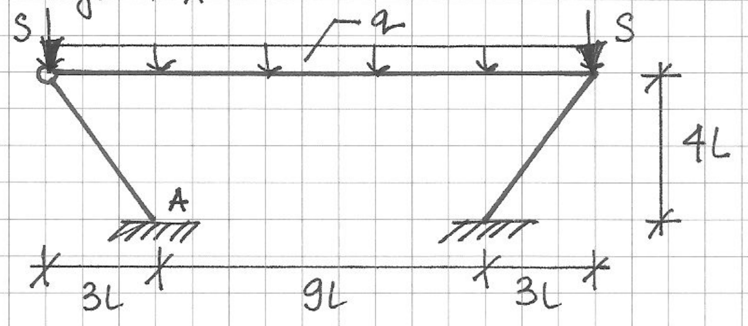
$$\varphi_D = -12{,}612\,\frac{qL^3}{EJ}$$

$$\psi = -7{,}824\,\frac{qL^3}{EJ}$$

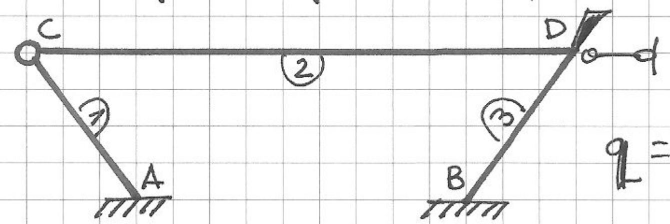
$$M_A = \Phi_A^{(1)} = 4{,}695\,qL^2$$

Kolokwium z MK2, 1.3b, r.ak. 2013/2014

Obliczyć M_A. $EJ = const.$ $S = \frac{1}{16}\frac{EJ}{L^2}$



Schemat geometrycznie wyznaczalny:



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

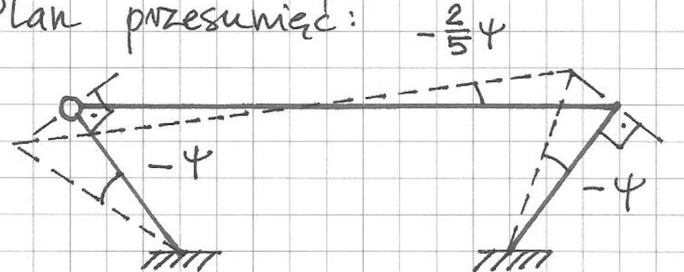
Wartości sił osiowych $S^{(k)}$ i parametrów $\sigma^{(k)}$ w prętach

$S^{(1)} = \frac{5}{4} S$ $\quad \sigma^{(1)} = \frac{5\sqrt{5}}{8}$

$S^{(2)} = -\frac{3}{4} S$ $\quad \sigma^{(2)} = \frac{15\sqrt{5}}{8} i$

$S^{(3)} = \frac{5}{4} S$ $\quad \sigma^{(3)} = \frac{5\sqrt{5}}{8}$

Plan przesunięć:



Równania równowagi:

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

2) $\Phi_A^{(1)} \cdot (-\bar{\psi}) + \Phi_D^{(2)} \cdot (-\frac{2}{5}\bar{\psi})$
$+ \left[\Phi_B^{(3)} + \Phi_D^{(3)}\right] \cdot (-\bar{\psi})$
$+ \frac{5}{4} S \cdot 5L \cdot (-\psi) \cdot (-\bar{\psi}) +$
$+ (-\frac{3}{4} S) \cdot 15L \cdot (-\frac{2}{5}\psi) \cdot (-\frac{2}{5}\bar{\psi})$
$+ \frac{5}{4} S \cdot 5L \cdot (-\psi) \cdot (-\bar{\psi}) = 0$

Uwaga: Praca wirtualna obciążenia q jest zerowa.

Wzory transformacyjne:

$$\Phi_A^{(1)} = \frac{EJ}{5L}\left[\alpha'\left(\frac{5\sqrt{5}}{8}\right)\psi\right]$$

$$\Phi_D^{(2)} = \frac{EJ}{15L}\left[\alpha'\left(\frac{15\sqrt{5}}{8} i\right)\left(\varphi_D + \frac{2}{5}\psi\right)\right] + \gamma'\left(\frac{15\sqrt{5}}{8} i\right) q (15L)^2$$

$$\Phi_B^{(3)} = \frac{EJ}{5L}\left[\beta\left(\frac{5\sqrt{5}}{8}\right)\varphi_D - \vartheta\left(\frac{5\sqrt{5}}{8}\right)(-\psi)\right]$$

$$\Phi_D^{(3)} = \frac{EJ}{5L}\left[\alpha\left(\frac{5\sqrt{5}}{8}\right)\varphi_D - \vartheta\left(\frac{5\sqrt{5}}{8}\right)(-\psi)\right]$$

$$\varphi_D = -29{,}613 \frac{qL^3}{EJ}$$

$$\psi = 7{,}525 \frac{qL^3}{EJ}$$

$$M_A = \Phi_A^{(1)} = 3{,}89\, qL^2$$