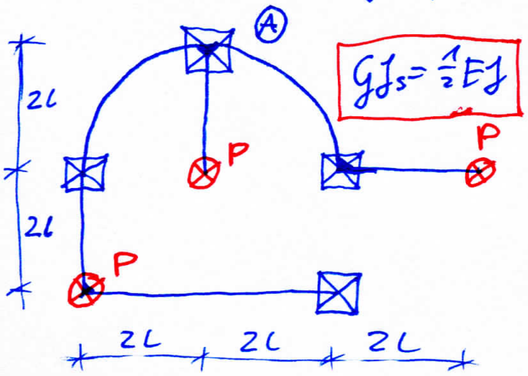
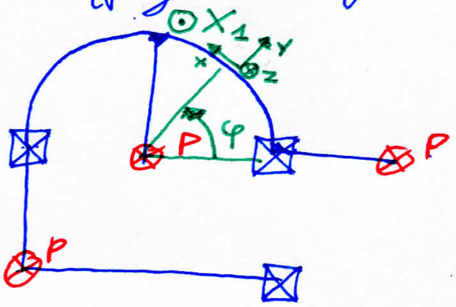
KOLOKWIUM MK IPB RA. 2018/19, termin podstawowy.

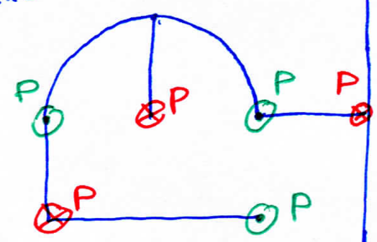
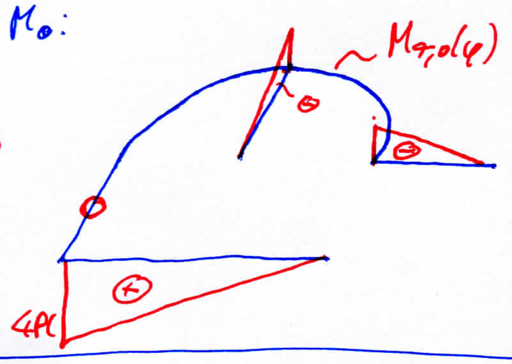
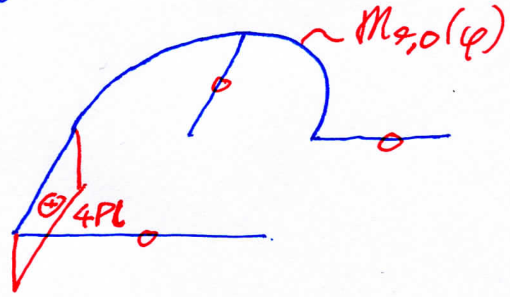
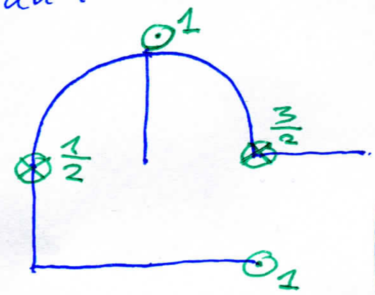
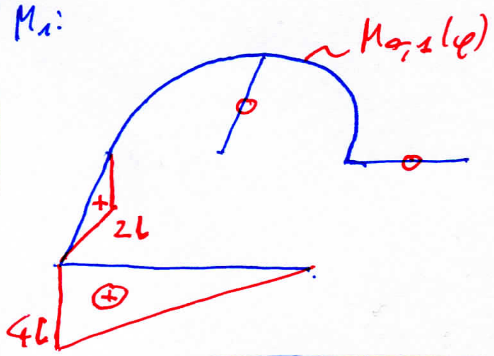
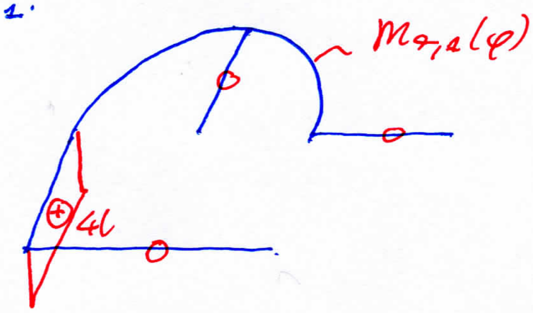
Oblicz reakcję w podporze (A):



Schemat zastępczy stat. wyzn.:



Układ biegunowy: $\varphi \in [0,\pi]$

Reakcje, obciążenia	M:	𝔐:
Stan "0" 	M_0: 	$\mathfrak{M}_0$: 
Stan "1" 	M_1: 	$\mathfrak{M}_1$: 

gdzie:

$$M_{\alpha,0}(\varphi) = -2Pl\cdot\sin\varphi \quad \text{dla } \varphi\in[0,\pi]$$

$$\mathfrak{M}_{\alpha,0}(\varphi) = \begin{cases} -2Pl\cos\varphi & \text{dla } \varphi\in[0,\frac{\pi}{2}] \\ -2Pl\cos\varphi + 2Pl & \text{dla } \varphi\in[\frac{\pi}{2},\pi] \end{cases}$$

$$M_{\alpha,1}(\varphi) = \begin{cases} -\frac{3}{2}\cdot 2l\cdot\sin\varphi & \text{dla } \varphi\in[0,\frac{\pi}{2}] \\ -\frac{3}{2}\cdot 2l\cdot\sin\varphi + 1\cdot 2l\cdot\sin(\varphi-\frac{\pi}{2}) & \text{dla } \varphi\in(\frac{\pi}{2},\pi] \end{cases}$$

$$\mathfrak{M}_{\alpha,1}(\varphi) = \begin{cases} \frac{3}{2}\cdot 2l\cdot(1-\cos\varphi) & \text{dla } \varphi\in[0,\frac{\pi}{2}] \\ \frac{3}{2}\cdot 2l(1-\cos\varphi) - 1\cdot 2l[1-\cos(\varphi-\frac{\pi}{2})] & \varphi\in[\frac{\pi}{2},\pi] \end{cases}$$

$$\delta_{11} = \frac{1}{EJ}\left(\frac{1}{2}\cdot 4l\cdot 4l\right)\left(+\frac{2}{3}\cdot 4l\right) + \frac{1}{EJ}\left(\frac{1}{2}\cdot 2l\cdot 2l\right)\left(+\frac{2}{3}\cdot 2l\right) + \frac{1}{EJ}\int_0^{\frac{\pi}{2}}[M_{\alpha,1}(\varphi)]^2\cdot \overset{2l}{R}\,d\varphi + \frac{1}{EJ}\int_{\frac{\pi}{2}}^{\pi}[M_{\alpha,1}(\varphi)]^2\cdot \overset{2l}{R}\,d\varphi +$$

$$+ \frac{1}{\underset{\frac{1}{2}EJ}{GJ_s}}(4l\cdot 2l)(+4l) + \frac{1}{\underset{\frac{1}{2}EJ}{GJ_s}}\int_0^{\frac{\pi}{2}}[\mathfrak{M}_{\alpha,1}(\varphi)]^2\cdot \overset{2l}{R}\,d\varphi + \frac{1}{\underset{\frac{1}{2}EJ}{GJ_s}}\int_{\frac{\pi}{2}}^{\pi}[\mathfrak{M}_{\alpha,1}(\varphi)]^2\cdot \overset{2l}{R}\,d\varphi = 234.504\frac{l^3}{EJ}$$

$$\delta_{10} = \frac{1}{EJ}\left(\frac{1}{2}\cdot 4Pl\cdot 4l\right)\left(+\frac{2}{3}\cdot 4l\right) + \frac{1}{EJ}\int_0^{\frac{\pi}{2}} M_{\alpha,1}(\varphi)\cdot M_{\alpha,0}(\varphi)\,\overset{2l}{R}\,d\varphi + \frac{1}{EJ}\int_{\frac{\pi}{2}}^{\pi} M_{\alpha,1}(\varphi)\cdot M_{\alpha,0}(\varphi)\,\overset{2l}{R}\,d\varphi +$$

$$+ \frac{1}{\underset{\frac{1}{2}EJ}{GJ_s}}(4Pl\cdot 2l)\cdot(+4l) + \frac{1}{\underset{\frac{1}{2}EJ}{GJ_s}}\int_0^{\frac{\pi}{2}} \mathfrak{M}_{\alpha,1}(\varphi)\cdot\mathfrak{M}_{\alpha,0}(\varphi)\cdot \overset{2l}{R}\,d\varphi + \frac{1}{\underset{\frac{1}{2}EJ}{GJ_s}}\int_{\frac{\pi}{2}}^{\pi} \mathfrak{M}_{\alpha,1}(\varphi)\cdot\mathfrak{M}_{\alpha,0}(\varphi)\cdot \overset{2l}{R}\,d\varphi =$$

$$= 182.448\frac{Pl^3}{EJ}$$

Równanie metody sił: $\delta_{11}X_1 + \delta_{10} = 0 \Rightarrow X_1 = \boxed{-0.778P = R_A}$ ~ reakcja w dół.

Przygotował: Karol Bołbotowski