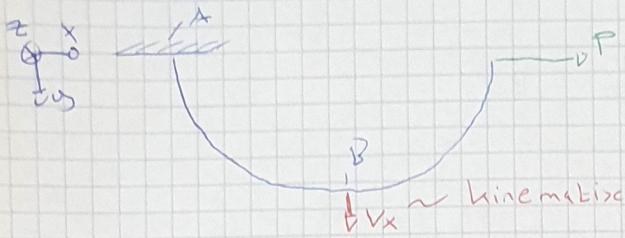
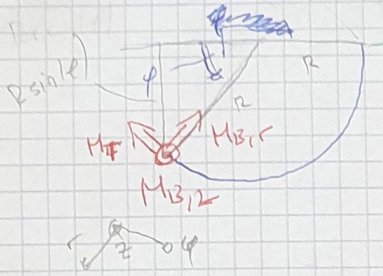
Serie 12: [S1]

1) Wahl eines stat. bestimmten Systems



~ kinematische Bedingung $V_x = 0$

2) LF0 - reale Lasten → M_0, T_0

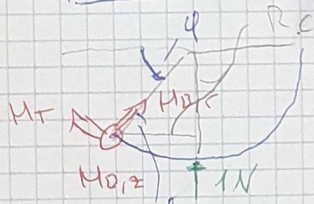


$\sum M_r^{\text{im Schnittufer}}: \quad M_{B,r} = 0$

$\sum M_\varphi^{\text{im Schnittufer}}: \quad M_T = 0$

$\sum M_z^{\text{im Schnittufer}}: \quad M_{B,z}^0 = R \sin(\varphi) \cdot P$

3) LF1 - Hilfskraft am ersetzten Lager mit Betrag 1 N → M_1, T_1



→ $M_{B,r} = 0$ → $M_T = 0$

$\sum M_z^{\text{im Schnittufer}}: \quad M_{B,z}^1 = -1 \cdot R \cos(\varphi)$

4) $\delta_{10} = \int_L \frac{M_z^0 M_z^1}{EI_z} dx = \frac{1}{EI_z} \int_0^{\pi/2} M_{B,z}^0 \cdot M_{B,z}^1 \, R \, d\varphi$

$= -\frac{1}{EI_z} \int_0^{\pi/2} R \sin(\varphi) \cdot P R \cos(\varphi) \, R \, d\varphi$ Integralbeziehen

$= -\frac{PR^3}{EI_z} \int_0^{\pi/2} \sin(\varphi) \cos(\varphi) \, d\varphi = -\frac{PR^3}{2EI_z}$

$\delta_{11} = \int_L \frac{M_z^1 M_z^1}{EI_z} dx = \frac{1}{EI_z} \int_0^{\pi/2} (M_{B,z}^1)^2 \, R \, d\varphi = \frac{1}{EI_z} \int_0^{\pi/2} R^2 \cos^2(\varphi) \, R \, d\varphi$

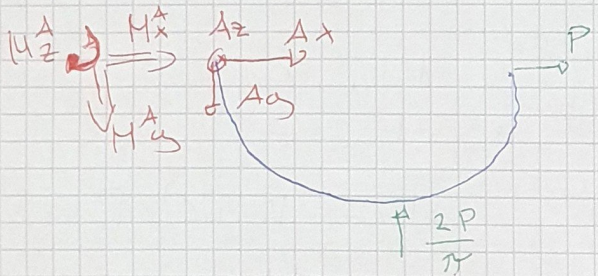
$= \frac{R^3}{EI_z} \int_0^{\pi/2} \cos^2(\varphi) \, d\varphi = \frac{\pi}{4} \frac{R^3}{EI} \rightarrow$

5.) Lagerbedingung

$$V_X = \delta_{10} + X \cdot \delta_{11} = 0 \quad \rightarrow \quad X = -\frac{\delta_{10}}{\delta_{11}}$$

$$X = + \frac{PR^3}{2EI_z} \cdot \frac{4}{\pi} \cdot \frac{EI_z}{R^3} = \boxed{\frac{2P}{\pi} = B_y}$$

6.) restliche Lagerkräfte:



$$\sum F_x: \quad A_x = -P$$

$$\sum F_y: \quad A_y = \frac{2P}{\pi}$$

$$\sum F_z: \quad A_z = 0$$

$$\sum M_x^{in A}: \quad M_x^A = 0$$

$$\sum M_y^{in A}: \quad M_y^A = 0$$

$$\sum M_z^{in A}: \quad M_z^A = \frac{2PR}{\pi}$$