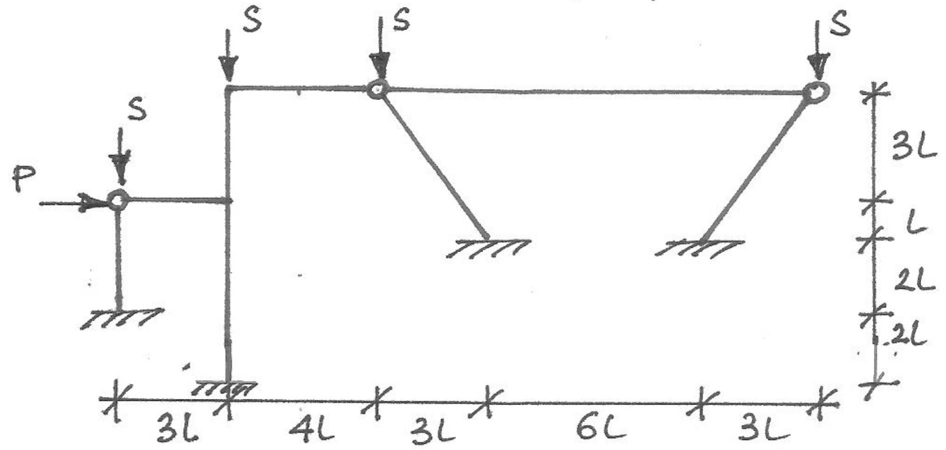
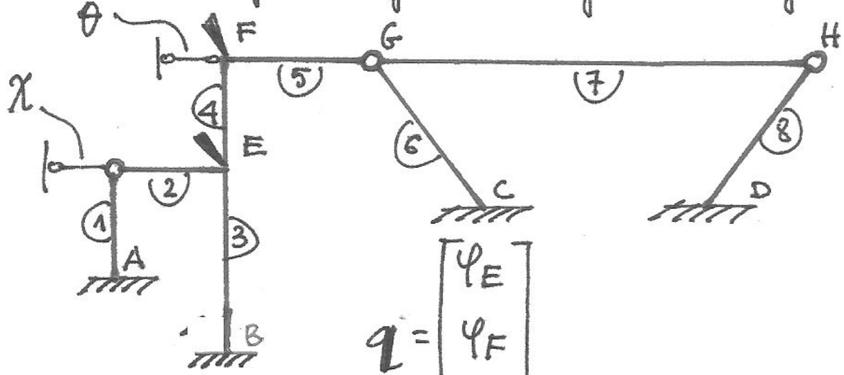
Kolokwium 1.1a (MK2), r.ak. 2014/2015

Zapisać układ równań metody przemieszczeń. $EJ=\text{const}$.



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

Schemat geometrycznie wyznaczalny:



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

$S^{(1)}=S$ $\quad \sigma^{(1)}=3$

$S^{(3)}=S$ $\quad \sigma^{(3)}=5$

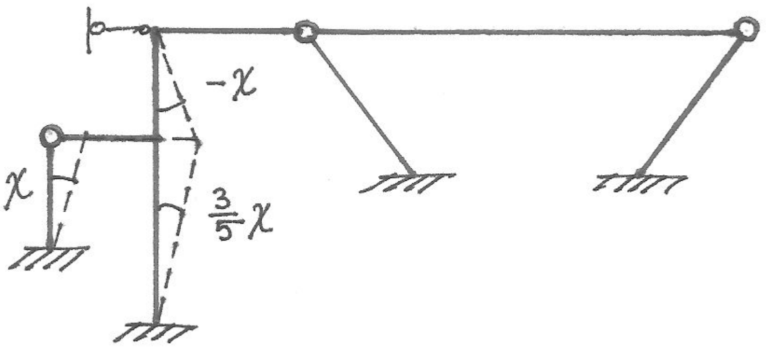
$S^{(4)}=S$ $\quad \sigma^{(4)}=3$

$S^{(6)}=\frac{5}{4}S$ $\quad \sigma^{(6)}=\frac{5\sqrt{5}}{2}$

$S^{(7)}=-\frac{3}{4}S$ $\quad \sigma^{(7)}=6\sqrt{3}\,i$

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

Plan przesunięć χ:



$\psi^{(1)}=\chi$

$\psi^{(2)}=0$

$\psi^{(3)}=\frac{3}{5}\chi$

$\psi^{(4)}=-\chi+\theta$

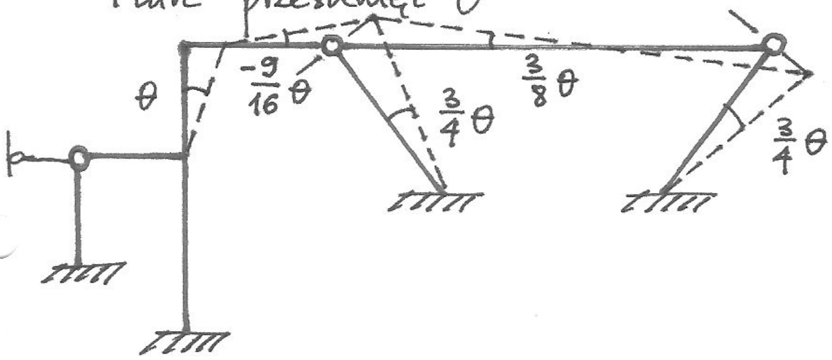
$\psi^{(5)}=-\frac{9}{16}\theta$

$\psi^{(6)}=\frac{3}{4}\theta$

$\psi^{(7)}=\frac{3}{8}\theta$

$\psi^{(8)}=\frac{3}{4}\theta$

Plan przesunięć θ:



Równania równowagi:

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

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

$$\Phi_A^{(1)} \cdot \overline{\chi} + \left[\Phi_B^{(3)} + \Phi_E^{(3)}\right] \cdot \frac{3}{5}\overline{\chi} + \left[\Phi_E^{(4)} + \Phi_F^{(4)}\right] \cdot (-\overline{\chi})$$

$$+ S \cdot \frac{3}{5}\chi \cdot 5L \cdot \frac{3}{5}\overline{\chi} + S \cdot (-\chi + \theta) \cdot 3L \cdot (-\overline{\chi}) + P \cdot 3L \cdot \overline{\chi} = 0$$

$$\left[\Phi_E^{(4)} + \Phi_F^{(4)}\right] \cdot \overline{\theta} + \Phi_F^{(5)} \cdot \left(-\frac{9}{16}\overline{\theta}\right) + \Phi_C^{(6)} \cdot \frac{3}{4}\overline{\theta} + \Phi_D^{(8)} \cdot \frac{3}{4}\overline{\theta}$$

$$+ S \cdot (-\chi + \theta) \cdot 3L \cdot \overline{\theta} + \frac{5}{4} S \cdot \frac{3}{4}\theta \cdot 5L \cdot \frac{3}{4}\overline{\theta} \cdot 2 - \frac{3}{4} S \cdot \frac{3}{8}\theta \cdot 12L \cdot \frac{3}{8}\overline{\theta} = 0$$

Wzory transformacyjne:

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

$$\Phi_E^{(2)} = \frac{3EJ}{3L}\left[\varphi_E\right]$$

$$\Phi_B^{(3)} = \frac{EJ}{5L}\left[\beta(5)\varphi_E - \vartheta(5) \cdot \frac{3}{5}\chi\right]$$

$$\Phi_E^{(3)} = \frac{EJ}{5L}\left[\alpha(5)\varphi_E - \vartheta(5) \cdot \frac{3}{5}\chi\right]$$

$$\Phi_E^{(4)} = \frac{EJ}{3L}\left[\alpha(3)\varphi_E + \beta(3)\varphi_F - \vartheta(5) \cdot (-\chi + \theta)\right]$$

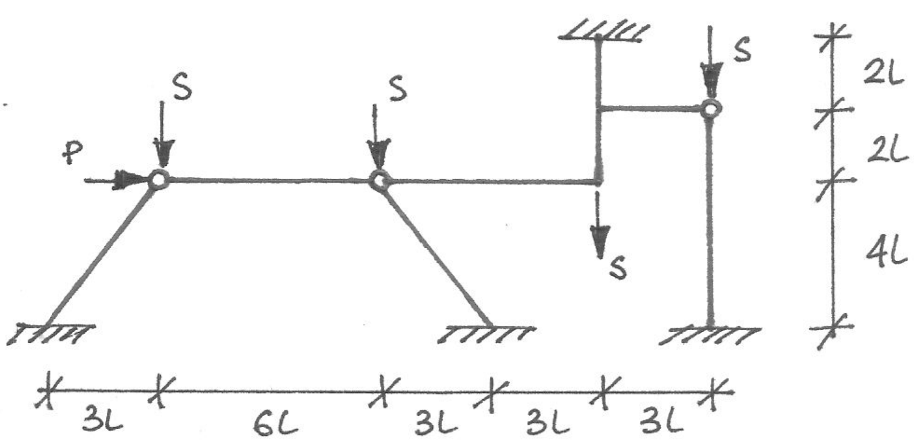
$$\Phi_F^{(4)} = \frac{EJ}{3L}\left[\beta(3)\varphi_E + \alpha(3)\varphi_F - \vartheta(5) \cdot (-\chi + \theta)\right]$$

$$\Phi_C^{(6)} = \frac{EJ}{5L}\left[-\alpha'\left(\frac{5\sqrt{5}}{2}\right) \cdot \frac{3}{4}\theta\right]$$

$$\Phi_D^{(8)} = \frac{EJ}{5L}\left[-\alpha'\left(\frac{5\sqrt{5}}{2}\right) \cdot \frac{3}{4}\theta\right]$$

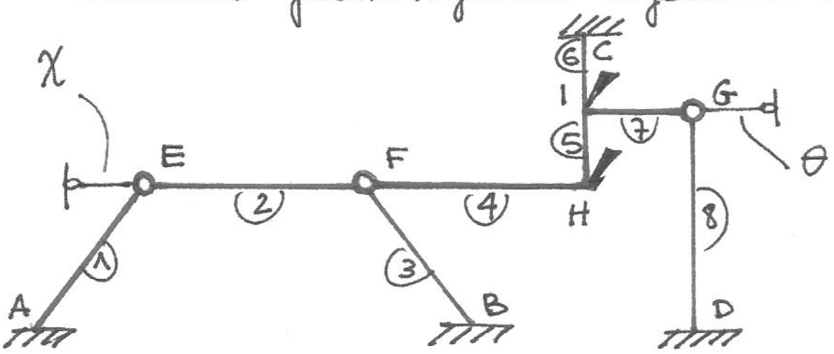
Kolokwium z MK2, 1.1b, r.ak. 2014/2015

Zapisać układ równań metody przemieszczeń. $EJ = const.$



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

Schemat geometrycznie wyznaczalny:



$S^{(1)} = \frac{5}{4} S \qquad \sigma^{(1)} = \frac{5\sqrt{5}}{2}$

$S^{(2)} = \frac{3}{4} S \qquad \sigma^{(2)} = 3\sqrt{3}$

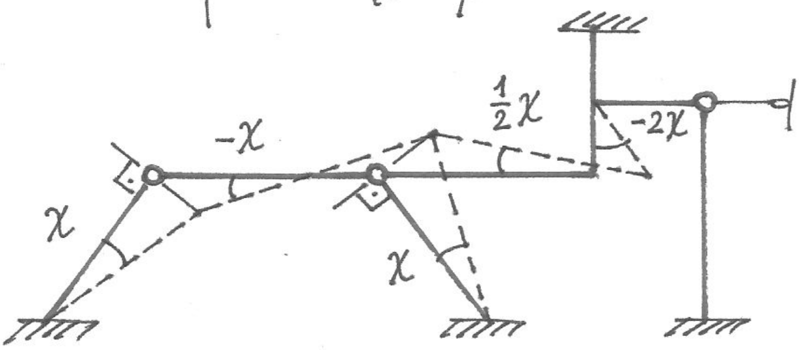
$S^{(3)} = \frac{5}{4} S \qquad \sigma^{(3)} = \frac{5\sqrt{5}}{2}$

$S^{(5)} = -S \qquad \sigma^{(5)} = 2i$

$S^{(6)} = -S \qquad \sigma^{(6)} = 2i$

$S^{(8)} = S \qquad \sigma^{(8)} = 6$

Plan przesunięć χ:



$\psi^{(1)} = \chi$

$\psi^{(2)} = -\chi$

$\psi^{(3)} = \chi$

$\psi^{(4)} = \frac{1}{2}\chi$

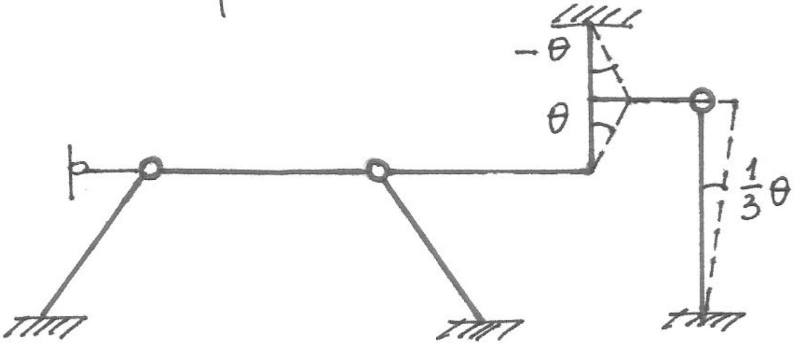
$\psi^{(5)} = -2\chi + \theta$

$\psi^{(6)} = -\theta$

$\psi^{(7)} = 0$

$\psi^{(8)} = \frac{1}{3}\theta$

Plan przesunięć θ:



Równania równowagi:

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

$$\Phi_1^{(5)} + \Phi_1^{(6)} + \Phi_1^{(7)} = 0$$

$$\Phi_A^{(1)} \cdot \bar{\chi} + \Phi_B^{(3)} \cdot \bar{\chi} + \Phi_H^{(4)} \cdot \frac{1}{2}\bar{\chi} + \left[\Phi_H^{(5)} + \Phi_1^{(5)}\right] \cdot (-2\bar{\chi})$$
$$+ \frac{5}{4}S \cdot \chi \cdot 5L \cdot \bar{\chi} \cdot 2 + \frac{3}{4}S \cdot 6L \cdot (-\chi) \cdot (-\bar{\chi}) - S \cdot 2L \cdot (-2\chi + \theta)(-2\bar{\chi})$$
$$+ P \cdot 4L \cdot \bar{\chi} = 0$$

$$\left[\Phi_H^{(5)} + \Phi_1^{(5)}\right] \cdot \bar{\theta} + \left[\Phi_1^{(6)} + \Phi_C^{(6)}\right] \cdot (-\bar{\theta}) + \Phi_D^{(8)} \cdot \frac{1}{3}\bar{\theta}$$
$$- S \cdot 2L \cdot (-2\chi + \theta) \cdot \bar{\theta} - S \cdot 2L \cdot (-\theta) \cdot (-\bar{\theta}) + S \cdot 6L \cdot \frac{1}{3}\theta \cdot \frac{1}{3}\bar{\theta} = 0$$

Wzory transformacyjne:

$$\Phi_A^{(1)} = \frac{EJ}{5L}\left[-\alpha'\left(\frac{5\sqrt{5}}{2}\right) \cdot \chi\right]$$

$$\Phi_B^{(3)} = \frac{EJ}{5L}\left[-\alpha'\left(\frac{5\sqrt{5}}{2}\right) \cdot \chi\right]$$

$$\Phi_H^{(4)} = \frac{3EJ}{6L}\left[\varphi_H - \frac{1}{2}\chi\right]$$

$$\Phi_H^{(5)} = \frac{EJ}{2L}\left[\hat{\alpha}(2)\varphi_H + \hat{\beta}(2)\varphi_1 - \hat{\vartheta}(2)(-2\chi + \theta)\right]$$

$$\Phi_1^{(5)} = \frac{EJ}{2L}\left[\hat{\beta}(2)\varphi_H + \hat{\alpha}(2)\varphi_1 - \hat{\vartheta}(2)(-2\chi + \theta)\right]$$

$$\Phi_1^{(6)} = \frac{EJ}{2L}\left[\hat{\alpha}(2)\varphi_1 - \hat{\vartheta}(2)(-\theta)\right]$$

$$\Phi_C^{(6)} = \frac{EJ}{2L}\left[\hat{\beta}(2)\varphi_1 - \hat{\vartheta}(2)(-\theta)\right]$$

$$\Phi_D^{(8)} = \frac{EJ}{6L}\left[\alpha'(6)\left(-\frac{1}{3}\theta\right)\right]$$