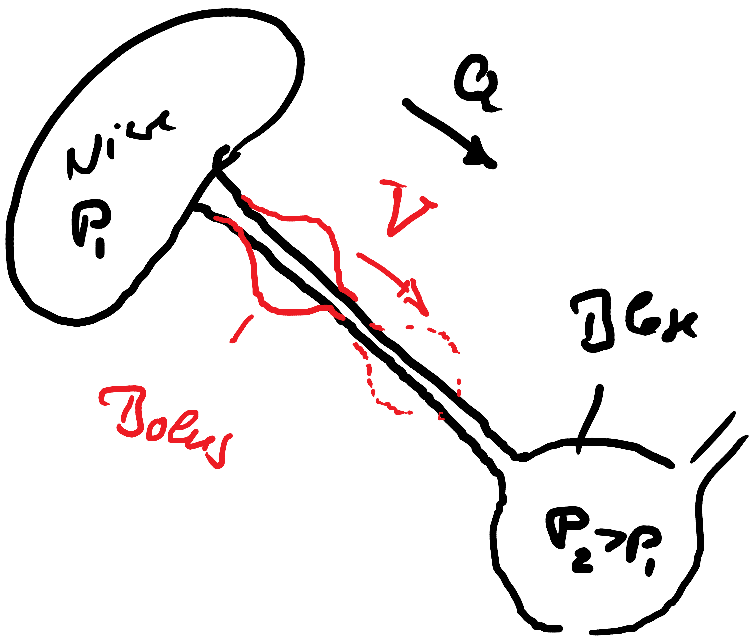
Peristaltik

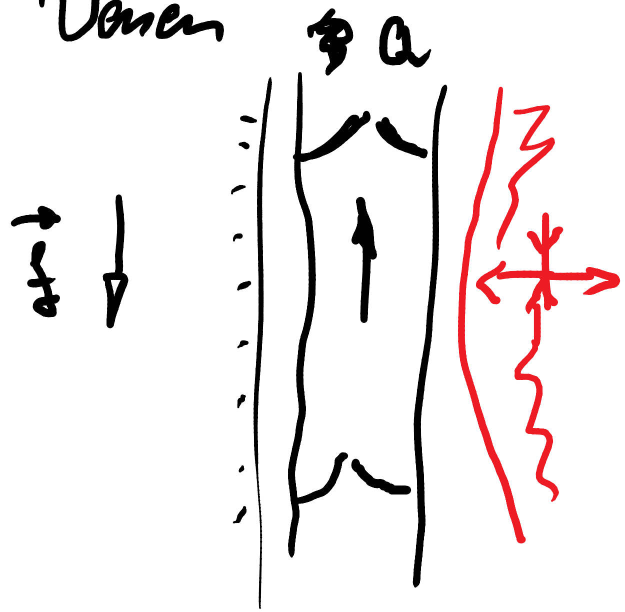
Peristaltik Innenströmung und i.d.R. $Re \ll 1$.

ohne Ventile
- Darm
- Samenleiter
- Harnleiter.



Verdrängermaschine

Venen

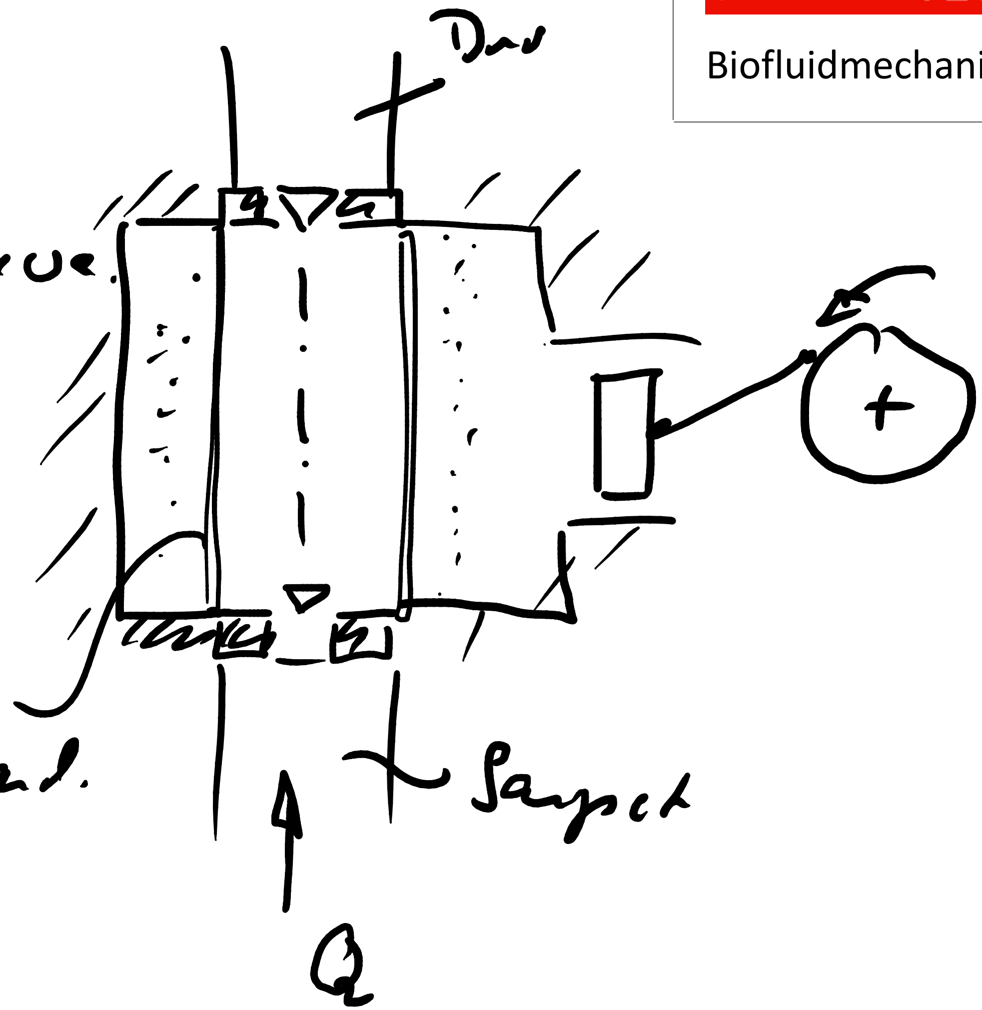


TECHNISCHE UNIVERSITÄT DARMSTADT
FLUID SYSTEM TECHNIK
Biofluidmechanik

Peristaltische Pumpen in der Technik

- Schlauchpumpe → Medizin
  ↳ Druck, …

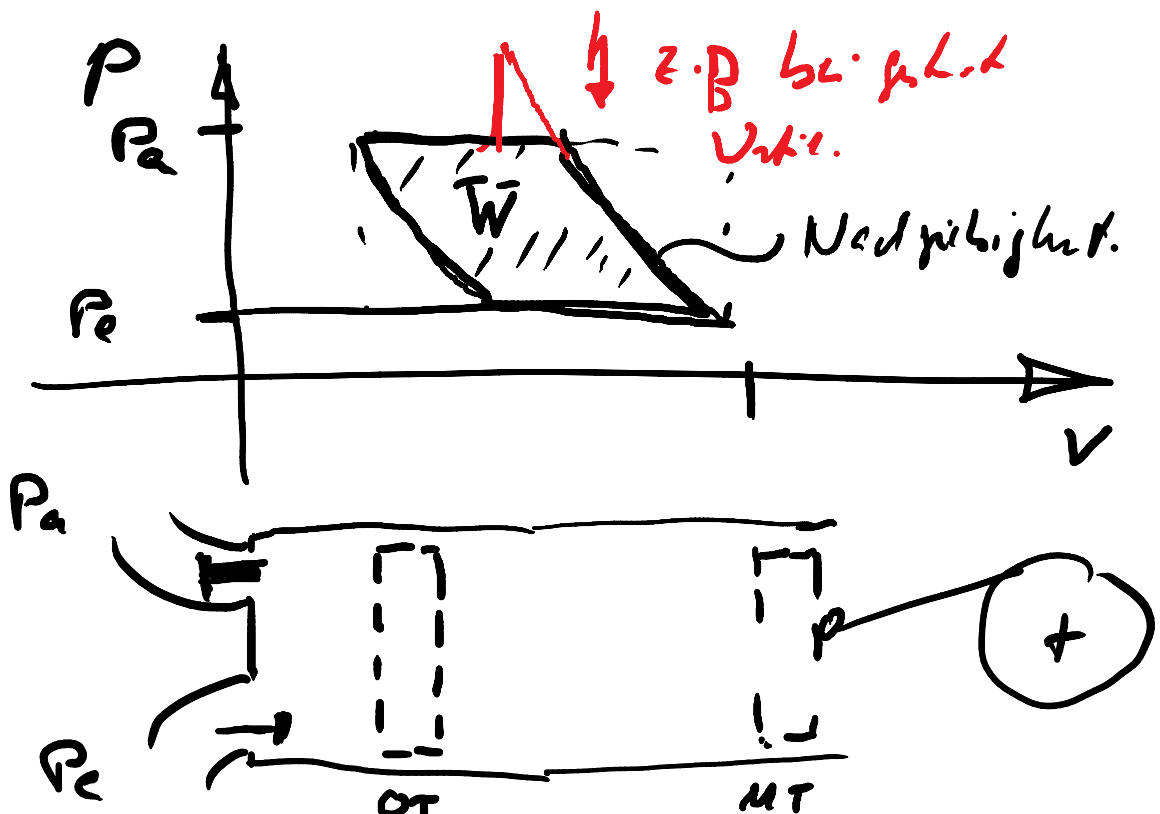
- Membranpumpe der Fa. Feluwa



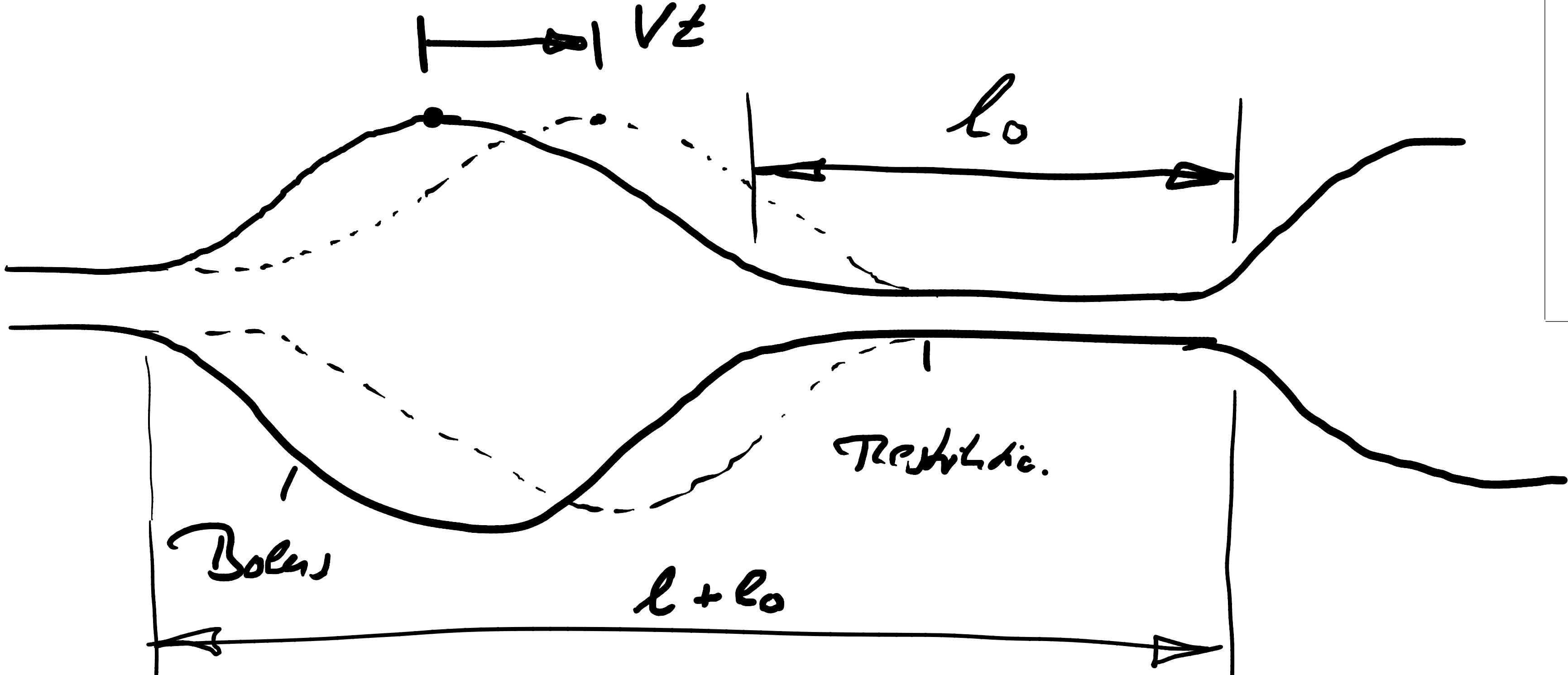
Medium: Paste (Bergbauschlamm.

Hier: Wir betrachten hier im Wesentlichen Pumpe ohne Ventile.

⇒ Pumpen mit Ventilen werden mittels Indikatordiagramm (p-V-Diagramm) beschrieben.

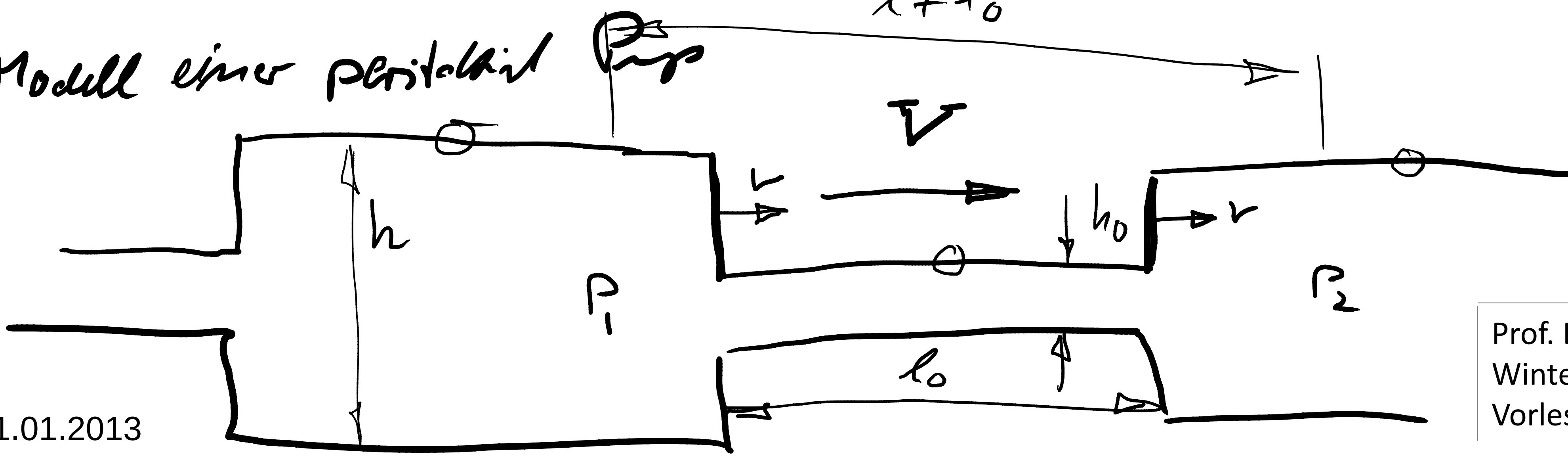


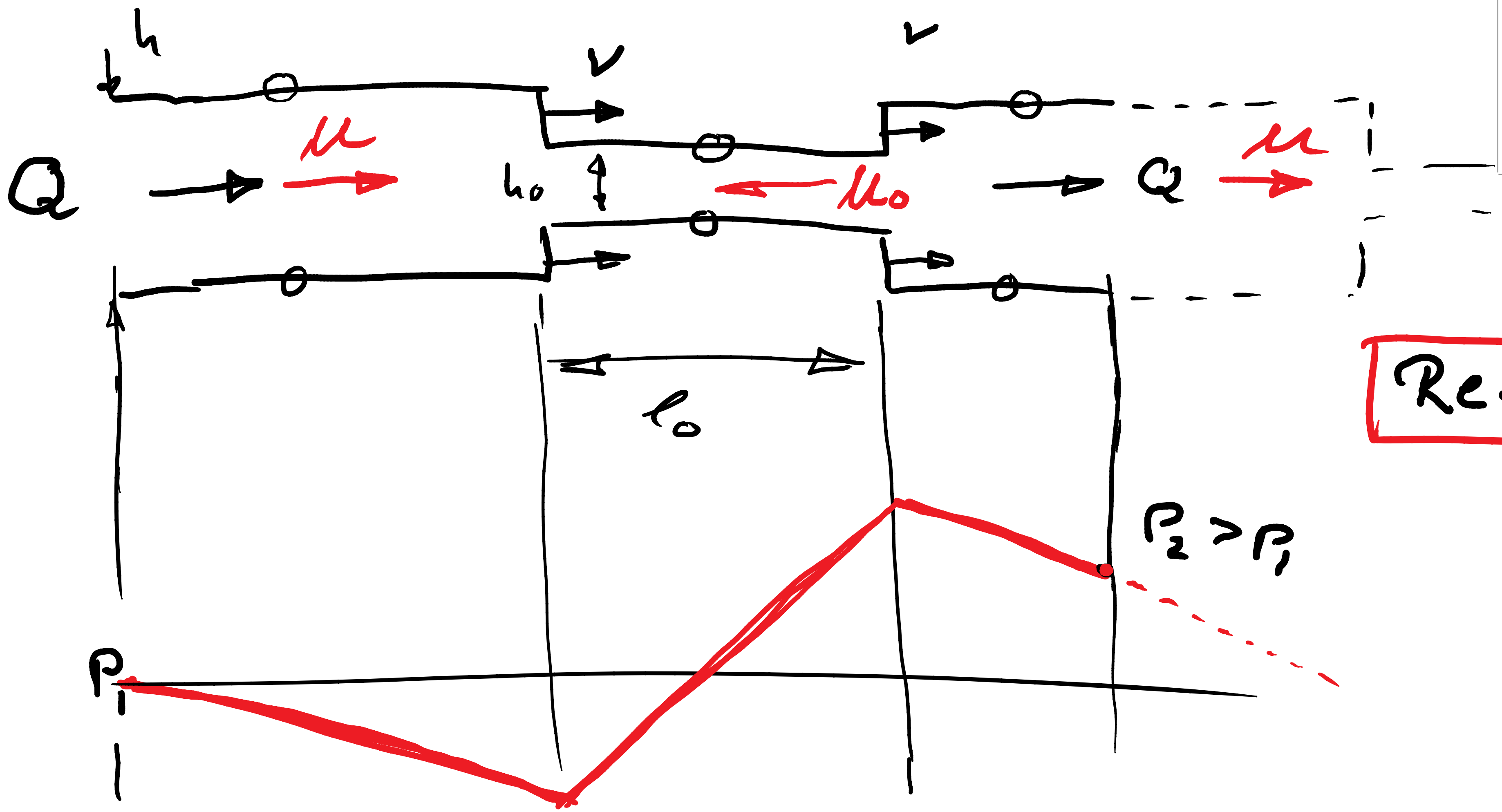
1. selbsttätige Ventile (Rückschlagventile) z.B. Venenklappe, Herzklappen.
2. gesteuerte Ventile: Ventilstellung = fn(Kolbenstellung)
3. geregelte Ventile.

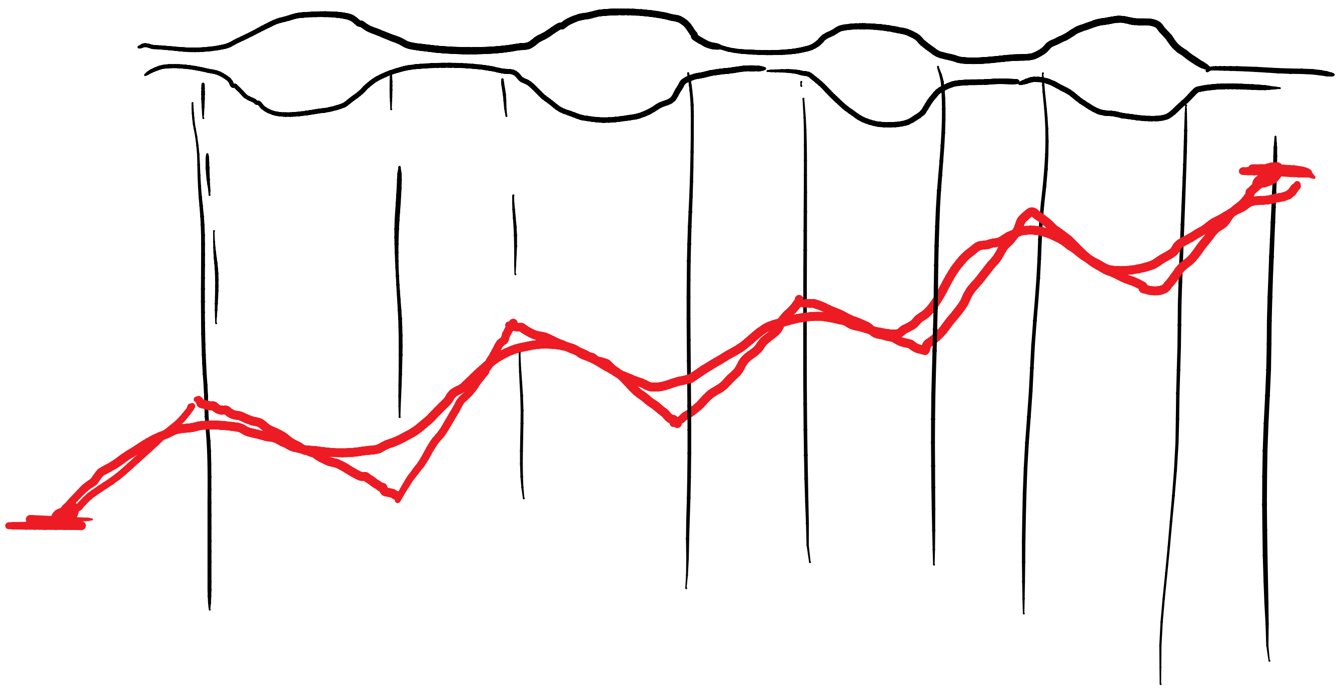


V Fortpflanzungsgeschwindigkeit d Welle

Modell einer peristaltischen Pump




h
v
v
Q
u
h0
u0
Q
u
l0
Re<<1
p2 > p1
p1

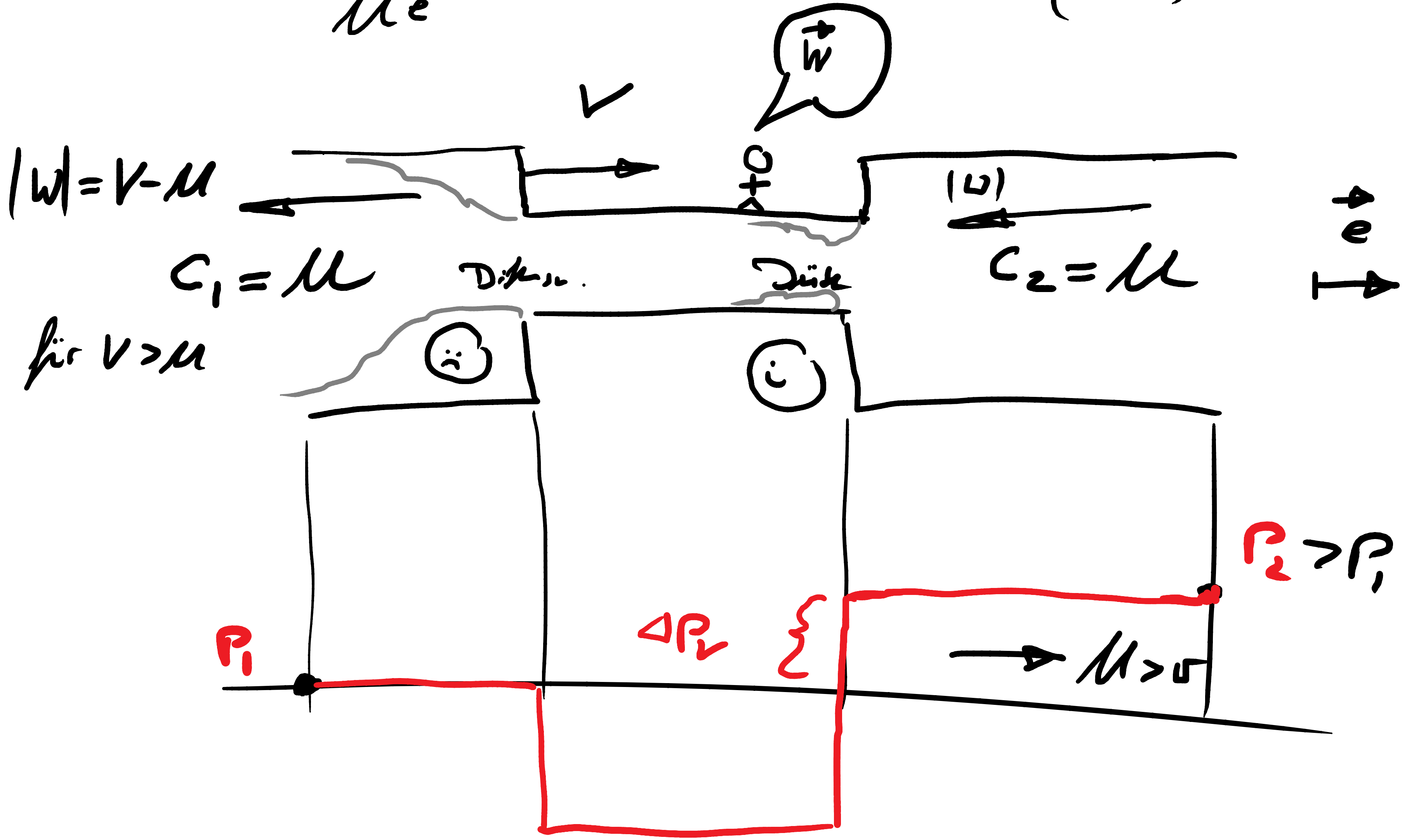


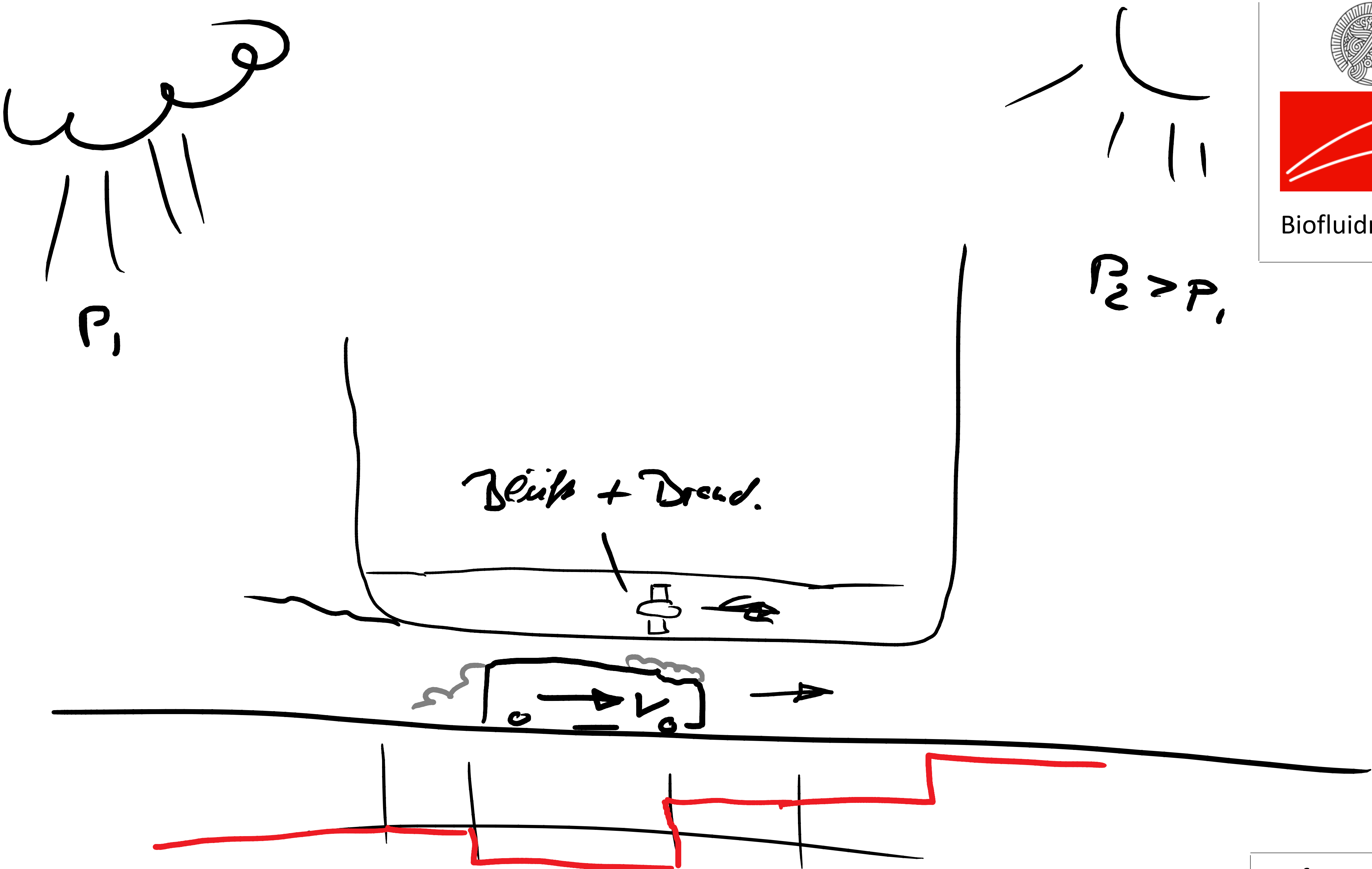
$Ri \ll 1$

$Re \gg 1$

$\vec{c} = \vec{w} + \vec{u}$ bei reiner Translation:

$u\vec{e} \quad V\vec{e} \rightsquigarrow \vec{w} = (u - V)\vec{e}$

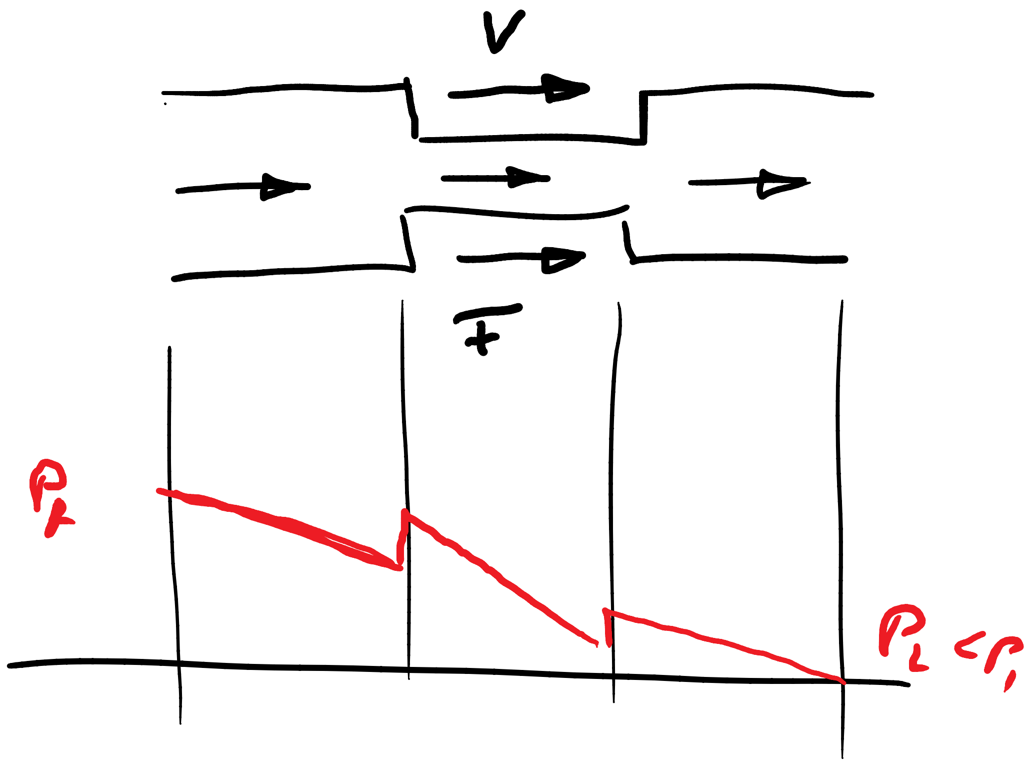



p_1
$p_2 > p_1$

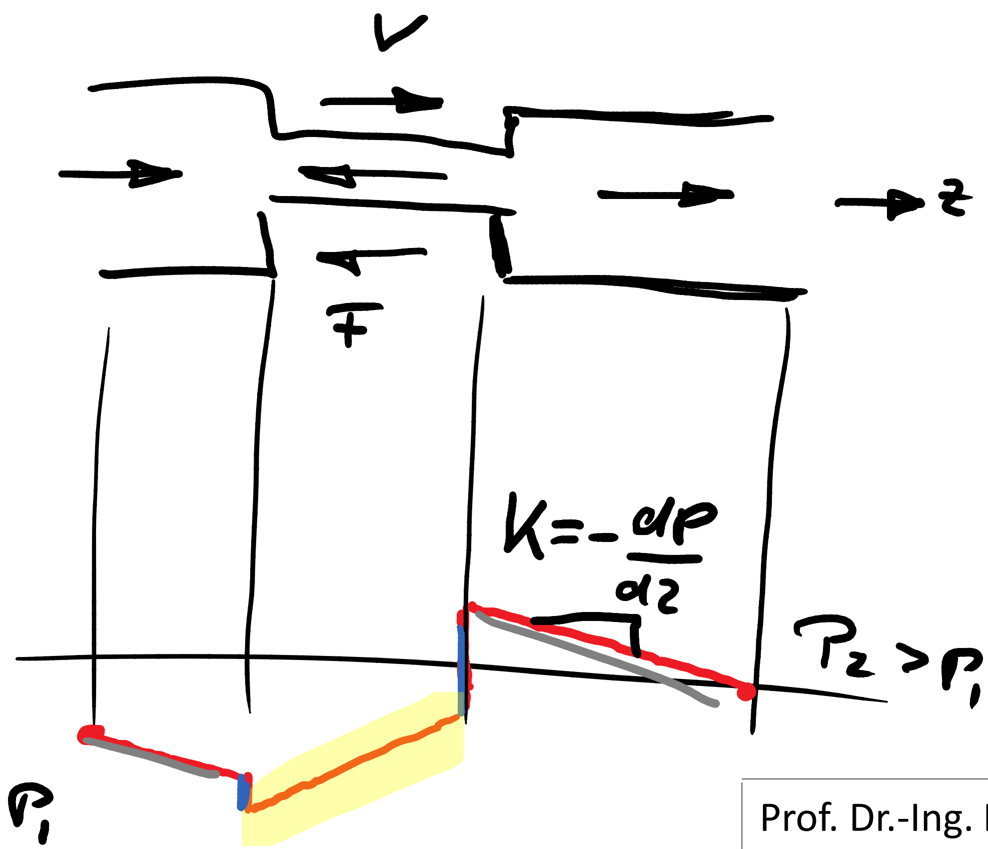
Re beliebig

$$p_1 - p_2 = K\ell + K_0 \ell_0 + \Delta p_{vc}$$

c) Motor



b) Pumpe

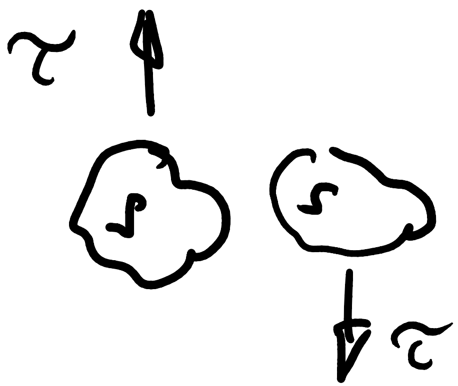


Binghammedium

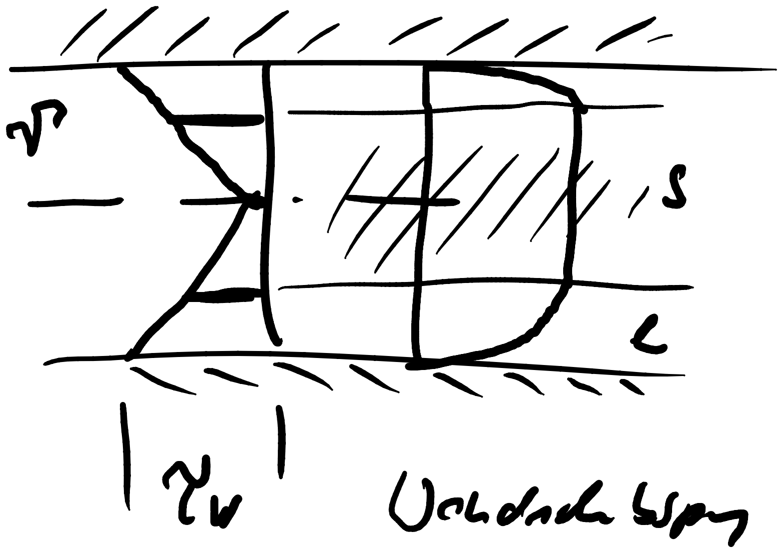
$\tau < \vartheta$: Festkörper

$\tau > \vartheta$: Flüssigkeit $\quad \tau = \vartheta + \mu \dot{\gamma}$

ϑ Fließgrenze = fn (Wechselwirkungskraft = Adhäsionskraft zwischen den suspendierten Teil.



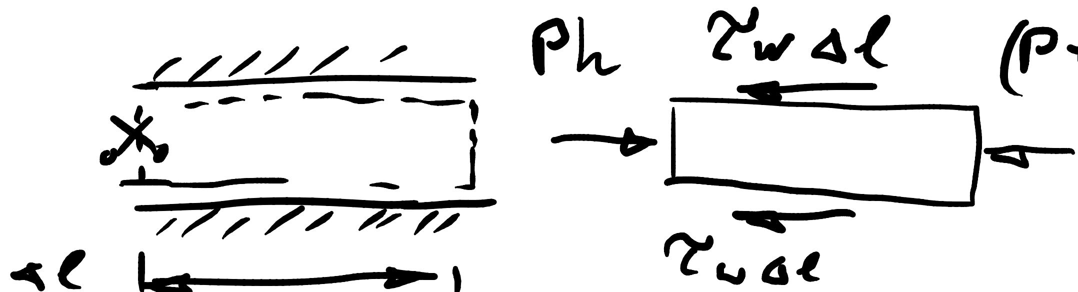
Druckgetriebene Str.



dimensionslose Größe $B = \frac{\tau_w}{\nu} \rightarrow B = \frac{2\nu}{Kh}$

$\rightarrow -\frac{\Delta p}{\Delta l} = K = \frac{\tau_w}{2h}$

$K := -\frac{dp}{dz}$



Widerstandsgesetz für ein [illegible] Binghamsch.

$$K = \underbrace{12\mu \frac{u}{h^2}}_{\text{Poisson-K.}} \left(1 - \frac{3}{2}B + \frac{1}{2}B^3\right)^{-1}$$

$$B := \frac{\vartheta}{\tau_w} = \frac{2\vartheta}{Kh}$$

$$K_0 = 12\mu \frac{u_0}{h_0^2} \left(1 - \frac{3}{2}B_0 + \frac{1}{2}B_0^3\right)^{-1}$$

$$B_0 = \frac{\vartheta}{\tau_{w0}} = \frac{2\vartheta}{K_0 h_0}$$

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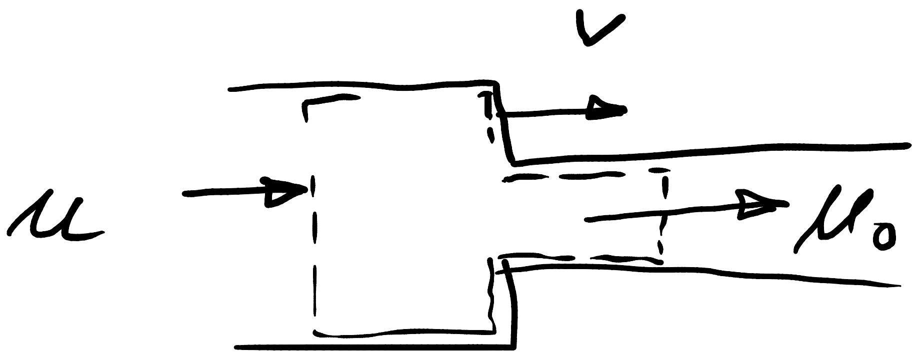
Kontinuitätsgleichung



$$u h - u_0 h_0 - V(h - h_0) = 0.$$

$$u_0 = (u - VH)\frac{h}{h_0}, \quad \text{mit} \quad H := 1 - \frac{h_0}{h}.$$