

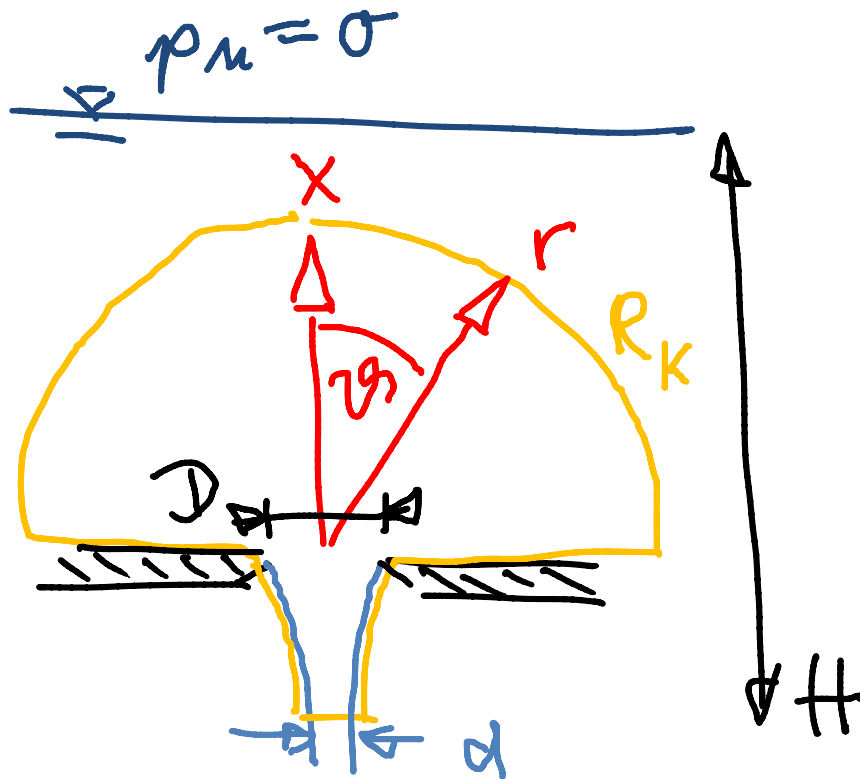
KONTRAKTIONSZIFFER α



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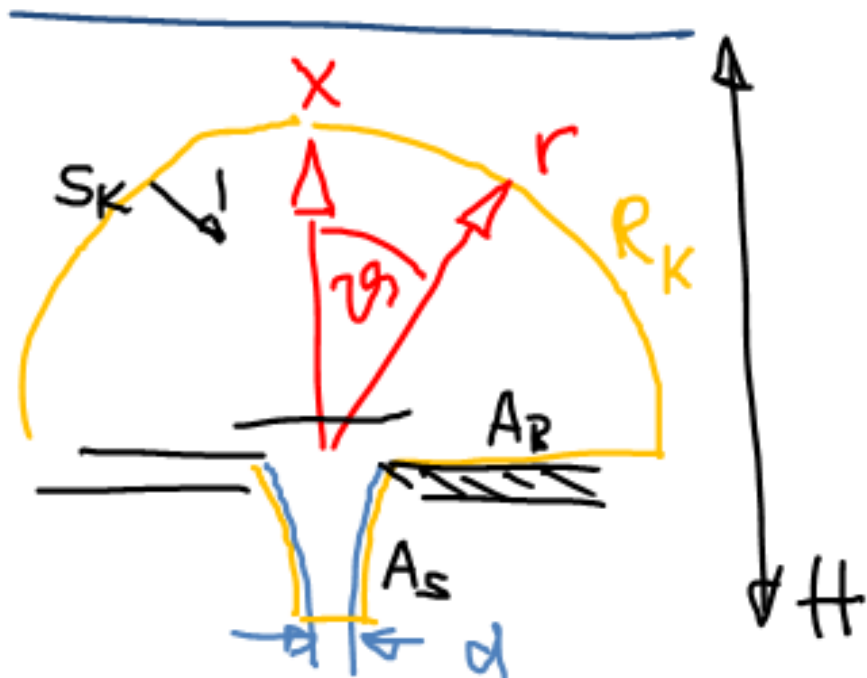
Einführung in die
Hydrodynamik
Vorrechenübung



$$\alpha = \left(\frac{d}{D} \right)^2$$

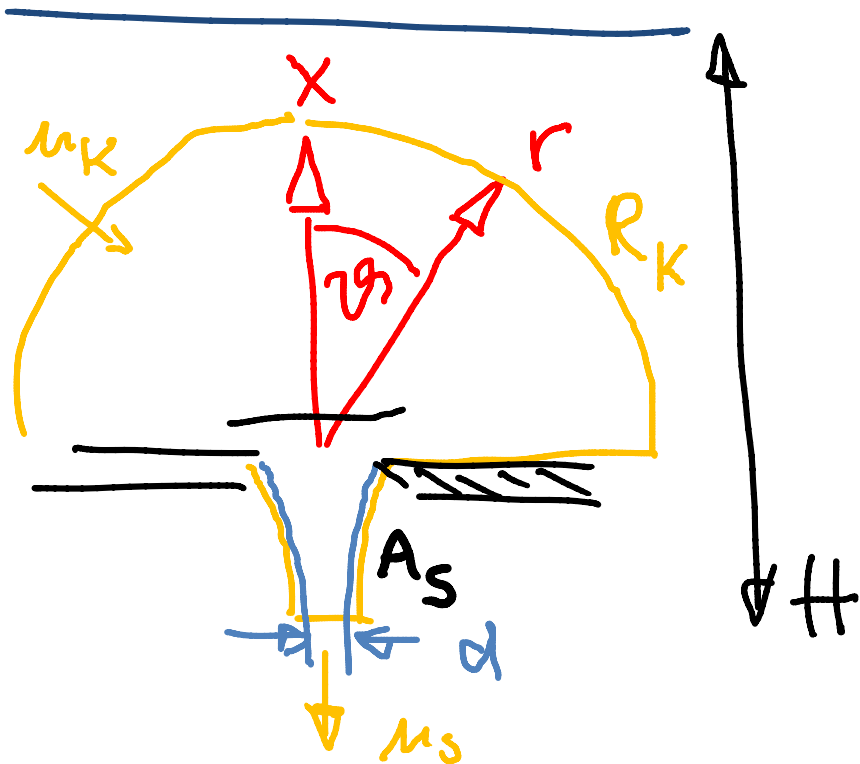
- ① Bestimmung aller Geschwindigkeiten und Drücke mit Hilfe Bernoulli & Konti
- ② Einsetzen in Impulssatz und Auflösen nach d

Prof. Dr.-Ing. Peter Pelz
Sommersemester 2012
Übung 8 F 47



$$\vec{e}_x \cdot \iint_{A_S} \rho \vec{u} \vec{n} \cdot \vec{v} dS$$
$$= \underline{\underline{-\rho \mu_S \mu_S \frac{\pi}{4} d^2}}$$

$$\vec{e}_x \cdot \iint_{S_K} \rho \vec{u} \vec{n} \cdot \vec{v} dS = \int_0^{2\pi} \int_0^{\pi/2} \rho \mu_K \cos \vartheta$$



$$\vec{m}_k = -\frac{A}{R_k^2} \vec{e}_r$$

$$\vec{m}_s = \sqrt{2gh}$$

$$\vec{e}_x \cdot \iint_{A_s} \rho \vec{u} \vec{u} \cdot \vec{n} dS = -\frac{\pi}{4} d^2 m_s$$

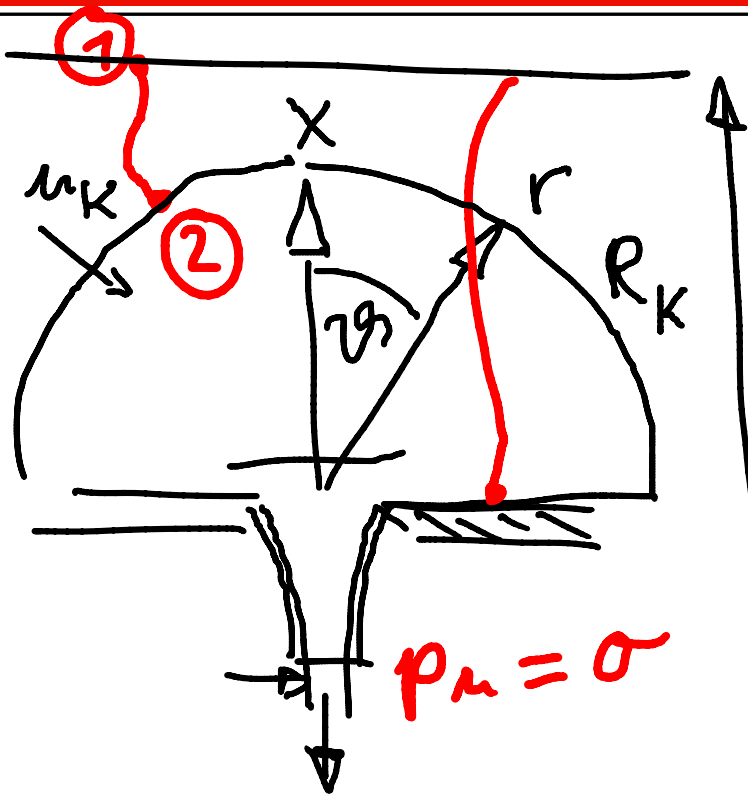


$$\vec{e}_x \cdot \iint_S \rho \vec{u} \vec{n} \cdot \vec{e}_x dS =$$

$$\int_0^{2\pi} \int_0^{\pi/2} (-\rho u_K \cos \vartheta) (-u_K) \underbrace{\sin \vartheta d\vartheta d\varphi R_K^2}_{dS_K} =$$
$$= \int_0^{2\pi} \int_0^{\pi/2} \rho \frac{A^2}{R_K^4} R_K^2 \underbrace{\sin \vartheta \cos \vartheta d\vartheta d\varphi}_{\frac{1}{2} \sin 2\vartheta} = \underline{\underline{\pi \rho \frac{A^2}{R_K^2}}}$$

$$\begin{aligned}\vec{e}_x \cdot \iiint \rho \vec{k} dV &= -\rho g V \\ &= \underline{\underline{-\rho g \frac{2}{3} \pi R_k^3}}\end{aligned}$$





$$\rho g H = \rho g R_K \cos \psi + p_K + \frac{\rho}{2} \frac{A^2}{R_K^4}$$

$$p_K = \rho g (H - R_K \cos \psi) - \frac{\rho}{2} \frac{A^2}{R_K^4}$$

$$\iint_{S_K} \vec{t} \, dS \cdot \vec{e}_x = - \int_0^{2\pi} \int_0^{\pi/2} p_K \cos \psi \sin \psi R_K^2 \, d\psi \, d\varphi$$



$$s_{gH} = p_B + \frac{\rho}{2} \frac{A^2}{R_K^4}$$

$$p_B = s_{gH} - \frac{\rho}{2} \frac{A^2}{R_K^4}$$

$$\vec{e}_x \cdot \iint \vec{t} dS_B = \int_0^{2\pi} \int_{\frac{D}{2}}^{R_K} p_B \underbrace{r dr d\varphi}_{dS_B} \dots$$

$$\frac{A}{R_K^2} 2\pi R_K^2 = \mu_s \frac{\pi}{4} d^2 \quad \text{Kont.}$$

$$A = \mu_s \frac{d^2}{8}$$



$$\oint_S \vec{g} \cdot \vec{n} \, dS = \iiint_V \vec{g} \cdot \vec{k} \, dV + \oint_S -p \vec{n} \, dS$$

$$2d^2 = D^2 + \frac{1}{4} \frac{d^4}{D^2} \quad | \cdot \frac{1}{D^2}$$
$$2 \left(\frac{d}{D} \right)^2 = 1 + \frac{1}{4} \left(\frac{d}{D} \right)^4$$
$$2 \alpha^2 = 1 + \frac{\alpha^4}{4}$$
$$\alpha = 4 \sqrt{12} = 0.536$$