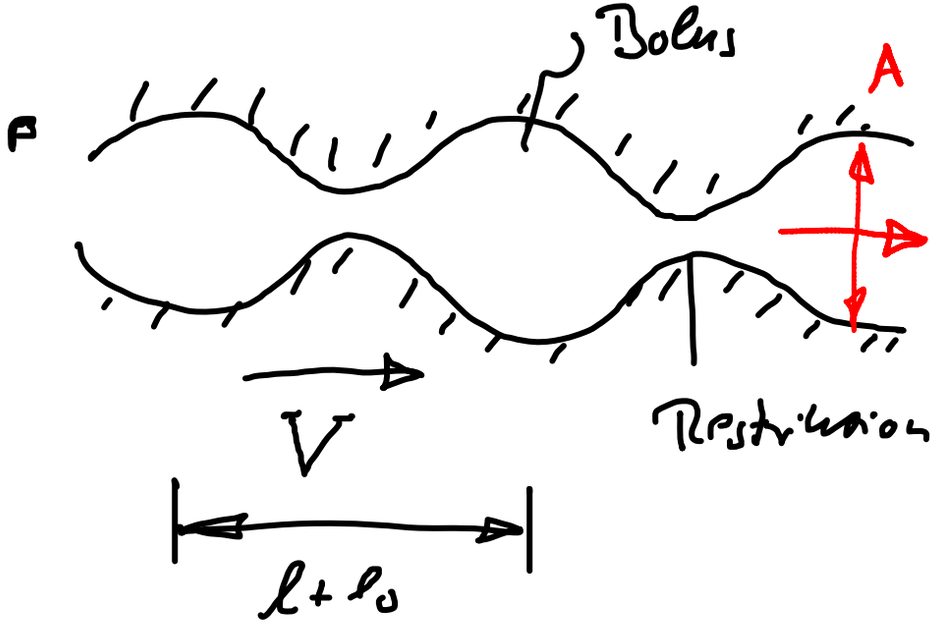
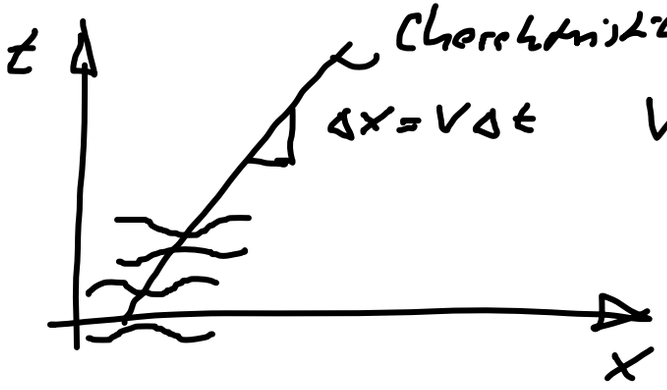
# Peristaltische Strömung




x-t Diagramm

V Geschwindigkeit, mit der die Restriktion durch die Lebenswirklichkeit

Phasengeschwindigkeit.



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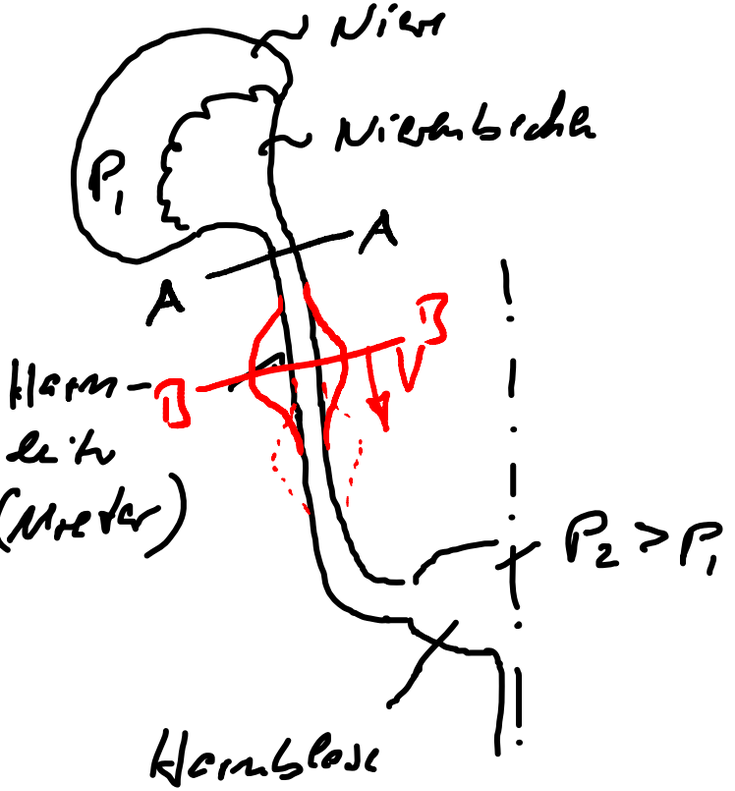
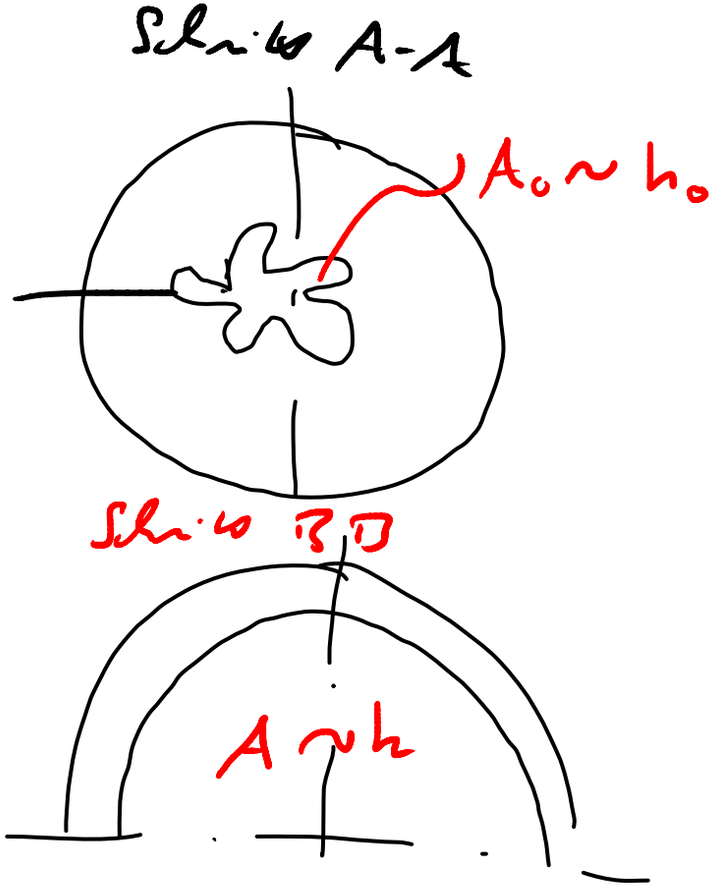
Peristaltische Pumpen sind häufig in biologischen Systemen anzutreffen.

Beispiel Harnleiter



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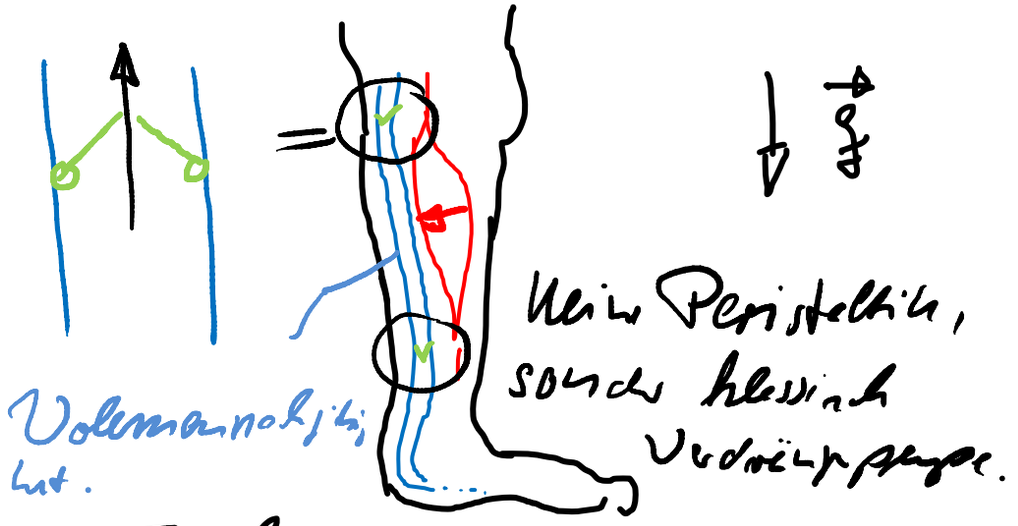
Andre Beispiele:

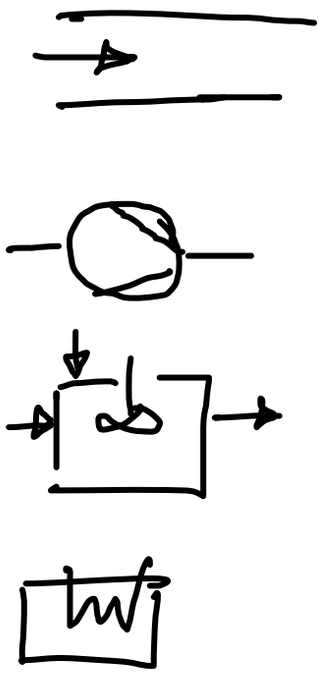
Darm

Eileiter ...




## Hohe Integration von Funktionen

- Material transportieren
- Energie einbringen
- Mischen
- Reaktor



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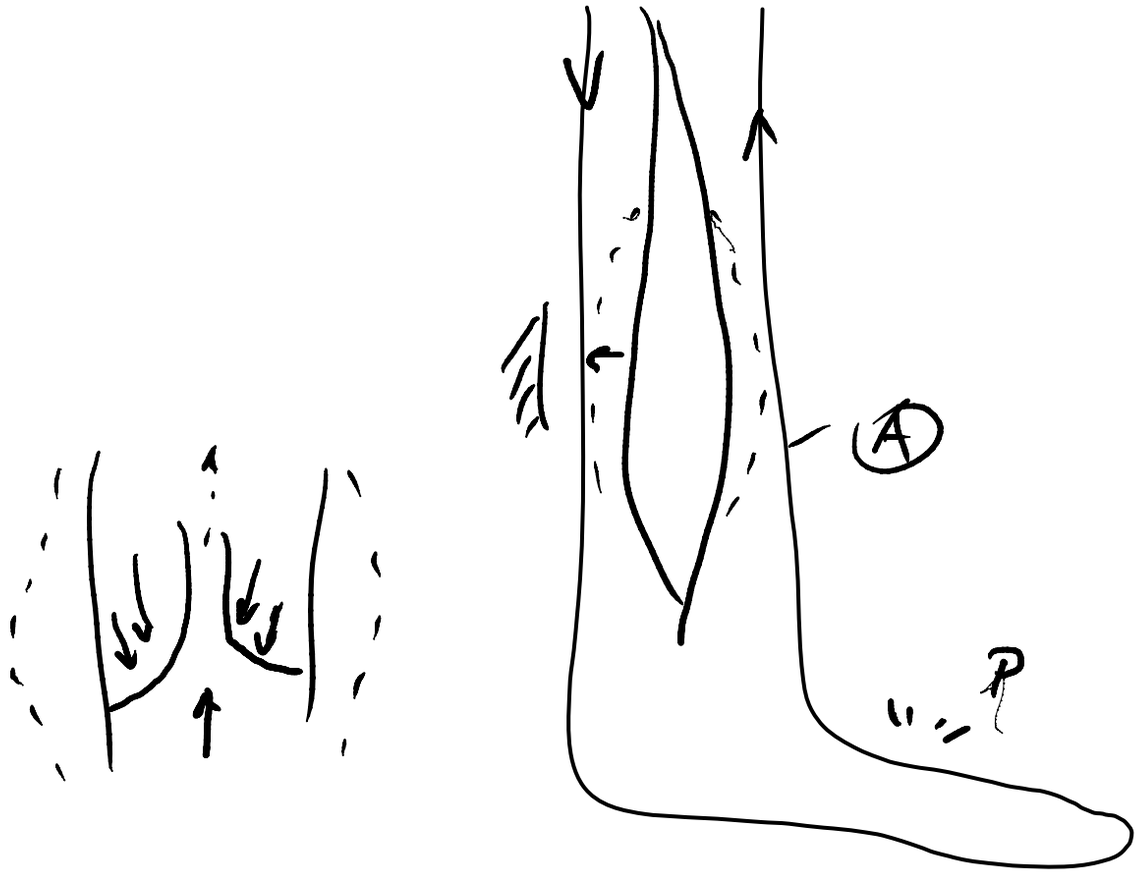


1. $p_v$
2. Muskel-p
3.

15 mm Hg

Puls

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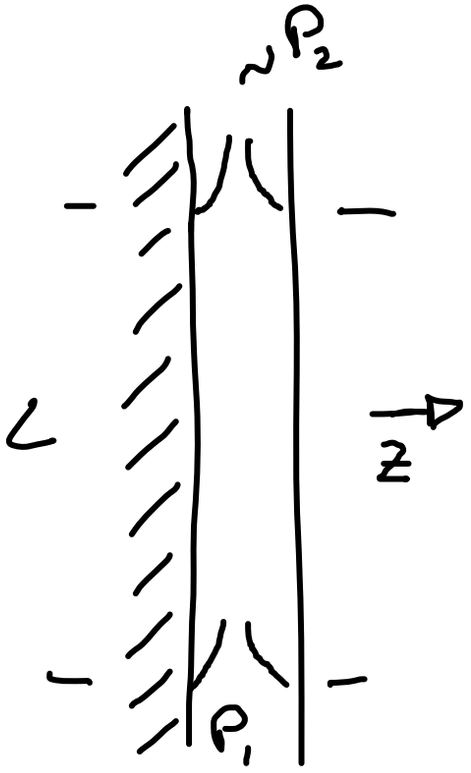
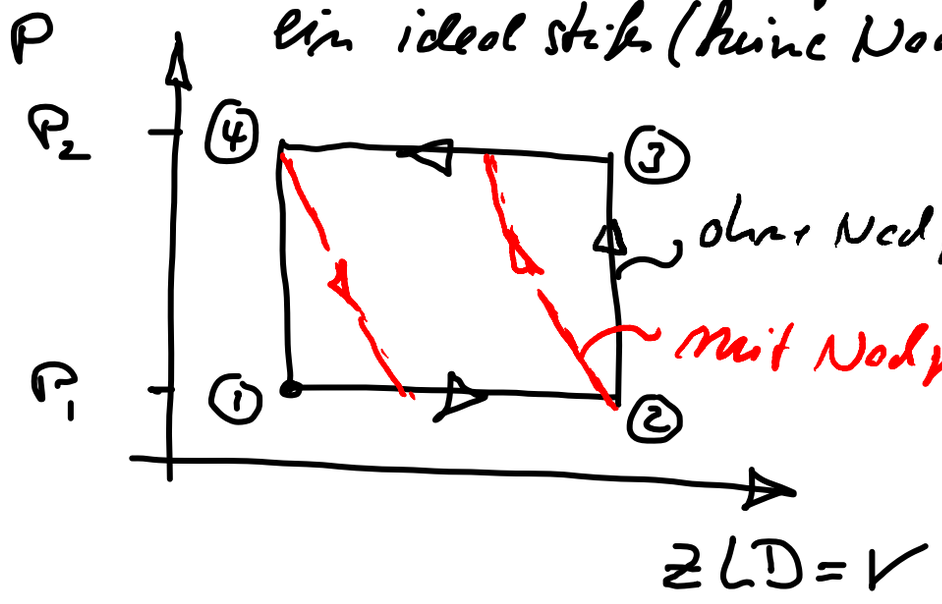



Indikatordiagramm für ein ideal steifes (keine Nachgiebigkeit)




① → ② Ansaugen

Hydrostatische Pumpe (kein Peristaltik)

② → ③ Kompression

③ → ④ Ausschieben

④ → ① Expansion



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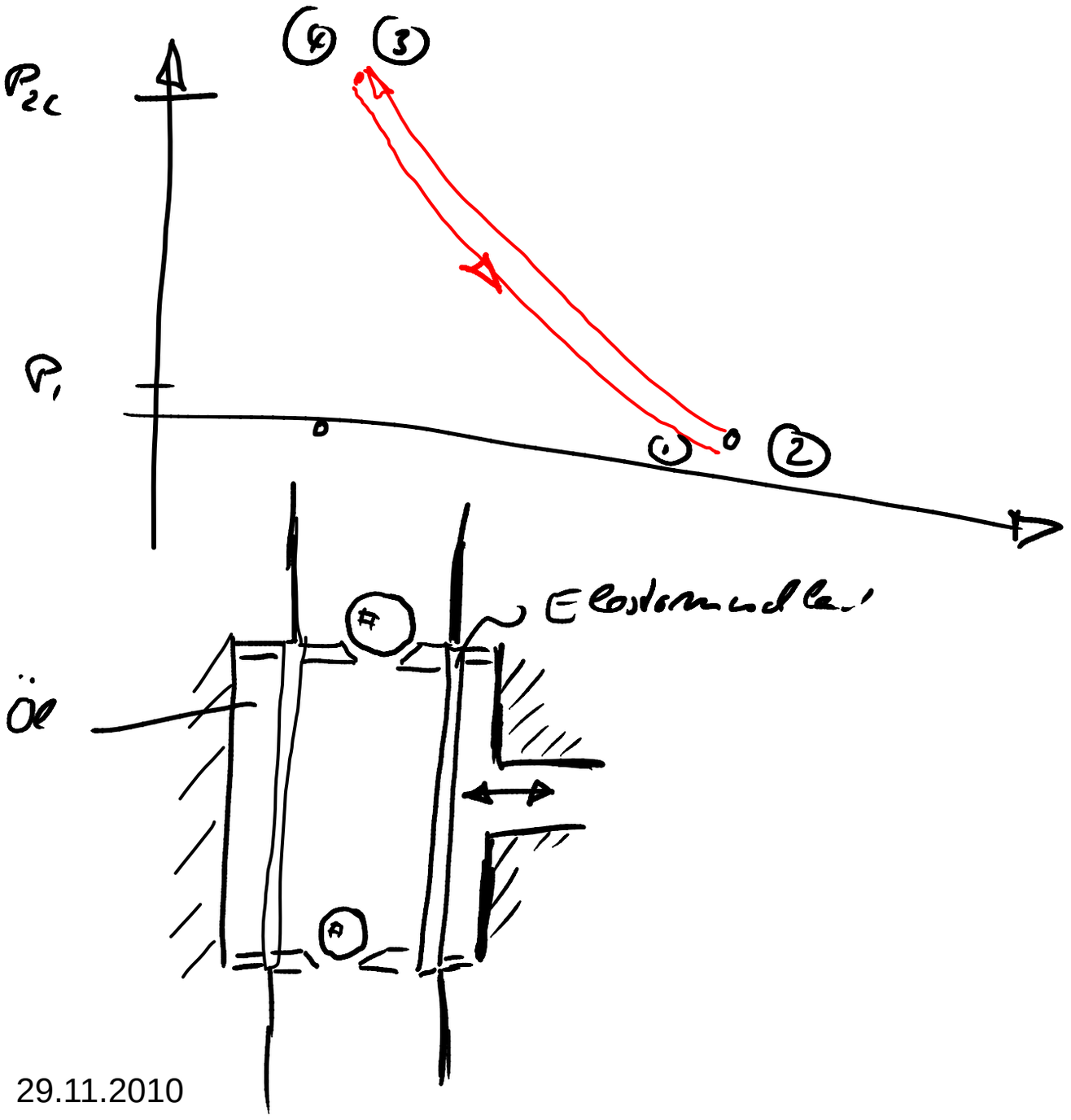




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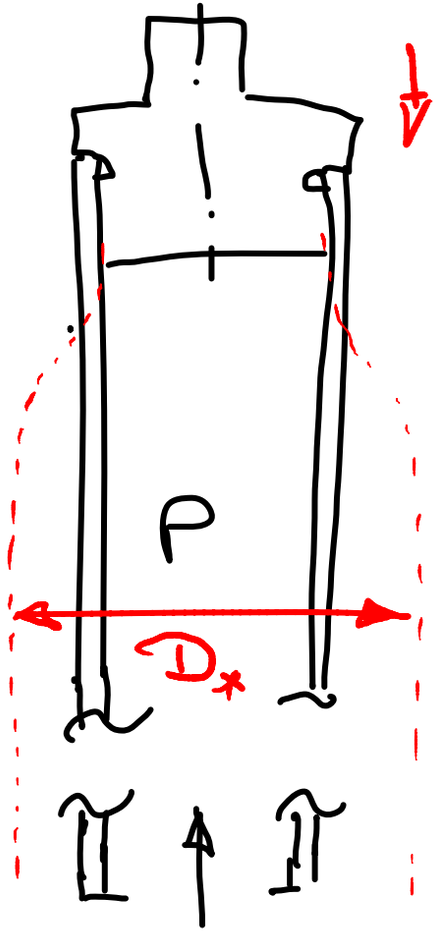
Künstliche Muskel Fa. FESTO.




$D_x$ Gleichgewichtsdurchmesser.



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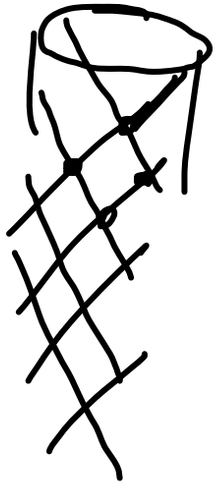
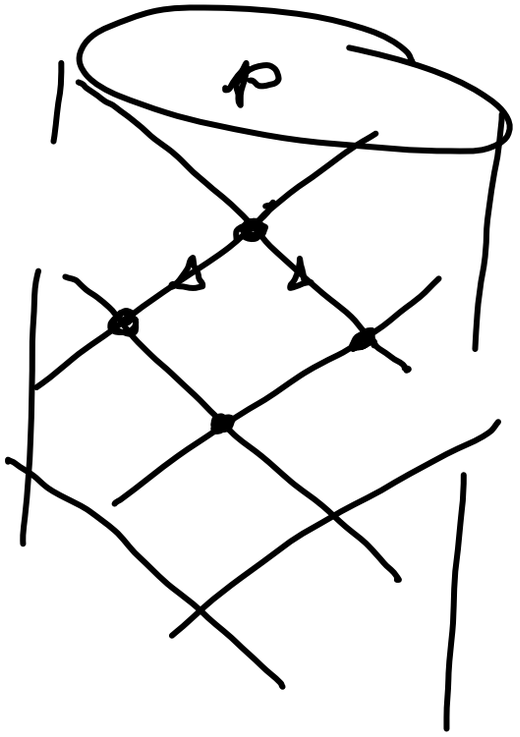
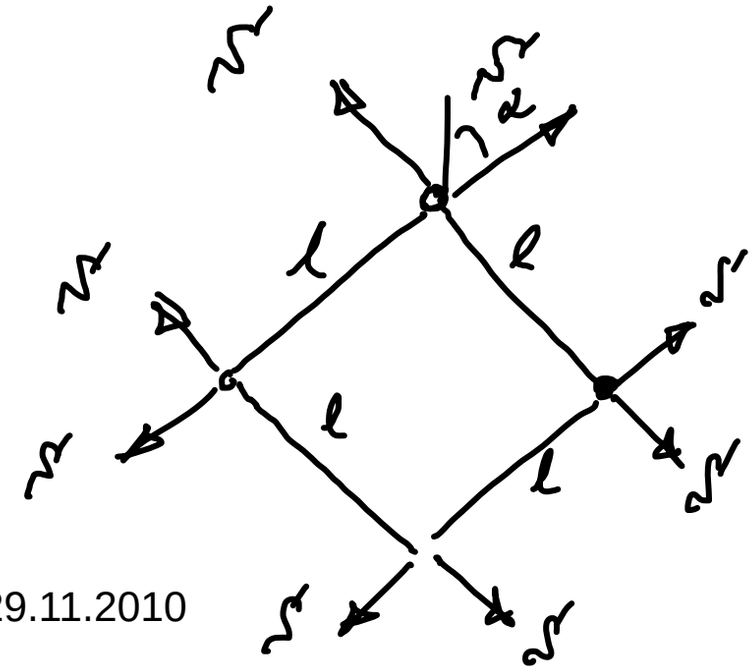
## Zahl der Fäden pro Maschenweite N

$$\frac{\pi}{4} P D^2 = 2N \cos\alpha \, s'$$






⇒ Gleichgewicht in α.



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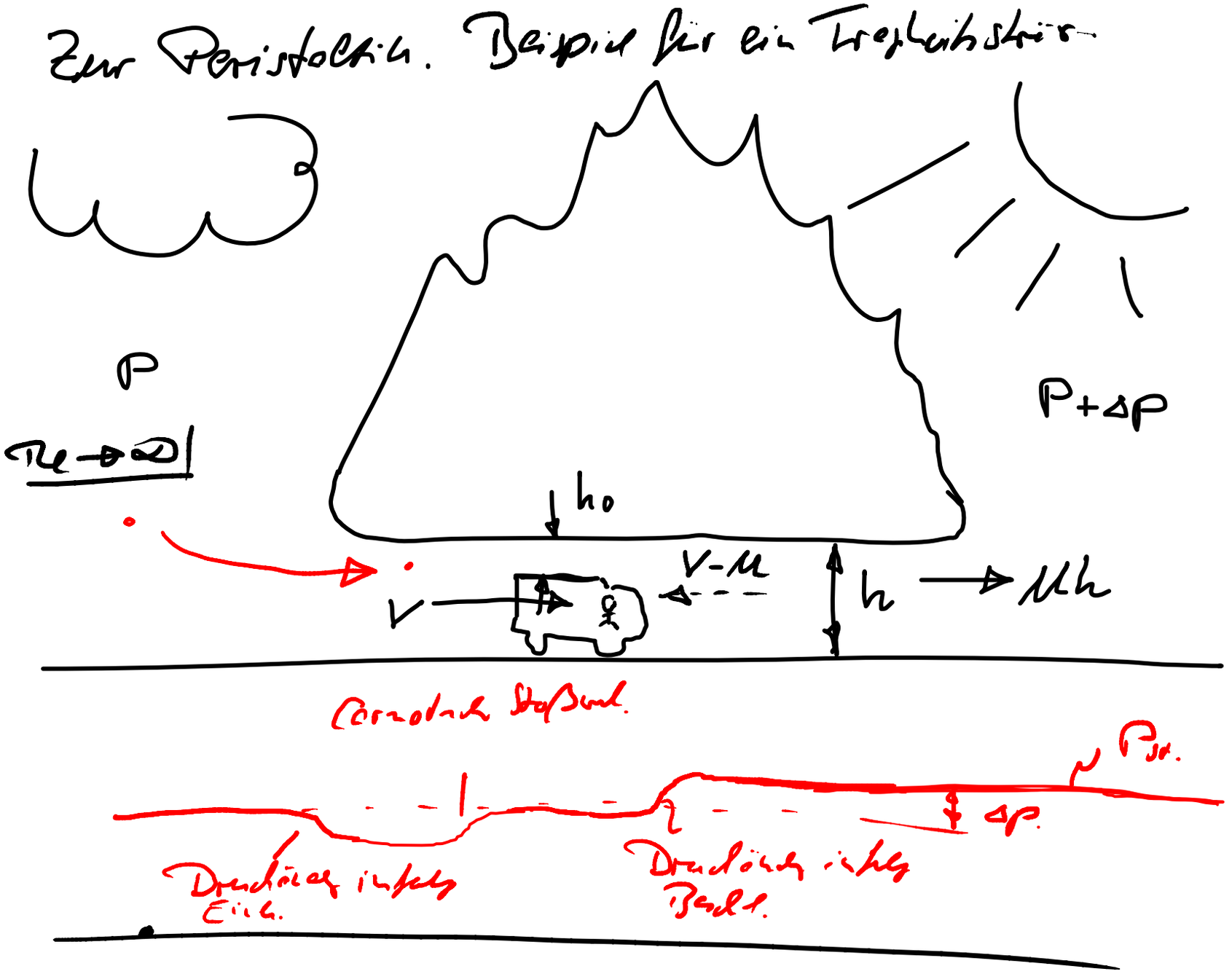




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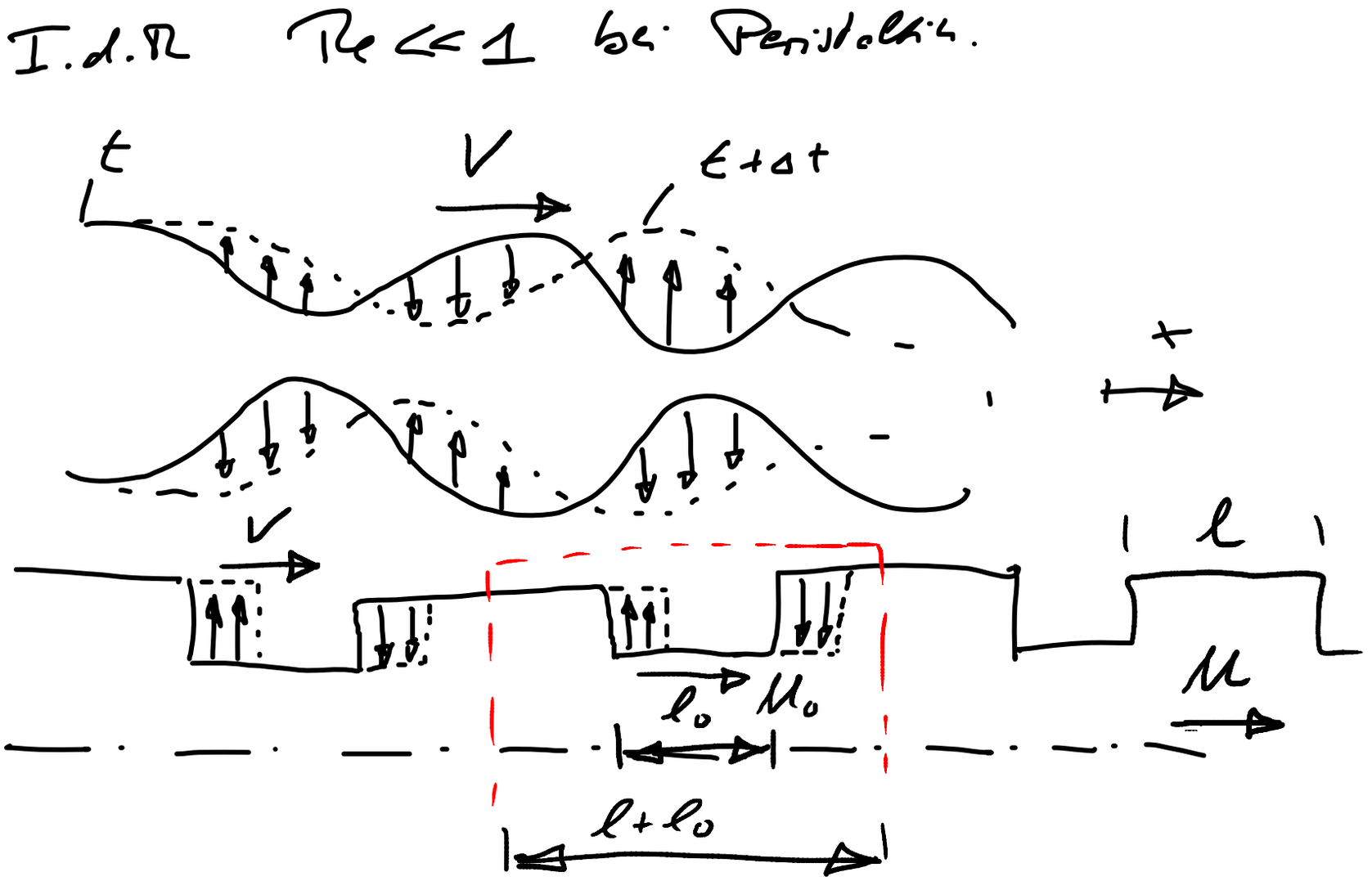


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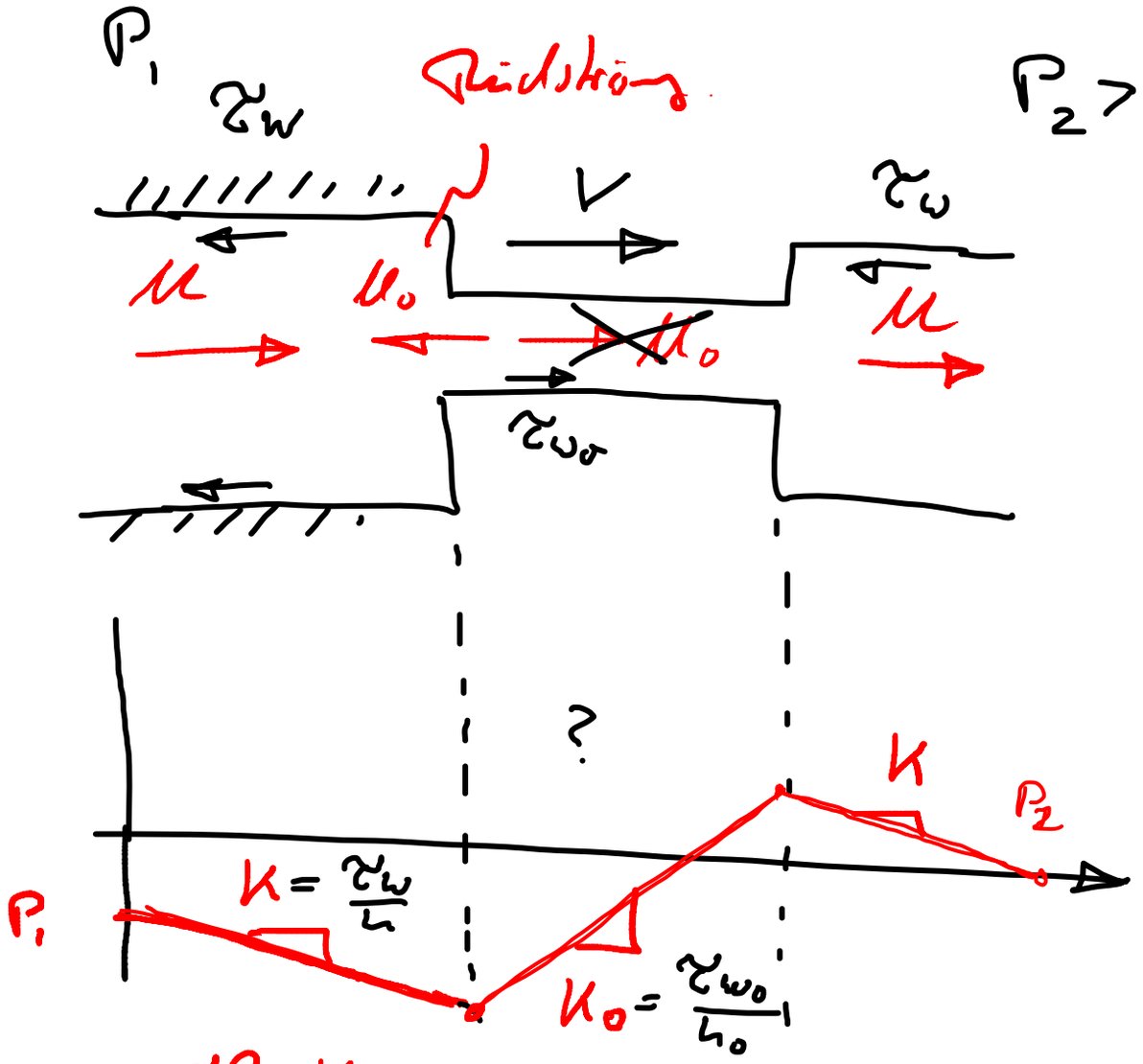


$p_2 > p_1$ für eine Pumpe

(Anm. Physiologisch Motor ist möglich

$$-\frac{dp}{dx} = K = \frac{\tau_w}{h}$$

$$h\,dp = -\tau_w\,dx \rightsquigarrow \frac{dp}{dx} = -\frac{\tau_w}{h}$$



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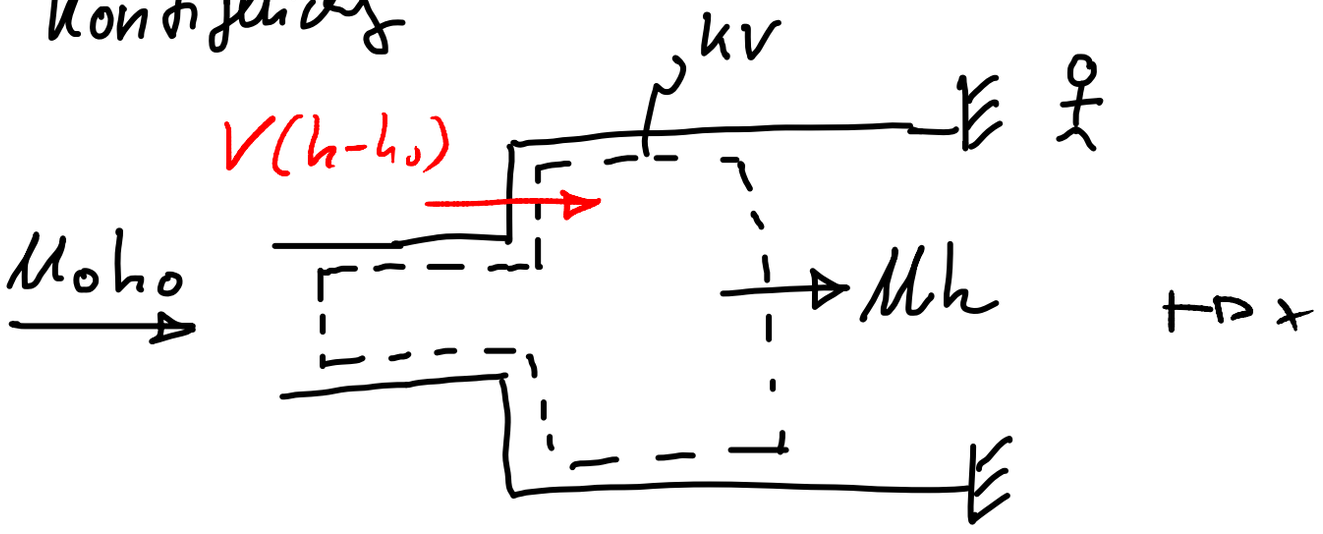
Kontinuität




Anm: $\dot{m}_0$ soll positiv in positiv x-Richtg.

$$-\dot{m}_0 h_0 - V(h-h_0) + \dot{m} h = 0$$

$$\underline{\dot{m}_0} = (\underline{\dot{m}} - \underline{V} H)\,\frac{h}{h_0}\,, \text{ mit}$$

$$H := 1 - \frac{h_0}{h}.$$



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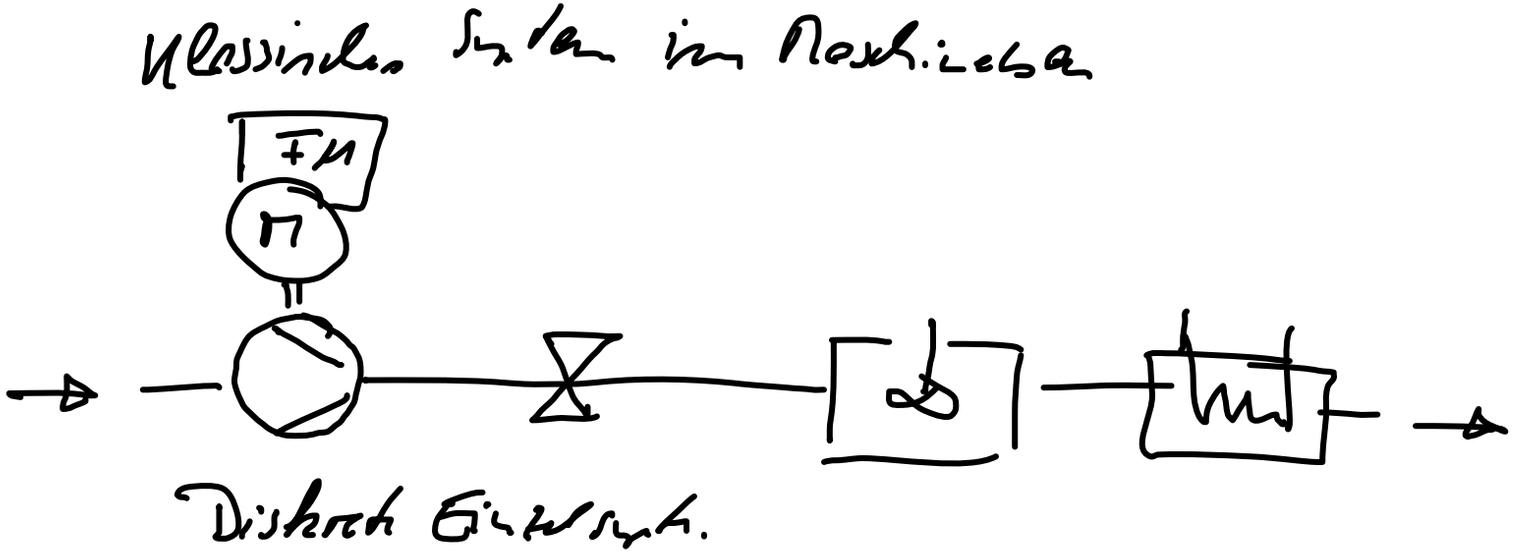


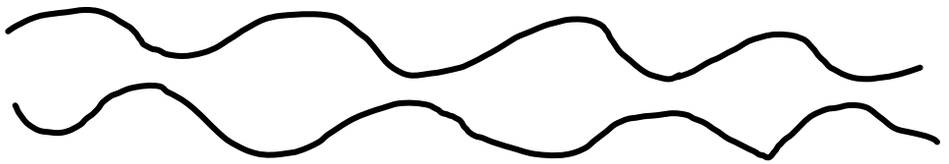



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Gesamt Druckverlust

$$p_1 - p_2 = K l + K_0 l_0 + \Delta p_{instat} \qquad (1)$$

Trägheitsanteil

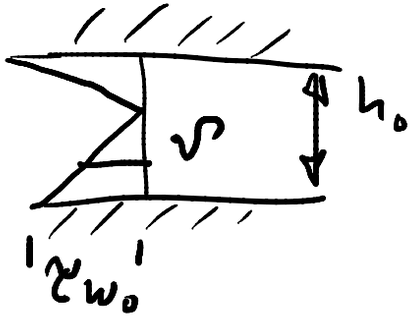
Widerstandsgesetz
für ein viskoses Strömungsfeld

$$K_0 = 12\mu \frac{l_0}{h_0^2}\left(1 - \frac{3}{2}B_0 + \frac{1}{2}B_0^3\right)^{-1}$$

$\mu$ dynamische Viskosität

$= \frac{3}{2}$ Poiseuille-Anteil

$$B_0 = \frac{s}{\tau_{w0}}$$




vgl. Spurkhard Kap. 5 Schichtströmungen





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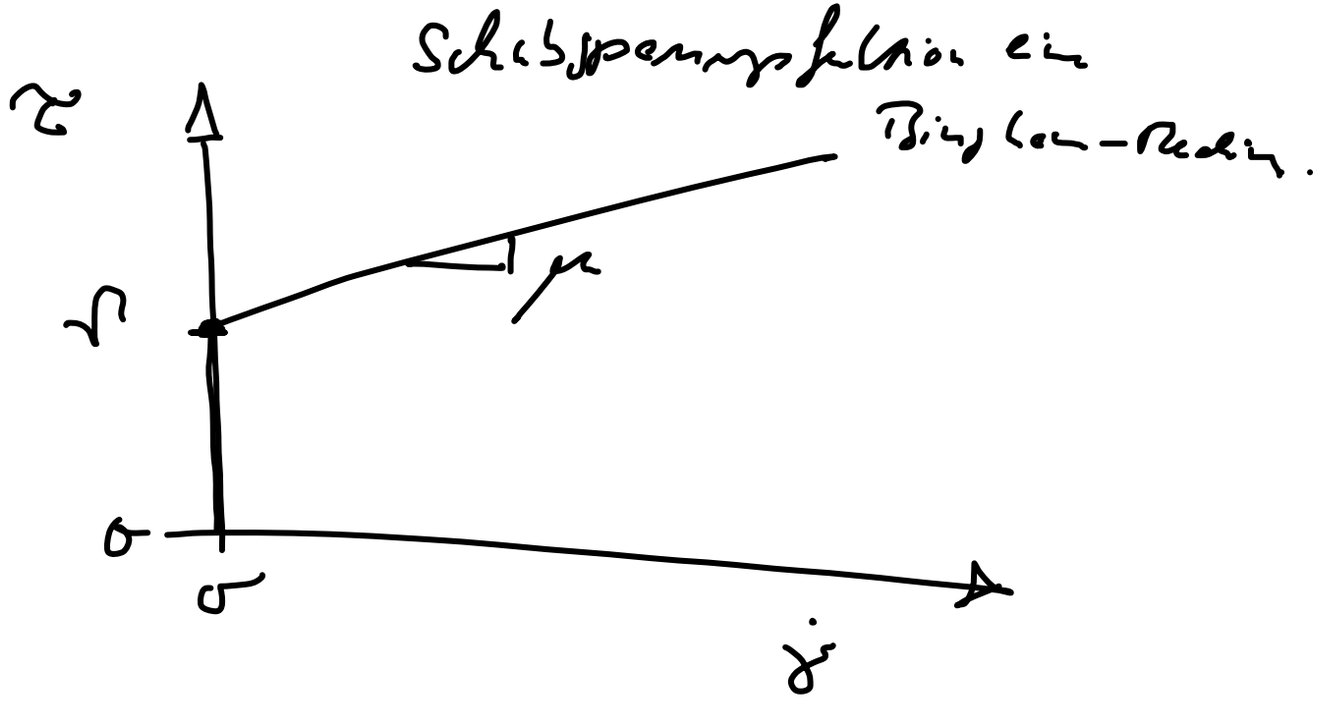
$$K = 12\mu \frac{M}{h^2}\left(1 - \frac{3}{2}\Pi + \frac{1}{2}\Pi^3\right)^{-1}$$

$$\Pi = \frac{\tau}{\tau_w}$$



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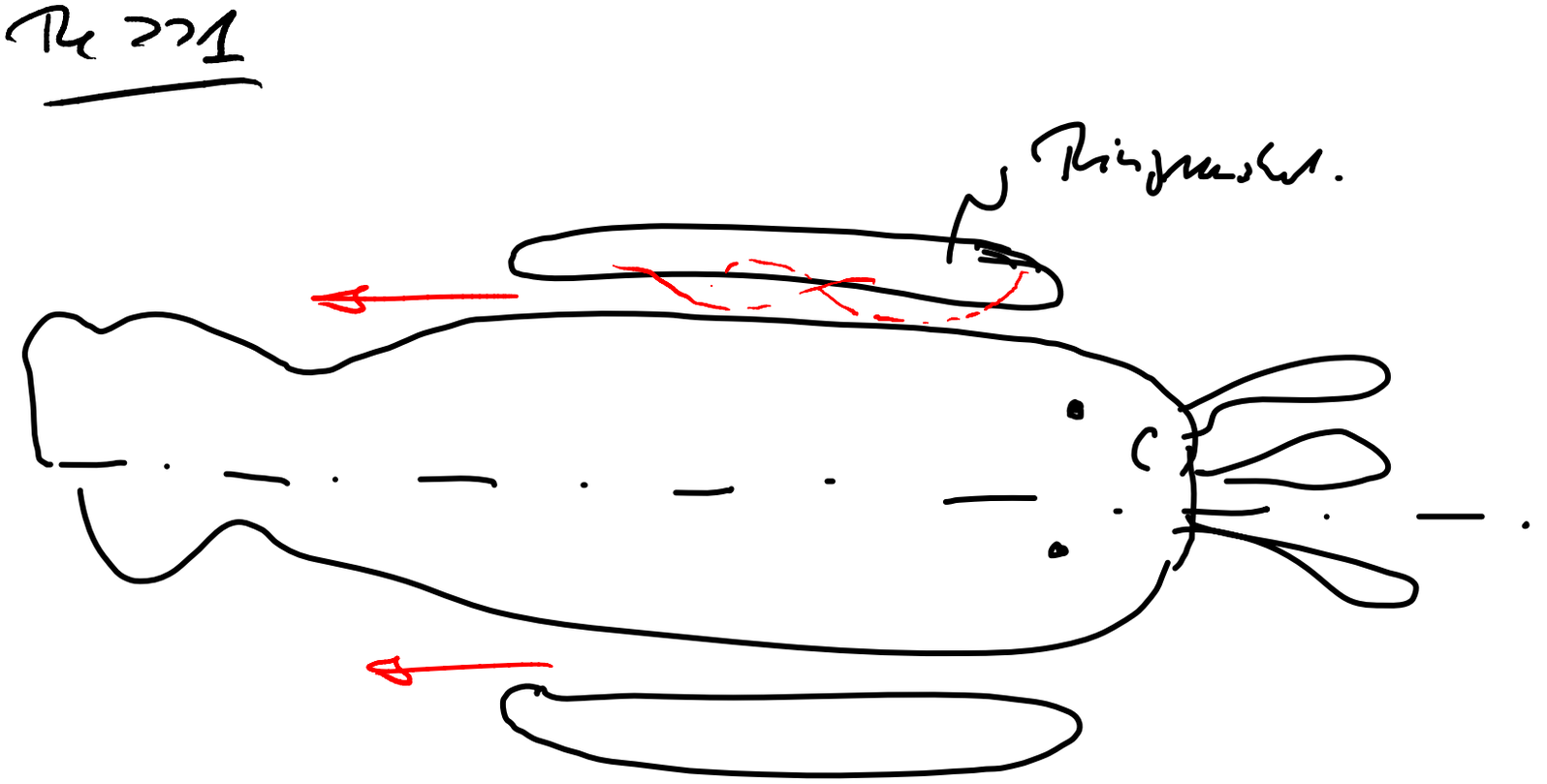

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