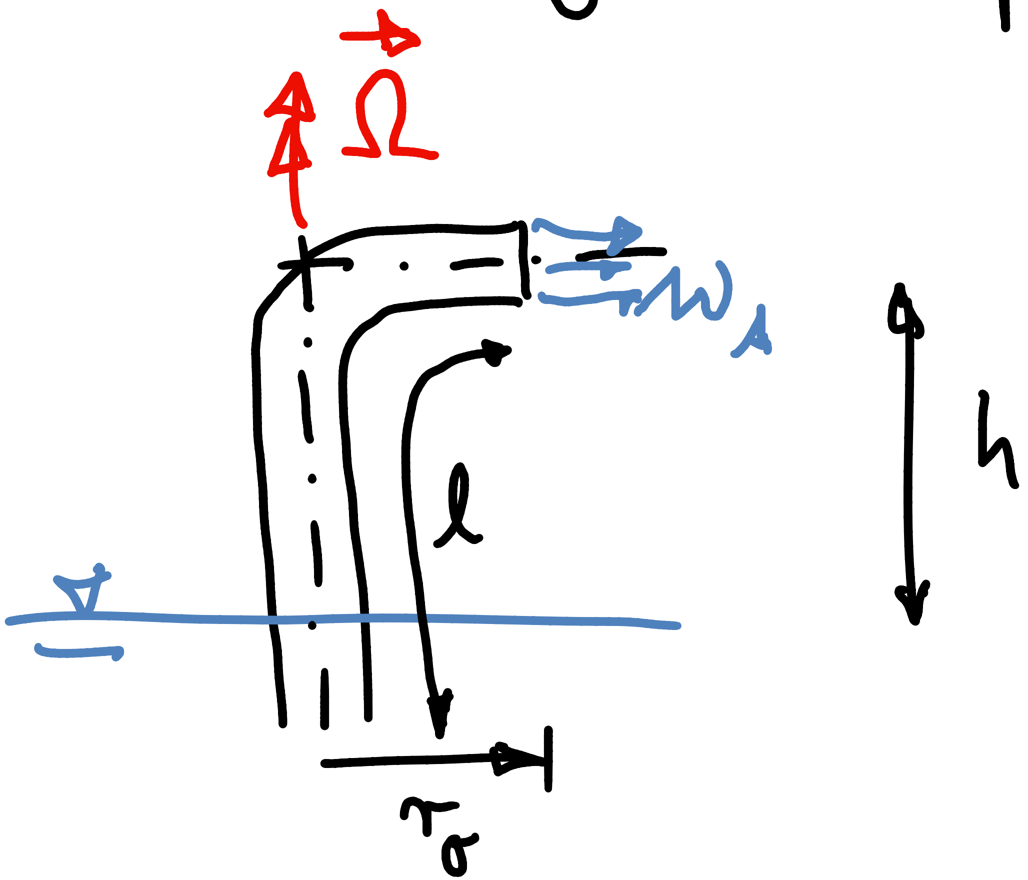
5 Übung Rohrpumpe



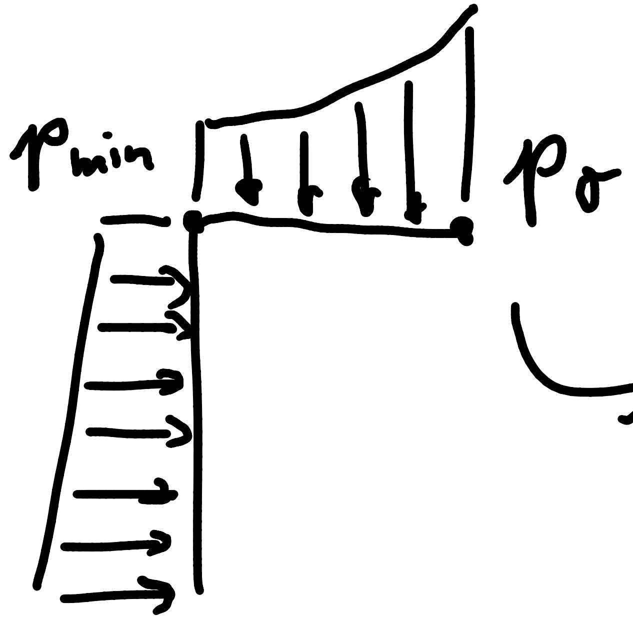
Ω_{max}?

$$\Omega_{max} = fcn(p_D)$$

$$\int \frac{\partial w}{\partial t}\,ds + \frac{w^2}{2} + \frac{p}{\rho} + gh - \frac{1}{2}(\Omega r)^2 = const$$

Spurk 4.81

rotierende Bernoulli-Gleichung

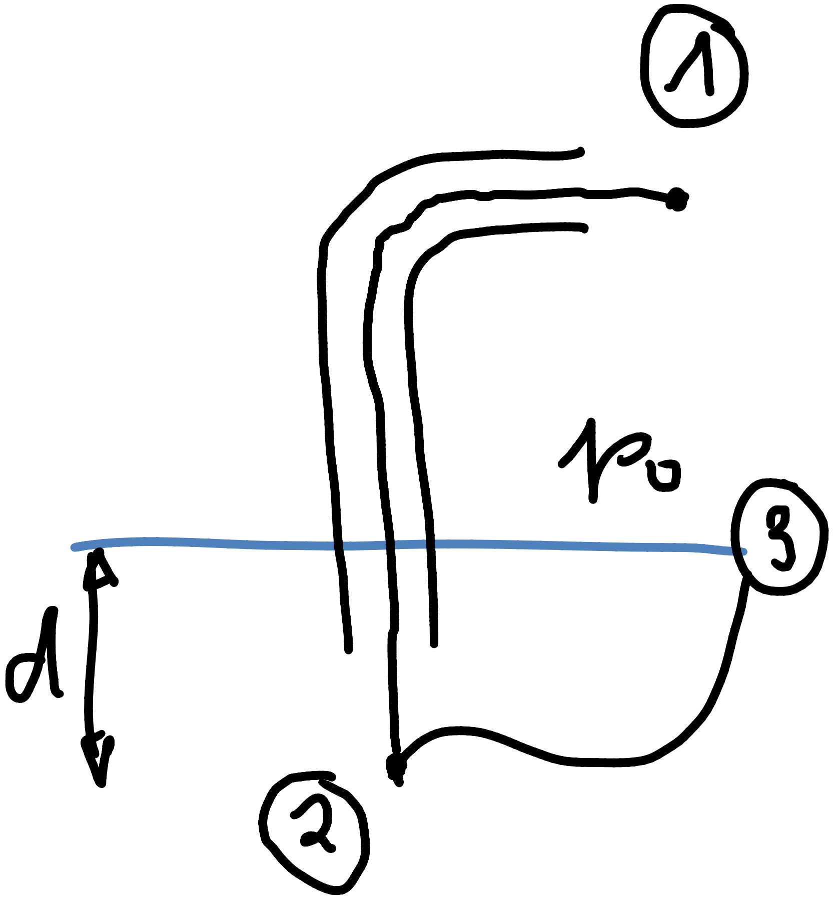


$$\rightarrow p_\sigma - \frac{\rho}{2}(\Omega r_0)^2 + \frac{\rho}{2} w_A^2 + \rho g h$$

$$= p_{min} + \frac{\rho}{2} w_A^2 + \rho g h$$

$$p_0 - p_{min} = \frac{\rho}{2}(\Omega r_0)^2$$

$$\frac{1}{r_0}\sqrt{\frac{(p_0 - p_D)}{\frac{1}{2}\rho}} = \Omega_{krit}$$



rot. Bernoulli

1 – 2

$$\frac{\partial w}{\partial t} l + \frac{w^2}{2} + \frac{p_0}{\varrho} + gh - \frac{1}{2}(\Omega r_0)^2$$

$$= \frac{p_2}{\varrho} - gd$$

Bernoulli im Inertialsys.

$$\frac{p_0}{\varrho} = \frac{p_2}{\varrho} - gd$$

$$\frac{\partial w}{\partial t} l + \frac{w^2}{2} + \frac{p_0}{\rho} + gh - \frac{1}{2}(\Omega r_0)^2 = \frac{p_0}{\rho}$$

$t = 0$

$$b = \left.\frac{\partial w}{\partial t}\right|_{t=0} = \frac{1}{l}\left[\frac{1}{2}(\Omega r_0)^2 - gh\right]$$

$$\frac{\partial w}{\partial t} l + \frac{w^2}{2} + gh - \frac{1}{2}(\Omega r_0)^2 = 0$$

$$\frac{dw}{dt} = \frac{(\Omega r_0)^2 - 2gh - w^2}{2l}$$

$$\int_0^w \frac{d\bar{w}}{\underbrace{(\Omega r_0)^2 - 2gh}_{c^2} - \bar{w}^2} = \int_0^t \frac{d\bar{t}}{2l}$$

$$w = c \tanh\left(\frac{ct}{2l}\right)$$