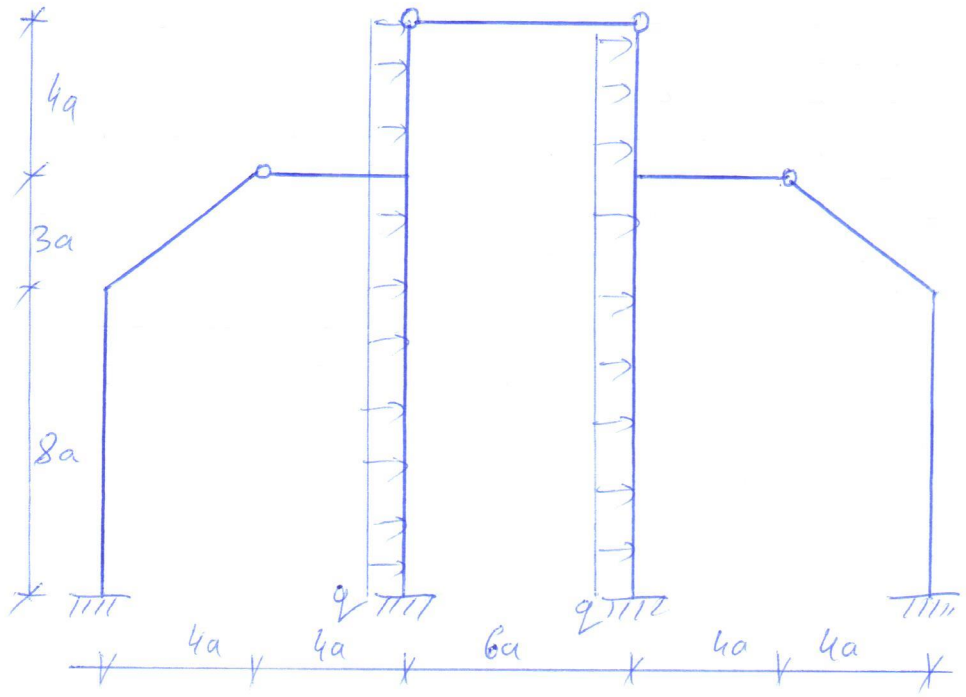
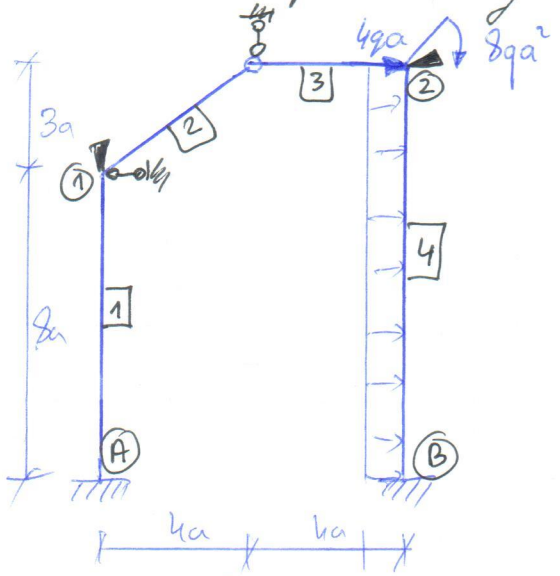
Kolokwium MP 2.3 wt

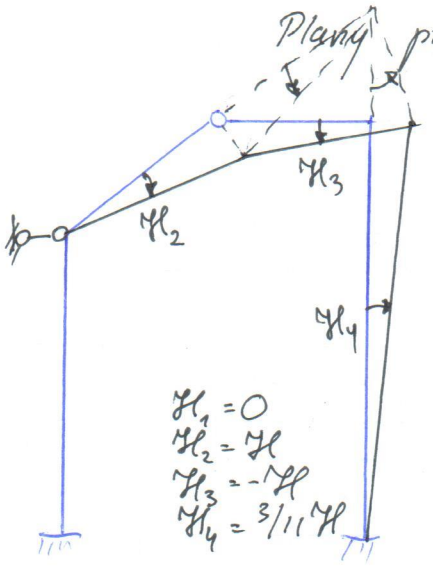
R. Ciubacki

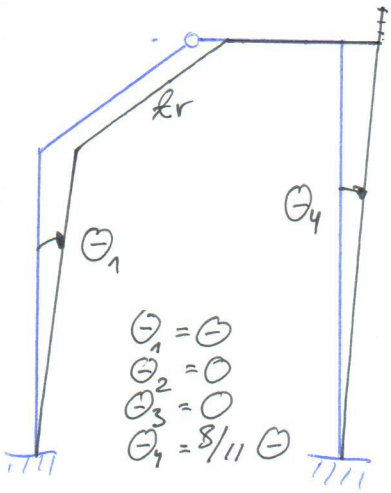


Schemat potrzebny:



Plany przemieszczeń:





$\Psi_1 = \Theta$
$\Psi_2 = \mathcal{H}$
$\Psi_3 = -\mathcal{H}$
$\Psi_4 = 3/11\,\mathcal{H} + 8/11\,\Theta$

1) $\phi_1^1 + \phi_1^2 = 0$

2) $\phi_2^3 + \phi_2^4 - 8qa^2 = 0$

3) $\phi_1^2 \cdot \mathcal{H} + \phi_2^3 \cdot (-\mathcal{H}) + (\phi_B^4 + \phi_2^4)\left(\frac{3}{11}\mathcal{H}\right) + 11qa \cdot \frac{11}{2}a \cdot \frac{3}{11}\mathcal{H} + 4qa \cdot \frac{3}{11}\mathcal{H} - 11a = 0$

4) $(\phi_A^1 + \phi_1^1) \cdot \Theta + (\phi_3^4 + \phi_B^4) \cdot \frac{8}{11}\Theta + 4qa \cdot 11a \cdot \frac{8}{11}\Theta + 11qa \cdot \frac{11}{2}a \cdot \frac{8}{11}\Theta = 0$

$\phi_A^1 = \frac{2EJ}{8a}(\varphi_1 - 3\Theta)$

$\phi_1^1 = \frac{2EJ}{8a}(2\varphi_1 - 3\Theta)$

$\phi_1^2 = \frac{3EJ}{5a}(\varphi_1 - \mathcal{H})$

$\phi_2^3 = \frac{3EJ}{4a}(\varphi_2 + \mathcal{H})$

$\phi_2^4 = \frac{2EJ}{11a}\left(2\varphi_2 - 3\left(\frac{3}{11}\mathcal{H} + \frac{8}{11}\Theta\right)\right] + \frac{q(11a)^2}{12}$

$\phi_B^4 = \frac{2EJ}{11a}\left(\varphi_2 - 3\left(\frac{3}{11}\mathcal{H} + \frac{8}{11}\Theta\right)\right] - \frac{q(11a)^2}{12}$

$$\frac{EJ}{a}\begin{bmatrix} 1.1. & 0 & -0.6 & -0.75 \\ 0 & 1.114 & 0.601 & -0.397 \\ -0.6 & 0.601 & 1.43 & 0.216 \\ -0.75 & -0.397 & 0.216 & 2.077 \end{bmatrix}\begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \mathcal{H} \\ \Theta \end{bmatrix} = \begin{bmatrix} 0 \\ -2.08 \\ 28.5 \\ 76 \end{bmatrix} qa^2$$

$\varphi_1 = 55.6 \cdot \frac{qa^3}{EJ}$

$\varphi_2 = -2.992\,\frac{qa^3}{EJ}$

$\mathcal{H} = 36.58\,\frac{qa^3}{EJ}$

$\Theta = 52.29\,\frac{qa^3}{EJ}$.

$\phi_1^1 = -11.41\,qa^2$

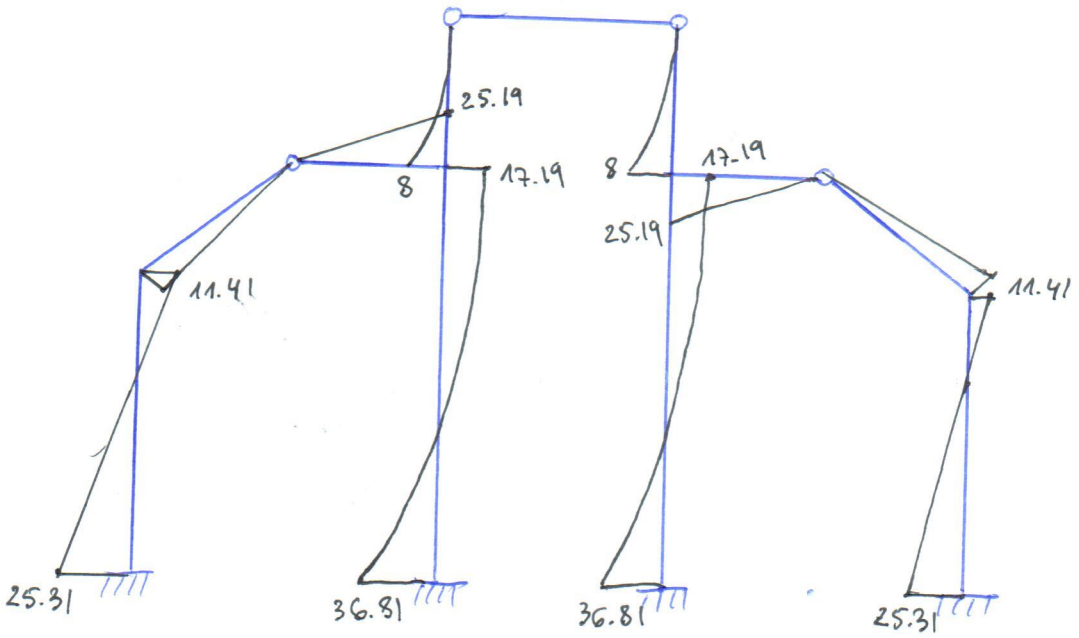
$\phi_B^4 = -36.81\,qa^2$

$\phi_2^3 = 25.19\,qa^2$

$\phi_1^2 = 11.41\,qa^2$

$\phi_2^4 = -17.19\,qa^2$

$\phi_A^1 = -25.31\,qa^2$

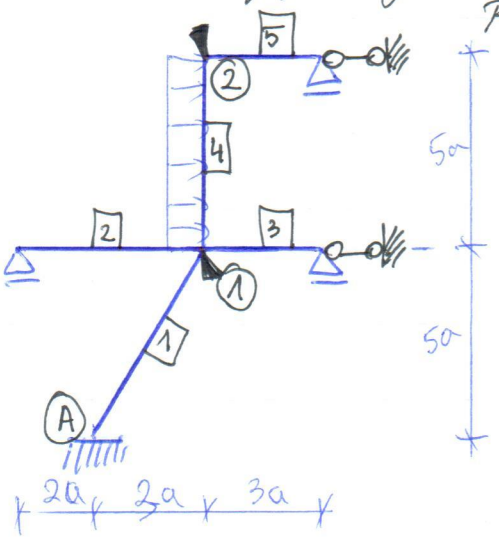


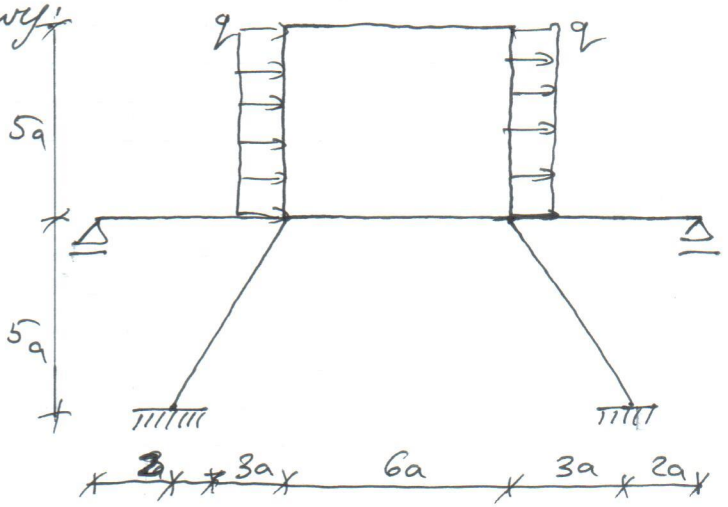
$M\alpha$
$[qa^2]$

R. Czubacki

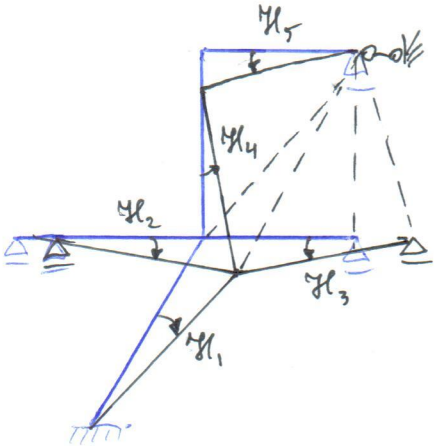
Kolokwium MP 2.3 cz.

Obciążenie antysymetryczne, schemat połówkowy:





Plany przemieszczeń:



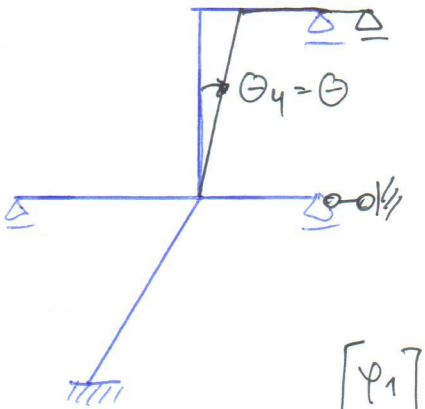
$\mathcal{H}_1 = \mathcal{H}$

$\mathcal{H}_2 = \frac{3}{5}\mathcal{H}$

$\mathcal{H}_3 = -\mathcal{H}$

$\mathcal{H}_4 = -\mathcal{H}$

$\mathcal{H}_5 = -\mathcal{H}$



$$q = \begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \Theta \\ \mathcal{H} \end{bmatrix}$$

$\psi_1 = \mathcal{H}$
$\psi_2^1 = 3/5\,\mathcal{H}$
$\psi_3 = -\mathcal{H}$
$\psi_4 = -\mathcal{H} + \Theta$
$\psi_5 = -\mathcal{H}$

1) $\Phi_1^2 + \Phi_1^4 + \Phi_1^3 + \Phi_1^1 = 0$

2) $\Phi_2^4 + \Phi_2^5 = 0$

3) $(\Phi_1^4 + \Phi_2^4)\bar{\Theta} + 5qa \cdot \frac{5}{2}a \cdot \bar{\Theta} = 0$

4) $(\Phi_R^1 + \Phi_1^1)\bar{\mathcal{H}} + \Phi_1^2 \frac{3}{5}\bar{\mathcal{H}} + \Phi_1^3(-\bar{\mathcal{H}}) + (\Phi_2^4 + \Phi_1^4)(-\bar{\mathcal{H}}) + \Phi_2^5(-\bar{\mathcal{H}}) + 5qa\frac{5}{2}a\,\bar{\mathcal{H}} = 0$

$$\Phi_1^1 = \frac{2EJ}{\sqrt{34}a}(2\varphi_1 - 3\mathcal{H}) \qquad \Phi_1^{04} = -\frac{q(5a)^2}{12} \qquad \Phi_2^{04} = \frac{q(5a)^2}{12}$$

$$\Phi_1^4 = \frac{2EJ}{5a}(2\varphi_1 + \varphi_2 - 3(-\mathcal{H} + \Theta)) + \Phi_1^{04}$$

$$\Phi_1^3 = \frac{3EJ}{3a}(\varphi_1 - (-\mathcal{H}))$$

$$\Phi_1^2 = \frac{3EJ}{5a}(\varphi_1 - \tfrac{3}{5}\mathcal{H})$$

$$\Phi_2^4 = \frac{2EJ}{5a}(\varphi_1 + 2\varphi_2 - 3(-\mathcal{H} + \Theta)) + \Phi_2^{04}$$

$$\Phi_2^5 = \frac{3EJ}{3a}(\varphi_2 - (-\mathcal{H}))$$

$$\Phi_R^1 = \frac{2EJ}{\sqrt{34}a}(\varphi_1 - 3\mathcal{H})$$

$$\frac{EJ}{L}\begin{bmatrix} \frac{12}{5}+\frac{4}{\sqrt{34}} & \frac{2}{5} & -\frac{6}{5} & \frac{11}{5}-\frac{9}{25}-\frac{6}{\sqrt{34}} \\ \frac{2}{5} & \frac{9}{5} & -\frac{6}{5} & \frac{11}{5} \\ -\frac{6}{5} & -\frac{6}{5} & \frac{12}{5} & -\frac{12}{5} \\ \frac{11}{5}-\frac{9}{25}-\frac{6}{\sqrt{34}} & \frac{11}{5} & -\frac{12}{5} & -\frac{577}{125}-\frac{12}{\sqrt{34}} \end{bmatrix} \begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \Theta \\ \mathcal{H} \end{bmatrix} = \begin{bmatrix} \frac{25}{12} \\ -\frac{25}{12} \\ \frac{25}{2} \\ \frac{25}{2} \end{bmatrix} qa^2$$

(1)

$$\begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \ominus \\ \mathcal{H} \end{bmatrix} = \begin{bmatrix} 4.273 \\ -1.259 \\ 13.248 \\ 6.533 \end{bmatrix} \frac{qa^3}{EJ}$$

$\phi_1^1 = -3.791\, qa^2$

$\phi_1^4 = -7.228\, qa^2$

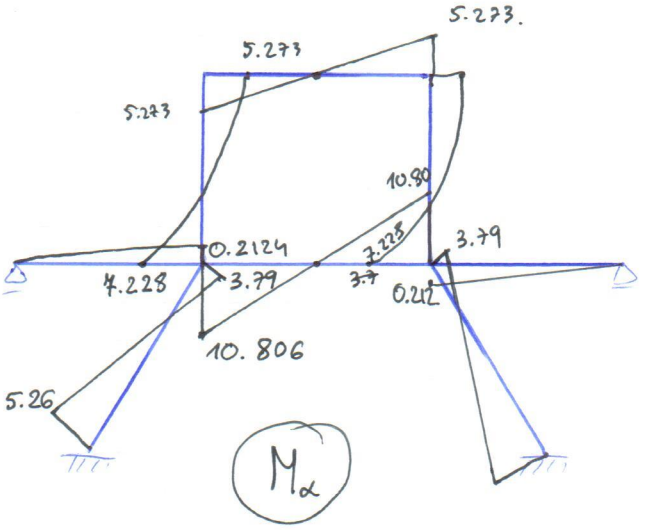
$\phi_1^3 = 10.806\, qa^2$

$\phi_1^2 = 0.212\, qa^2$

$\phi_2^4 = -5.273\, qa^2$

$\phi_2^5 = 5.273\, qa^2$

$\phi_A^1 = -5.257\, qa^2$



$[qa^2]$