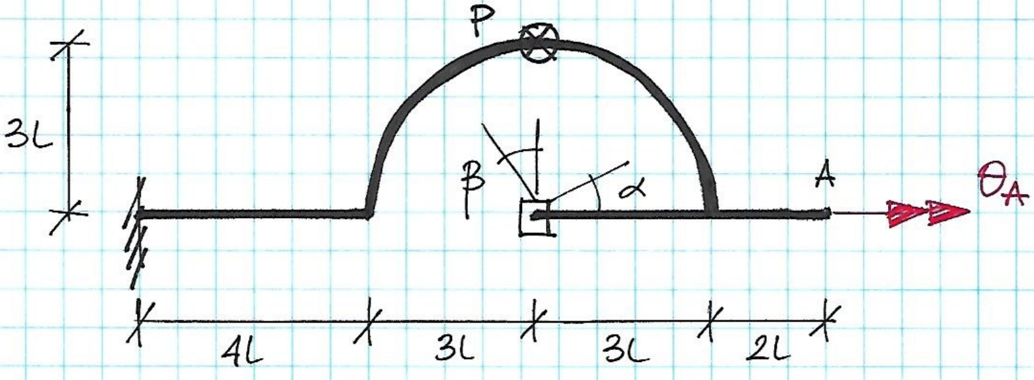
Kolokwium IPB/BZ 19 IV 2018

Oblicz kąt obrotu Θ_A. $\frac{1}{2}EJ = GJ_s$

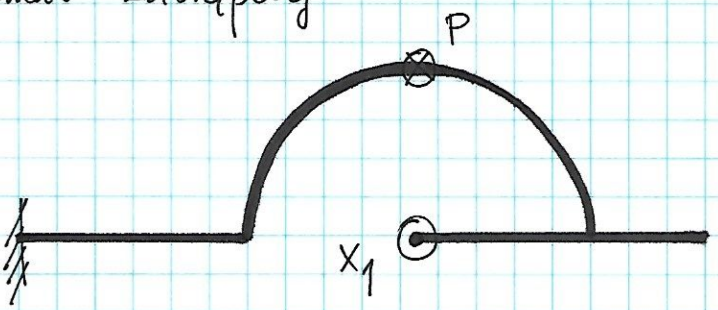


$\alpha \in (0, \frac{1}{2}\pi)$

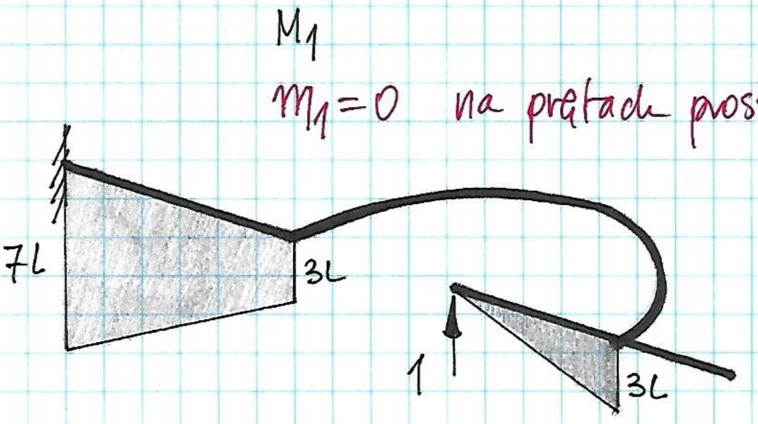
$\beta \in (0, \frac{1}{2}\pi)$

$\beta = \alpha - \frac{1}{2}\pi$

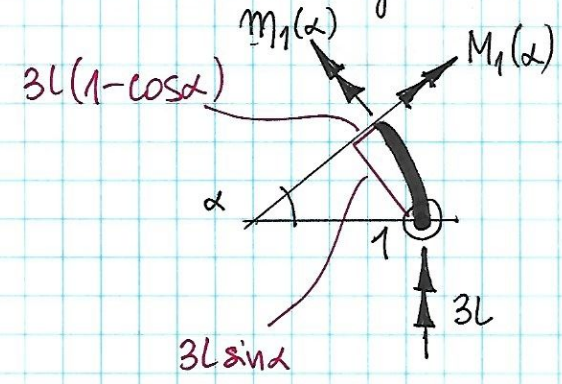
Schemat zastępczy



$X_1 = 1$



Łuk kołowy

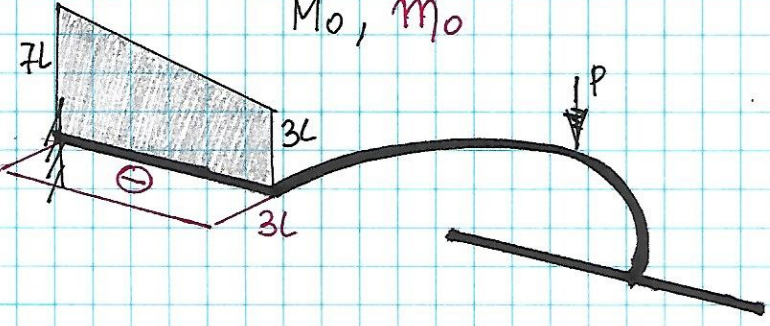


$$M_1(\alpha) = 0 \quad , \quad \mathcal{M}_1(\alpha) = -3L$$

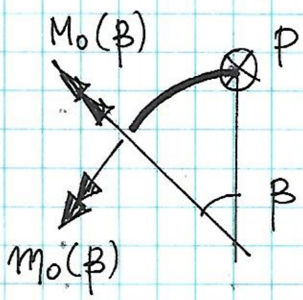
$$\delta_{11} = \frac{1}{EJ}\left[114{,}33\, L^3\right] + \frac{1}{GJ_s}\left[84{,}82\, L^3\right] = 283{,}98\,\frac{L^3}{EJ}$$

Stan "0"

M_0, $\mathfrak{M}_0$



Łuk kołowy



$$M_0(\beta) = -3PL\cos\beta$$

$$\mathfrak{M}_0(\beta) = 3PL(1-\cos\beta)$$

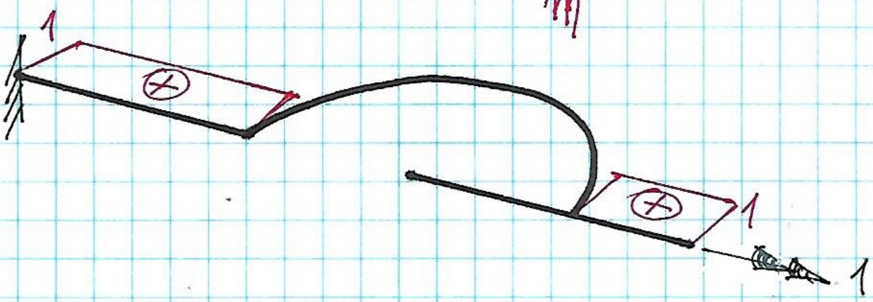
$$\delta_{10} = \frac{1}{EJ}\left[-105{,}33\,PL^3\right] + \frac{1}{GJ_s}\left[-15{,}411\,PL^3\right] = -136{,}16\,\frac{PL^3}{EJ}$$

$$X_1 = 0{,}48\,P$$

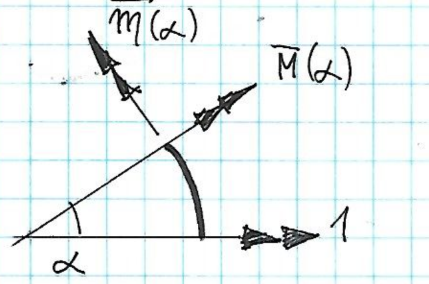
Obciążenie momentem jednostkowym w punkcie A zgodnie z założonym zwrotem kąta θ_A

$\overline{M} = 0$ na prętach prostych

$\overline{\mathfrak{M}}$



Łuk kołowy



$$\overline{M}(\alpha) = -\cos\alpha \quad , \quad \overline{M}(\beta) = \overline{M}\left(\alpha - \tfrac{1}{2}\pi\right)$$

$$\overline{\mathfrak{M}}(\alpha) = \sin\alpha \quad , \quad \overline{\mathfrak{M}}(\beta) = \overline{\mathfrak{M}}\left(\alpha - \tfrac{1}{2}\pi\right)$$

$$\theta_A = \frac{1}{EJ}\int_{łuk}(M_1X_1 + M_0)\overline{M}\,ds + \frac{1}{GJ_s}\int_{łuk}(\mathfrak{M}_1X_1 + \mathfrak{M}_0)\overline{\mathfrak{M}}\,ds = -27{,}08\,\frac{PL^3}{EJ}$$

Opracował Szymon Spodzieja