

Vorrechen
übung

Gruppen
übung

13

4

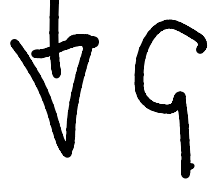
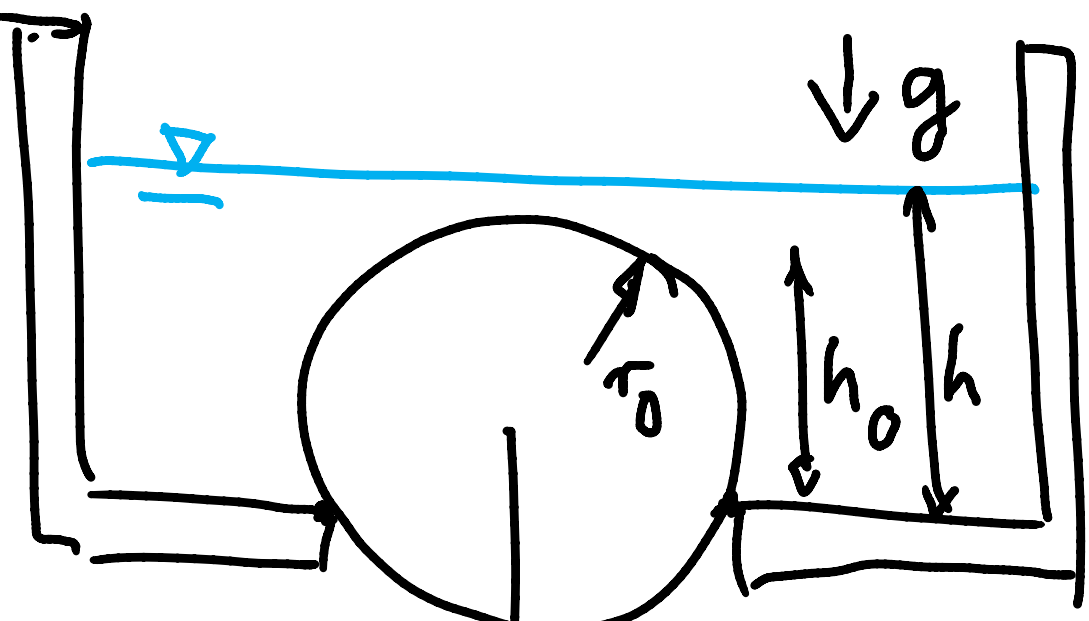


TECHNISCHE
UNIVERSITÄT
DARMSTADT

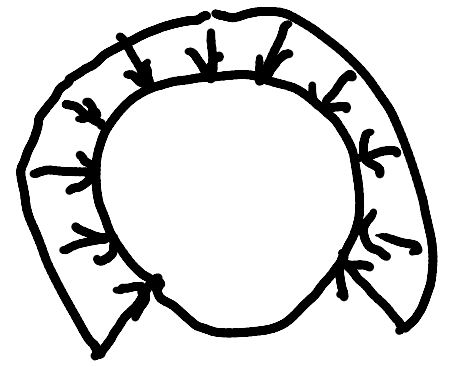


Einführung in die
Hydrodynamik
Vorrechenübung

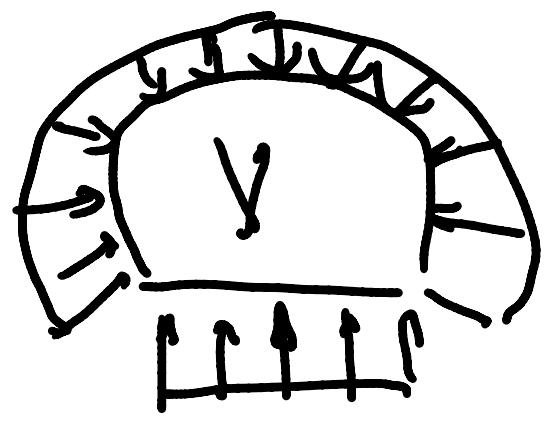
Prof. Dr.-Ing. Peter Pelz
Sommersemester 2012
Übung 4 F 20



p

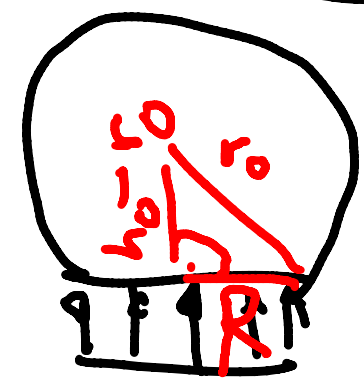


=



I

-



II

$$R^2 = r_0^2 - (h_0 - r_0)^2$$

$$A = \pi R^2 = \pi [r_0^2 - (h_0 - r_0)^2]$$

$$= \pi (2r_0 h_0 - h_0^2)$$

$$\underline{\underline{F_A}} = \overset{\text{I}}{\underbrace{\rho g V_{\text{Kerzote}}}} - \overset{\text{II}}{\underbrace{\rho g h A}}$$

$$= \rho g \left[\frac{\pi}{3} h_0^2 (3r_0 - h_0) - h h_0 \pi (2r_0 - h_0) \right]$$

$$\underline{\underline{F_{DS} = G - F_A}}$$





$$F_A(h=h_0) = 0$$

$$\cancel{\frac{\pi}{3}} h_0^2 (3r_0 - h_0) = \cancel{\pi} h_0^2 (2r_0 - h_0)$$

$$3r_0 - h_0 = 6r_0 - 3h_0$$

$$0 = 3r_0 - 2h_0$$

$$2h_0 = 3r_0$$

$$\frac{h_0}{r_0} = 1.5$$

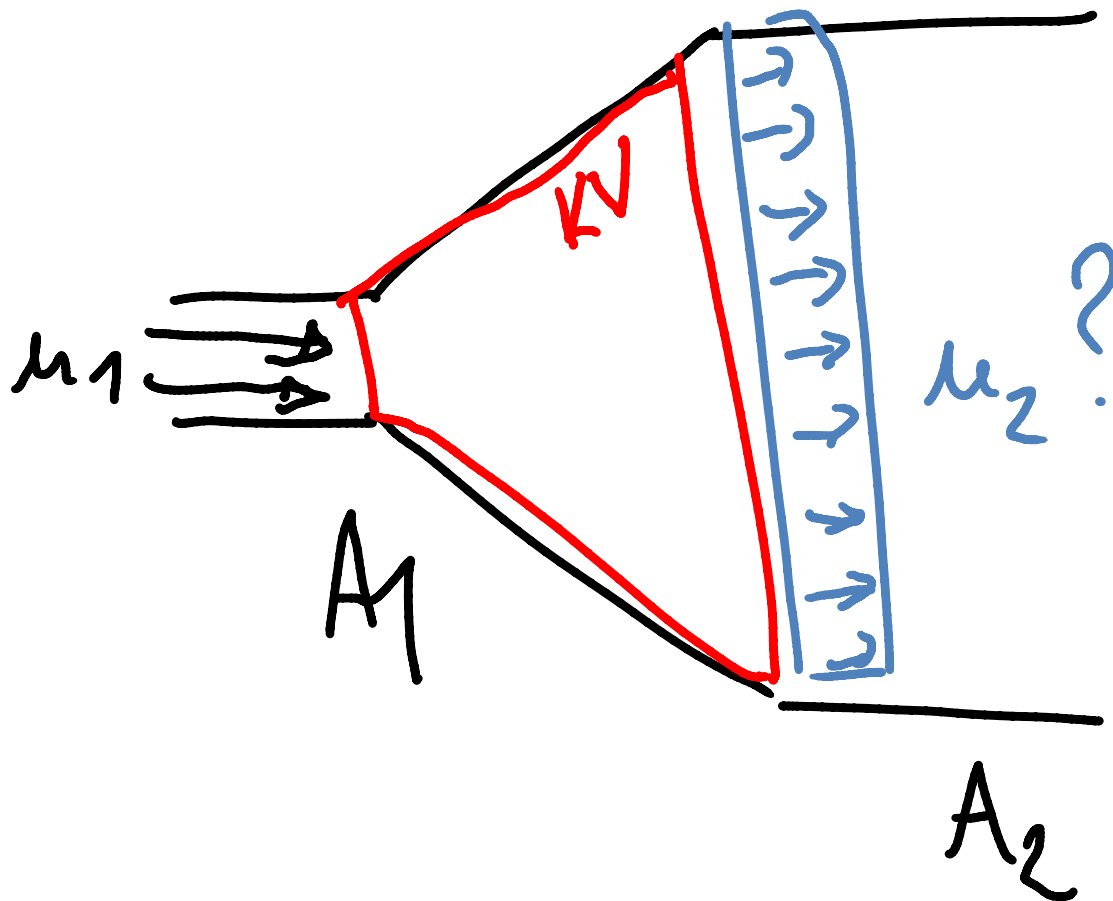
IMPULSSATZ / BERNOULLI



TECHNISCHE
UNIVERSITÄT
DARMSTADT



Einführung in die
Hydrodynamik
Vorrechenübung

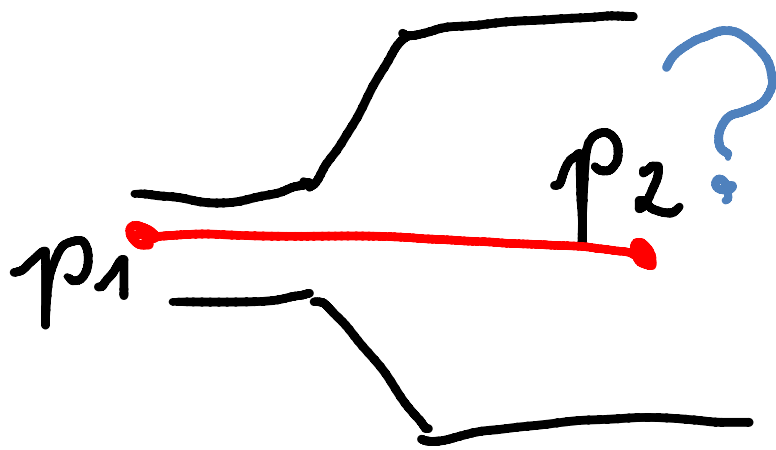


"Diffusor"

Prof. Dr.-Ing. Peter Pelz
Sommersemester 2012
Übung 4 F 24



$$-u_1 A_1 + u_2 A_2 = 0$$
$$u_2 = u_1 \frac{A_1}{A_2}$$



stationärer Bernoulli

$$\rho + \cancel{\rho g h} + \rho \frac{u^2}{2} = \text{const}$$

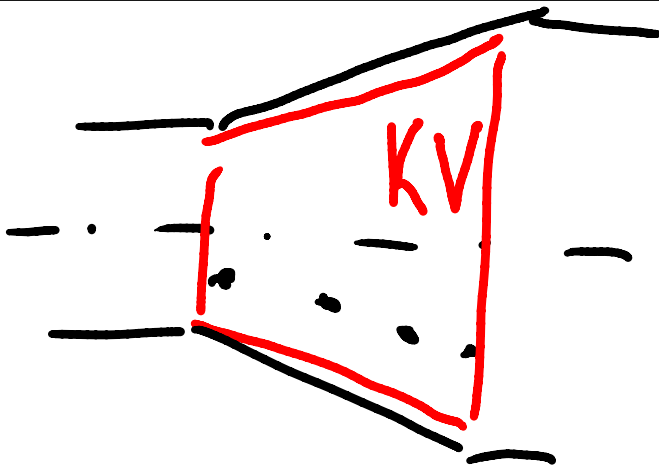
$\rho = \text{const}$
verlustfrei

$$p_1 + \frac{\rho}{2} u_1^2 = p_2 + \frac{\rho}{2} u_2^2$$



$$p_2 = p_1 + \frac{\rho}{2} (u_1^2 - u_2^2)$$
$$= p_1 + \frac{\rho}{2} \left[1 - \left(\frac{A_1}{A_2} \right)^2 \right] u_1^2$$





$$\frac{D\vec{I}}{Dt} = \vec{F}$$

$$\vec{I} = \int_V \rho \vec{u} dV$$

Stationärer Impulssatz (inkompressibel)

$$\int_S \rho \vec{u} (\vec{u} \cdot \vec{n}) dS = \vec{F}$$



$$\rho \mu_1 (-\mu_1 A_1) + \rho \mu_2 (\mu_2 A_2) =$$
$$p_1 A_1 - p_2 A_2 + F_{D \rightarrow F}$$

$$- \rho \mu_1^2 A_1 + \rho \mu_2 \mu_1 A = \sum F$$

$$\rho \mu_1^2 \left(\frac{A_1}{A_2} - 1 \right) A_1 = p_1 A_1 - p_2 A_2 + F_{D \rightarrow S}$$

$$F_{D \rightarrow S} = \rho \mu_1^2 \left(\frac{A_1}{A_2} - 1 \right) A_1 - p_1 A_1 + p_2 A_2$$

$$= \rho \mu_1^2 \left(\frac{A_1}{A_2} - 1 \right) A_1 - p_1 A_1 + \left[p_1 + \frac{\rho}{2} \left(1 - \frac{A_1}{A_2} \right)^2 \right] A_2$$