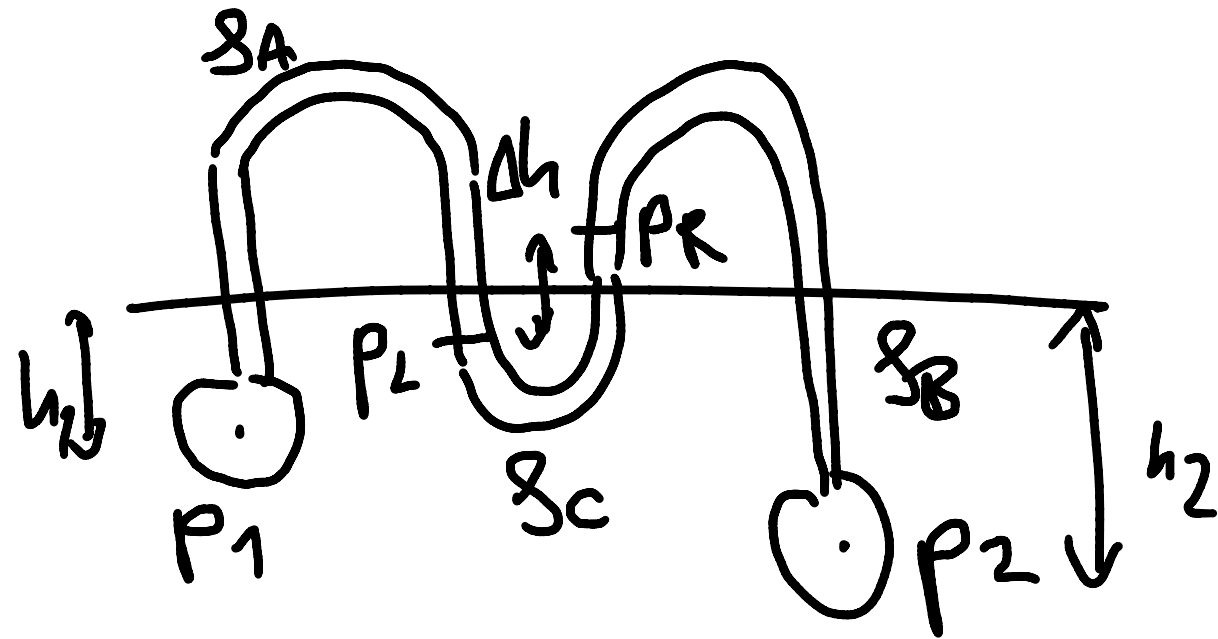


U-Rohrmanometer



$$\nabla p = \rho \vec{g}$$
$$\underline{\underline{p + \rho g z = \text{const}}}$$

$$\text{ges: } p_1 - p_2$$



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Einführung in die
Hydrodynamik
Vorrechenübung



$$p_1 - \rho_A g h_1 = p_L - \rho_A g \frac{\Delta h}{2}$$

$$\hookrightarrow p_L = p_1 + \rho_A g \left(\frac{\Delta h}{2} - h_1 \right) \quad (\text{I})$$

$$p_2 - \rho_B g h_2 = p_R + \rho_B g \frac{\Delta h}{2}$$

$$\hookrightarrow p_R = p_2 - \rho_B g \left(\frac{\Delta h}{2} + h_2 \right) \quad (\text{II})$$

$$p_L - p_R = \rho_c g \Delta h \quad \text{III}$$

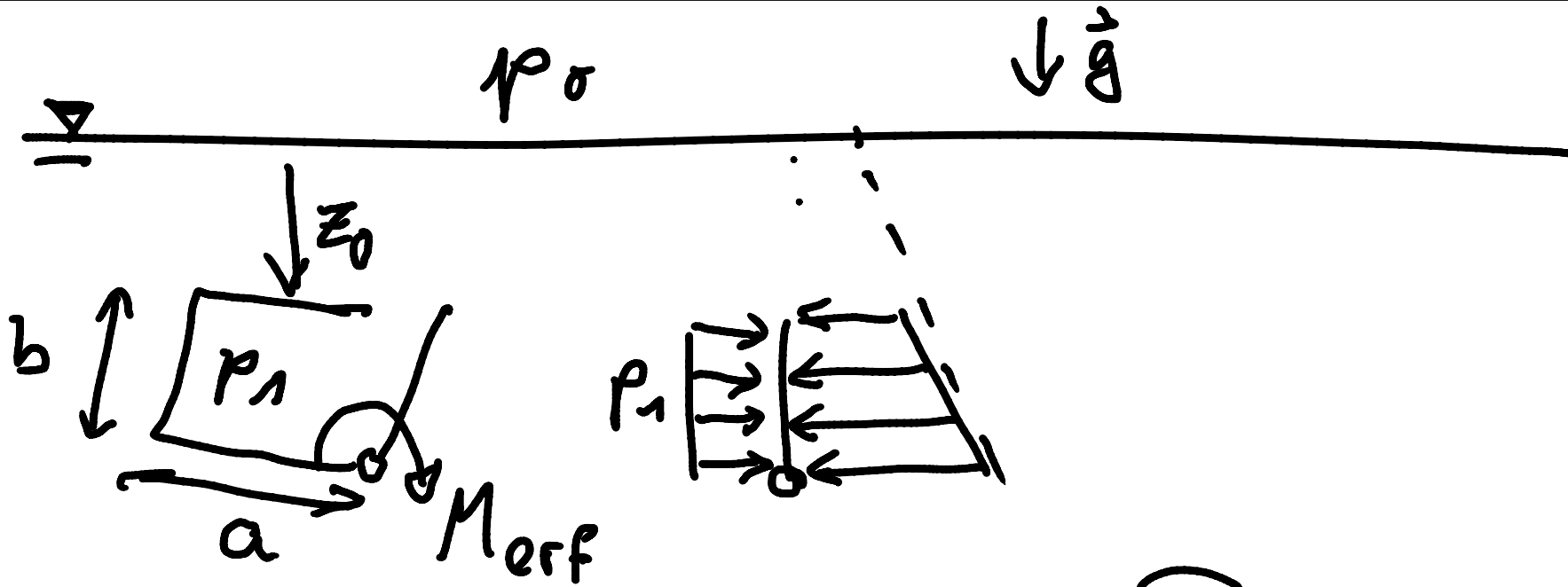
I & II in III

$$\left[p_1 + \rho_A g \left(\frac{\Delta h}{2} - h_1 \right) \right]$$

$$- \left[p_2 - \rho_B g \left(\frac{\Delta h}{2} + h_2 \right) \right] = \rho_c g \Delta h$$

$$p_1 - p_2 = \rho_c g \Delta h - \rho_A g \left(\frac{\Delta h}{2} - h_1 \right) - \rho_B g \left(\frac{\Delta h}{2} + h_2 \right)$$





$$\begin{aligned}
 & \text{Diagram of trapezoidal pressure distribution} = \text{Diagram of uniform pressure } p_1 + \text{Diagram of linear pressure distribution } p_0 + \rho g(z_0 + b/2) \\
 & F_{res} = p_1 b c \left[p_0 + \rho g(z_0 + b/2) \right] b c \sigma
 \end{aligned}$$

$$\begin{aligned}
 & \text{Diagram of trapezoidal pressure distribution} = \text{Diagram of uniform pressure } p_1 + \text{Diagram of linear pressure distribution} = \text{Diagram of resultant force } F_{res} \text{ at } M_{res}
 \end{aligned}$$



$p_{III} = \rho g \zeta$ ("Zeta")

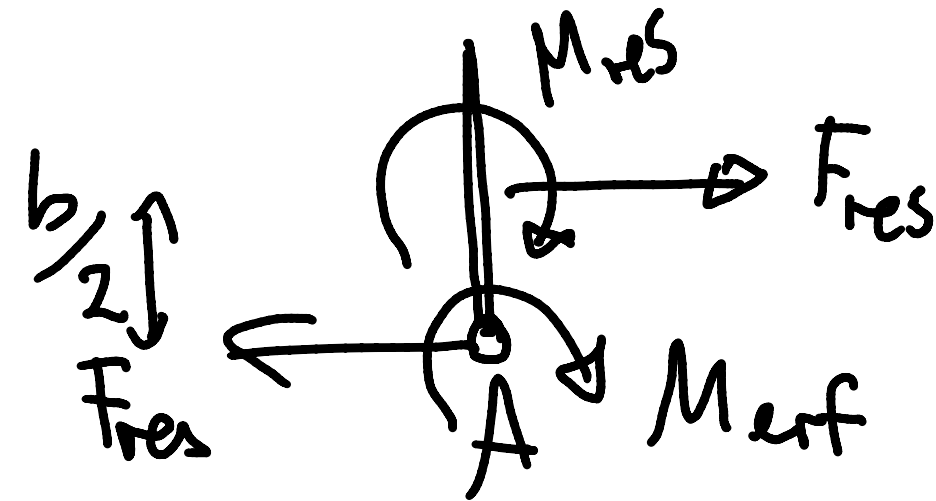
$$M_{res} = \iint_A p_{III} \zeta dA = \rho g \underbrace{\iint_A \zeta^2 dA}$$

$$I_{\square} = \frac{\text{Höhe}^3 \text{ breite}}{12} = \frac{b^3 c}{12} \quad I_{\square}$$

$$M_{res} = \rho g \frac{b^3 c}{12}$$

"Flächenträgheitsmoment"

Freikörperbild



$$\overset{\curvearrowright}{A}: M_{res} + M_{erf} + \frac{b}{2} F_{res}$$

$$\underline{\underline{M_{erf}}} = -M_{res} - \frac{b}{2} F_{res} = -\rho g \frac{b^3 c}{12} - \frac{b^2 c}{2} \cdot \rightarrow$$

$$\rightarrow [\rho_1 - \rho_0 - \rho g z_0 - \rho g b/2] =$$

$$\underline{\underline{\rho g \frac{b^3 c}{12} + \rho g \frac{b^2 c z_0}{2} + (\rho_0 - \rho_1) \frac{b^2 c}{2}}}$$