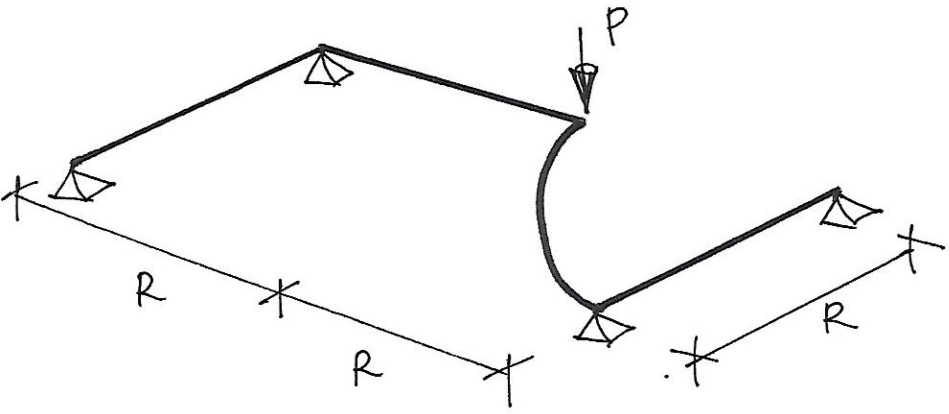
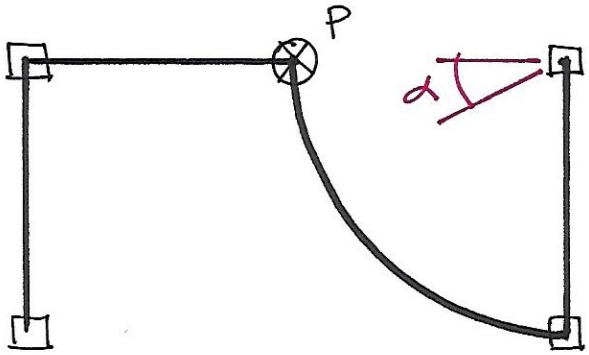
Test 1.2 15 VI 2018

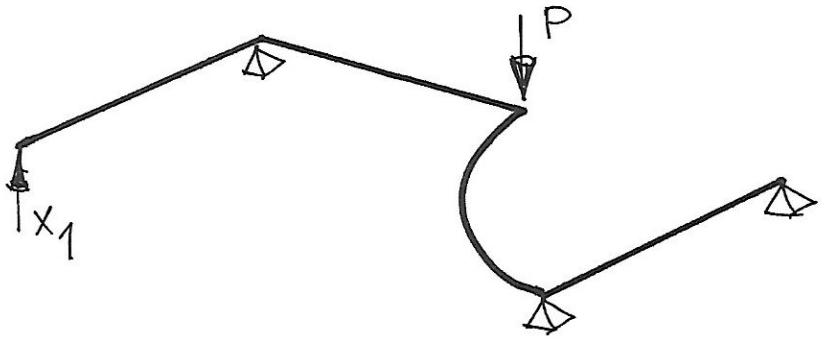
Calculate the reactions. $EJ = GJ_s$



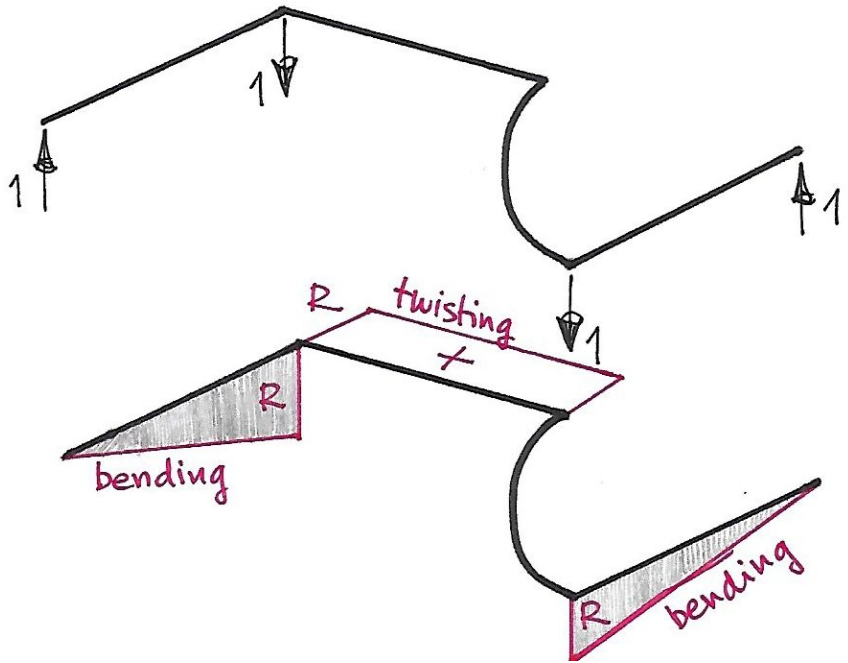


Statical indeterminacy of the grillage is 1.

Primary structure:

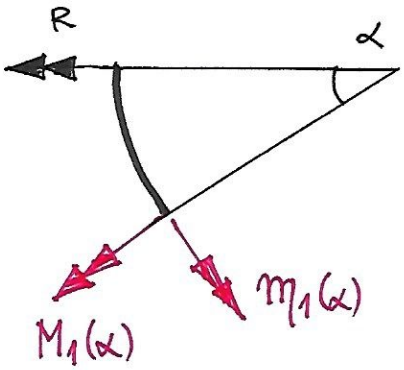


$X_1 = 1$



Reactions

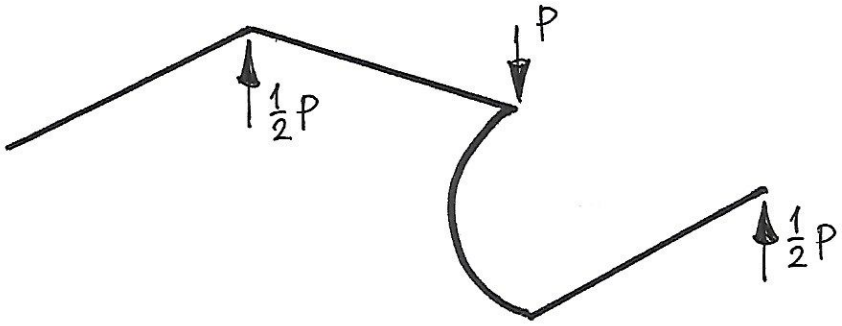
Diagrams of moments on straight members



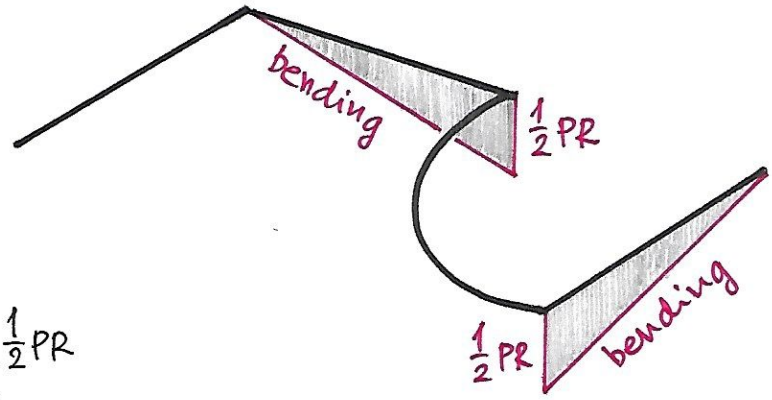
Functions of moments on the curved part.

$$M_1(\alpha) + R\cos\alpha = 0 \rightarrow M_1(\alpha) = -R\cos\alpha$$
$$m_1(\alpha) - R\sin\alpha = 0 \rightarrow m_1(\alpha) = R\sin\alpha$$
$$\alpha \in (0, \tfrac{\pi}{2})$$

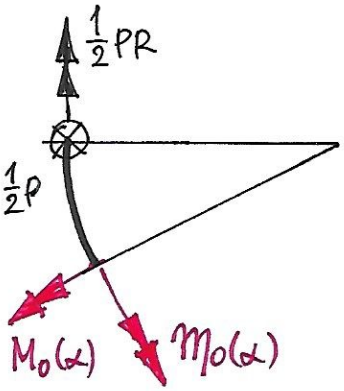
"0"



Reactions



Diagrams of moments on straight members



Functions of moments on the curved part.

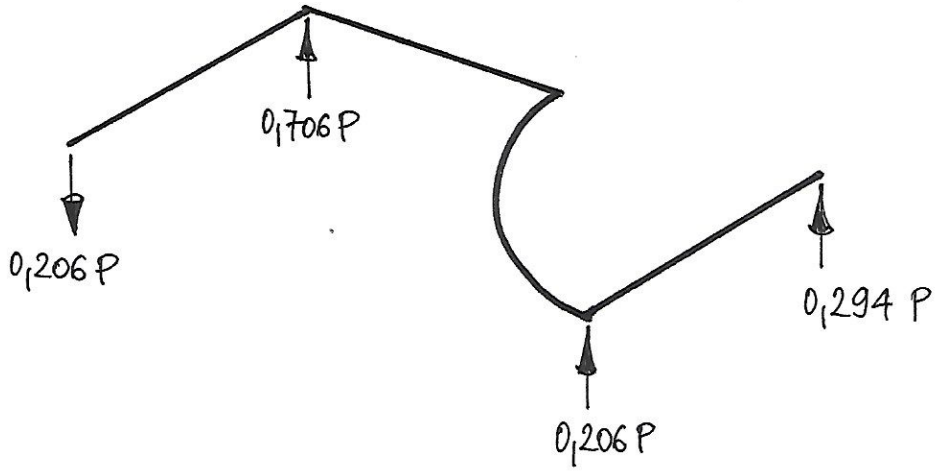
$$M_0(\alpha) + \tfrac{1}{2}P \cdot R\sin\alpha - \tfrac{1}{2}PR\sin\alpha = 0 \rightarrow M_0(\alpha) = 0$$
$$m_0(\alpha) - \tfrac{1}{2}P \cdot R(1-\cos\alpha) - \tfrac{1}{2}PR\cos\alpha = 0 \rightarrow m_0(\alpha) = \tfrac{1}{2}PR$$

$$\delta_{11} = \frac{1}{EJ}\left[\frac{1}{2}R \cdot R \cdot \frac{2}{3}R \cdot 2 + \int_0^{\pi/2} (-R\cos\alpha)^2 R\,d\alpha\right] +$$
$$\frac{1}{GJ_s}\left[R \cdot R \cdot R + \int_0^{\pi/2} (R\sin\alpha)^2 R\,d\alpha\right] = 3{,}237\,\frac{R^3}{EJ}$$

$$\delta_{10} = \frac{1}{EJ}\left[\frac{1}{2}R \cdot R \cdot \frac{2}{3} \cdot \frac{1}{2}PR\right] + \frac{1}{GJ_s}\left[\int_0^{\pi/2} R\sin\alpha \cdot \frac{1}{2}PR \cdot R\,d\alpha\right] = 0{,}667\,\frac{PR^3}{EJ}$$

$$X_1 = -\frac{\delta_{10}}{\delta_{11}} = -0{,}206\ P$$

Reactions in statically indeterminate structure calculated by the superposition principle.



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