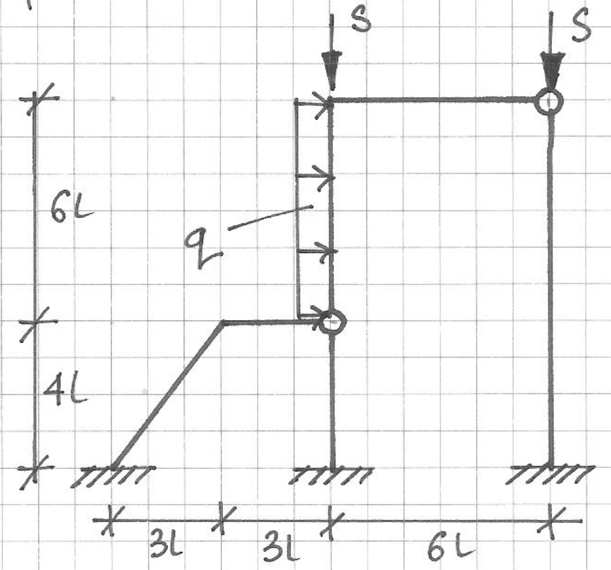
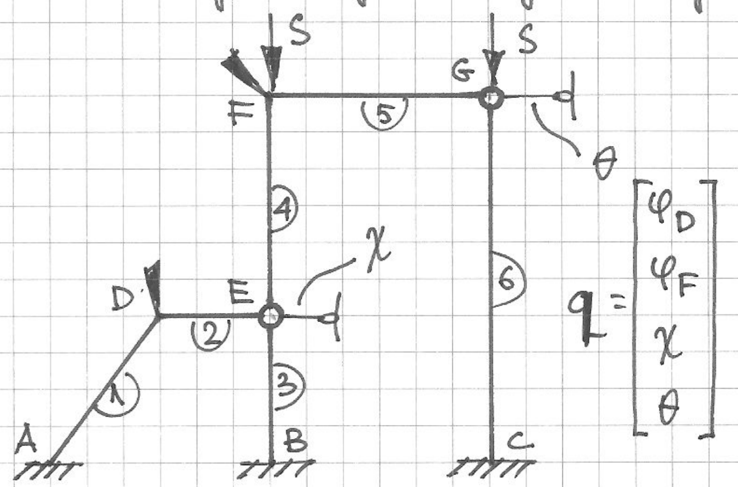
Kolokwium z MK2, 1.2a, r. ak. 2014/2015

Zapisać układ równań Metody Przemieszczeń $EJ = \text{const.}$

$$S = \frac{EJ}{l^2}$$



Układ geometrycznie wyznaczalny:



$$q = \begin{bmatrix} \varphi_D \\ \varphi_F \\ \chi \\ \theta \end{bmatrix}$$

DSO i parametry $\sigma^{(k)}$:

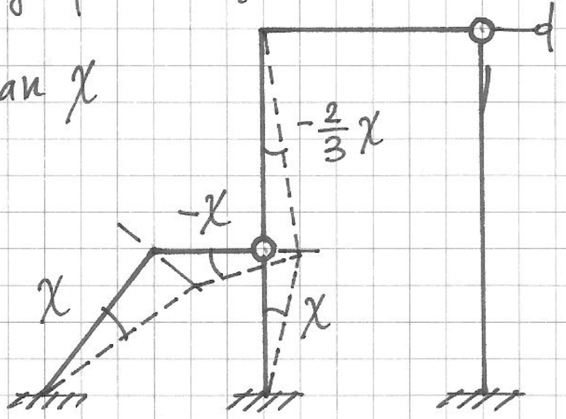
$S^{(3)} = S \qquad \sigma^{(3)} = 4$

$S^{(4)} = S \qquad \sigma^{(4)} = 6$

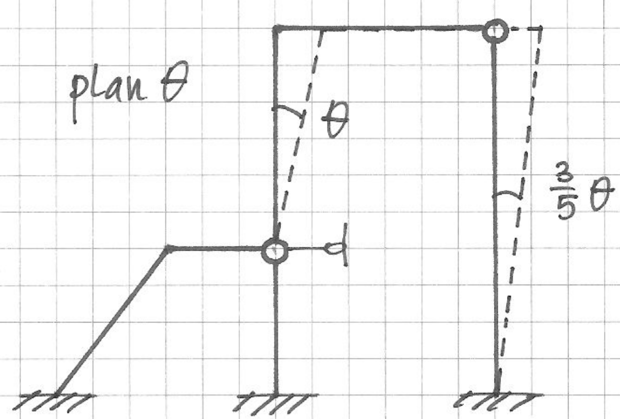
$S^{(6)} = S \qquad \sigma^{(6)} = 10$

Plany przesunięć:

plan χ



plan θ



Równania równowagi:

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

2) $\Phi_F^{(4)} + \Phi_F^{(5)} = 0$

3) $\left[\Phi_A^{(1)} + \Phi_D^{(1)}\right]\cdot\bar{\chi} + \Phi_D^{(2)}\cdot(-\bar{\chi}) + \Phi_B^{(3)}\cdot\bar{\chi} + \Phi_F^{(4)}\cdot\left(-\frac{2}{3}\bar{\chi}\right)$
$+ S\cdot 4l\cdot\chi\cdot\bar{\chi} + S\cdot 6l\cdot\left(-\frac{2}{3}\chi + \theta\right)\cdot\left(-\frac{2}{3}\bar{\chi}\right) + q\cdot 6l\cdot 3l\cdot\frac{2}{3}\bar{\chi} = 0$

4) $\Phi_F^{(4)}\cdot\bar{\theta} + \Phi_C^{(6)}\cdot\frac{3}{5}\bar{\theta} + S\cdot 6l\cdot\left(-\frac{2}{3}\chi + \theta\right)\cdot\bar{\theta} + S\cdot 10l\cdot\frac{3}{5}\theta\cdot\frac{3}{5}\bar{\theta} + q\cdot 6l\cdot 3l\cdot\bar{\theta} = 0$

Wzory transformacyjne:

$$\Phi_A^{(1)} = \frac{2EJ}{5l}\left[\varphi_D - 3\chi\right]$$

$$\Phi_D^{(1)} = \frac{2EJ}{5l}\left[2\varphi_D - 3\chi\right]$$

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

$$\Phi_B^{(3)} = \frac{EJ}{4l}\left[\alpha'(4)(-\chi)\right]$$

$$\Phi_F^{(4)} = \frac{EJ}{6l}\left[\alpha'(6)\left(\varphi_F + \frac{2}{3}\chi - \theta\right)\right] + \gamma'(6)\cdot q\cdot(6l)^2$$

$$\Phi_F^{(5)} = \frac{3EJ}{6l}\left[\varphi_F\right]$$

$$\Phi_C^{(6)} = \frac{EJ}{10l}\left[\alpha'(10)\left(-\frac{3}{5}\theta\right)\right]$$

$$\mathbf{K}(\sigma)\,\mathbf{q} = \mathbf{Q}_0(\sigma)$$

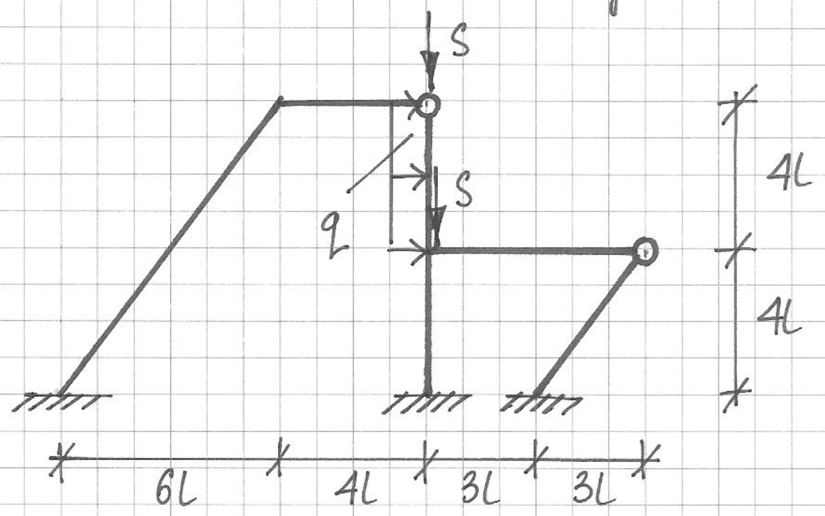
$$\mathbf{K}(\sigma) = \frac{EJ}{l}\left[\begin{array}{c|c|c|c}
\frac{4}{5}+1 & 0 & -\frac{6}{5}+1 & 0 \\
\hline
0 & \frac{1}{6}\alpha'(6)+\frac{1}{2} & \frac{1}{9}\alpha'(6) & -\frac{1}{6}\alpha'(6) \\
\hline
-\frac{2}{5}-\frac{4}{5}+1 & \frac{1}{9}\alpha'(6) & \frac{6}{5}\cdot 2 + 1 + \frac{1}{4}\alpha'(4) + \frac{2}{27}\alpha'(6) - \frac{20}{3}\cdot\sigma^2 & -\frac{1}{9}\alpha'(6) + 4\sigma^2 \\
\hline
0 & -\frac{1}{6}\alpha'(6) & -\frac{1}{9}\alpha'(6) + 4\sigma^2 & \frac{1}{6}\alpha'(6) + \frac{9}{250}\alpha'(10) - \frac{48}{5}\sigma^2
\end{array}\right]$$

$$\mathbf{Q}_0(\sigma) = \begin{bmatrix} 0 \\ -36\gamma'(6) \\ 12 - 24\gamma'(6) \\ 18 + 36\gamma'(6) \end{bmatrix} q l^2$$

Kolokwium z MK2, 1.2b, r. ak. 2014/2015

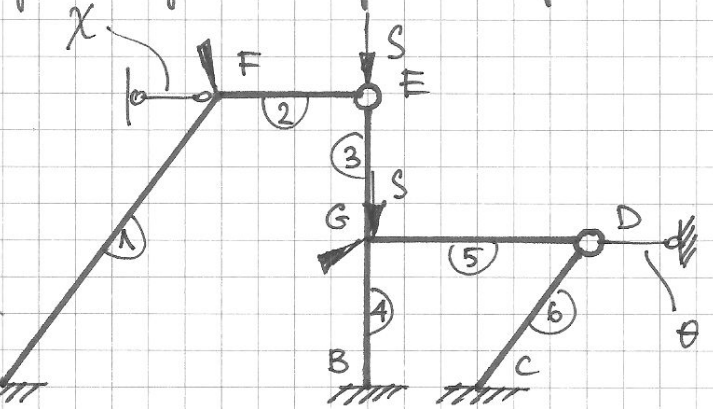
Zapisać układ równań Metody Przemieszczeń $EJ = const.$

$S = \frac{EJ}{L^2}$



Układ geometrycznie wyznaczalny:

$$\mathbf{q} = \begin{bmatrix} \varphi_F \\ \varphi_G \\ \chi \\ \theta \end{bmatrix}$$

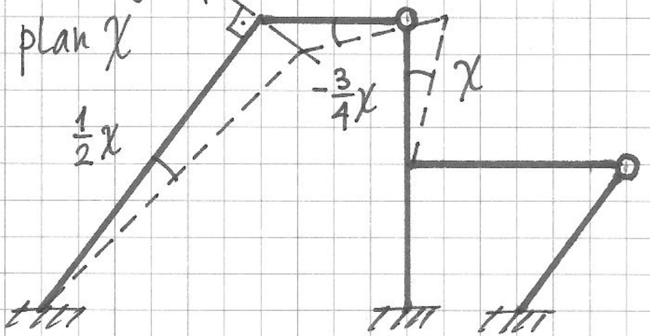


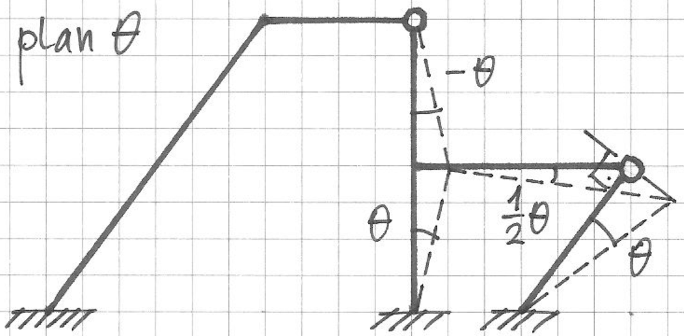
DSO i parametry $\sigma^{(K)}$

$S^{(3)} = S \qquad \sigma^{(3)} = 4$

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

Plany przesunięć:





Równania równowagi:

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

2) $\Phi_G^{(3)} + \Phi_G^{(4)} + \Phi_G^{(5)} = 0$

3) $\left[\Phi_A^{(1)} + \Phi_F^{(1)}\right] \cdot \frac{1}{2}\bar{\chi} + \Phi_F^{(2)} \cdot \left(-\frac{3}{4}\bar{\chi}\right) + \Phi_G^{(3)} \cdot \bar{\chi} + S \cdot 4L \cdot (\chi - \theta) \cdot \bar{\chi}$
$\qquad + q \cdot 4L \cdot 2L \cdot \bar{\chi} = 0$

4) $\Phi_G^{(3)} \cdot (-\bar{\theta}) + \left[\Phi_G^{(4)} + \Phi_B^{(4)}\right] \cdot \bar{\theta} + \Phi_G^{(5)} \cdot \frac{1}{2}\bar{\theta} + \Phi_C^{(6)} \cdot \bar{\theta}$
$\qquad + S \cdot 4L \cdot (\chi - \theta) \cdot (-\bar{\theta}) + 2S \cdot 4L \cdot \theta \cdot \bar{\theta} + q \cdot 4L \cdot 2L \cdot \bar{\theta} = 0$

Wzory transformacyjne:

$$\Phi_A^{(1)} = \frac{2EJ}{10L}\left[\varphi_F - \frac{3}{2}\chi\right]$$

$$\Phi_F^{(1)} = \frac{2EJ}{10L}\left[2\varphi_F - \frac{3}{2}\chi\right]$$

$$\Phi_F^{(2)} = \frac{3EJ}{4L}\left[\varphi_F + \frac{3}{4}\chi\right]$$

$$\Phi_G^{(3)} = \frac{EJ}{4L}\left[\alpha'(4)(\varphi_G - \chi + \theta)\right] + \gamma'(4)\,q\,(4L)^2$$

$$\Phi_G^{(4)} = \frac{EJ}{4L}\left[\alpha(4\sqrt{2})\varphi_G - \vartheta(4\sqrt{2})\theta\right]$$

$$\Phi_B^{(4)} = \frac{EJ}{4L}\left[\beta(4\sqrt{2})\varphi_G - \vartheta(4\sqrt{2})\theta\right]$$

$$\Phi_G^{(5)} = \frac{3EJ}{6L}\left[\varphi_G - \frac{1}{2}\theta\right]$$

$$\Phi_C^{(6)} = \frac{3EJ}{5L}\left[-\theta\right]$$

$$\mathbf{K}(\sigma)\,\mathbf{q} = \mathbf{Q}_0(\sigma)$$