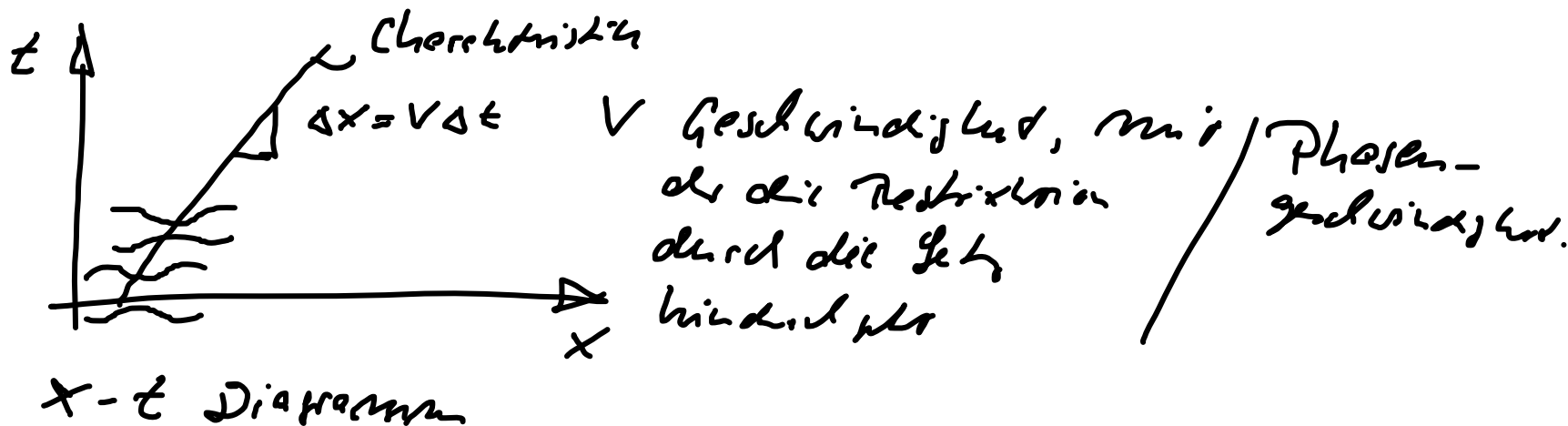
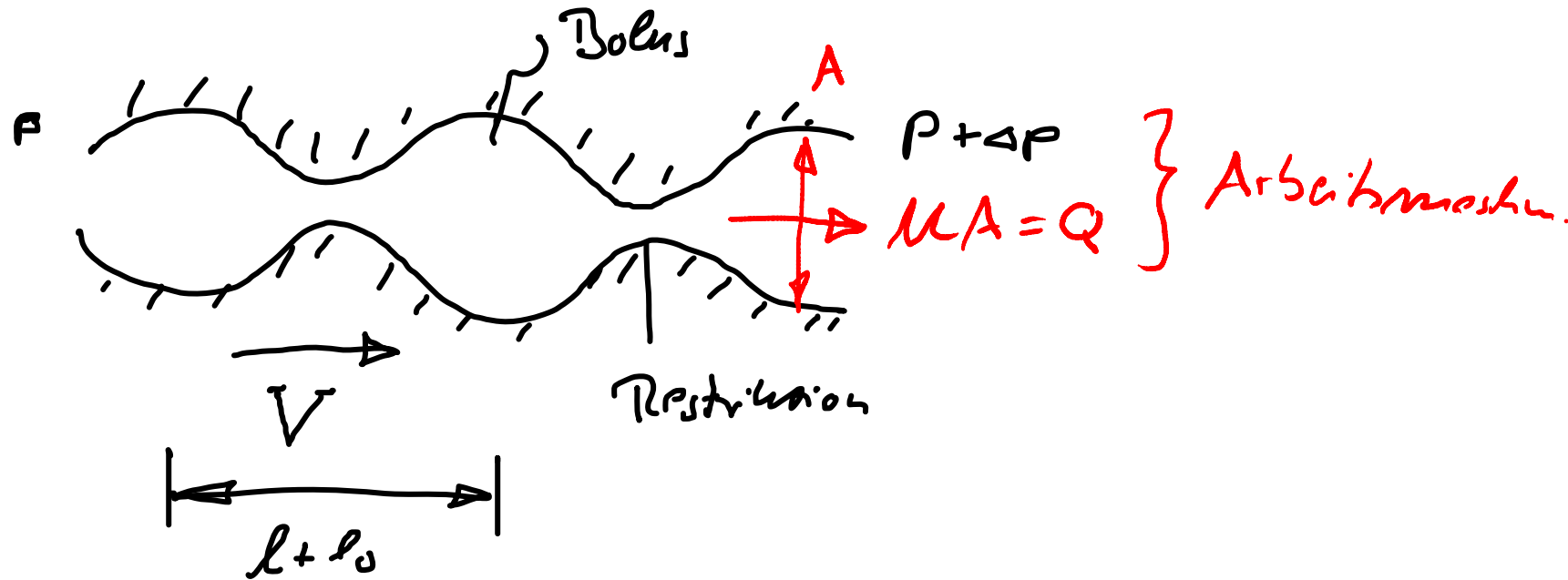


Peristaltische Strömung



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

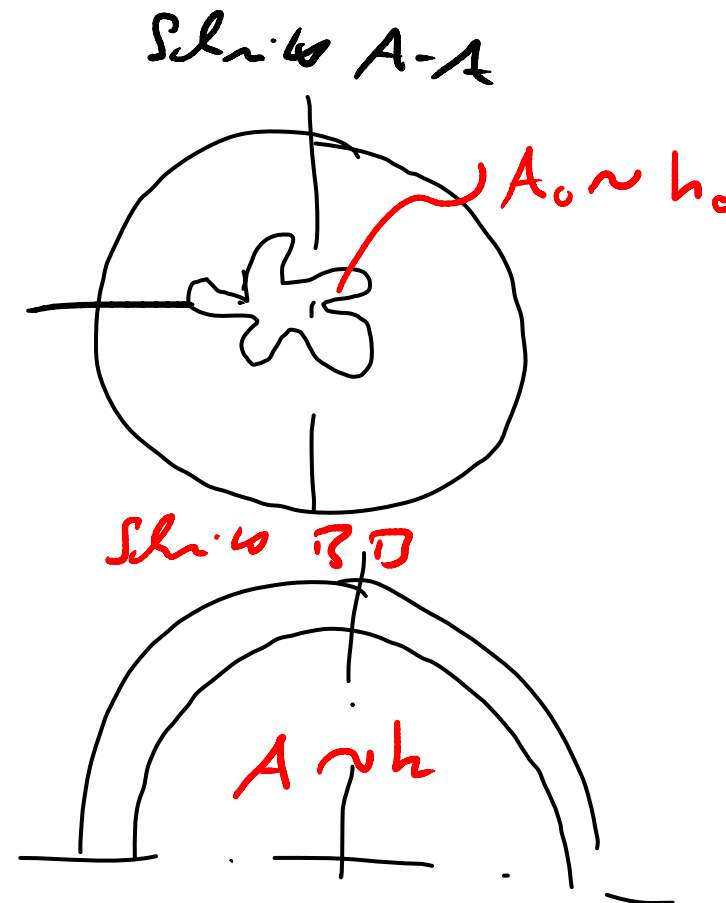
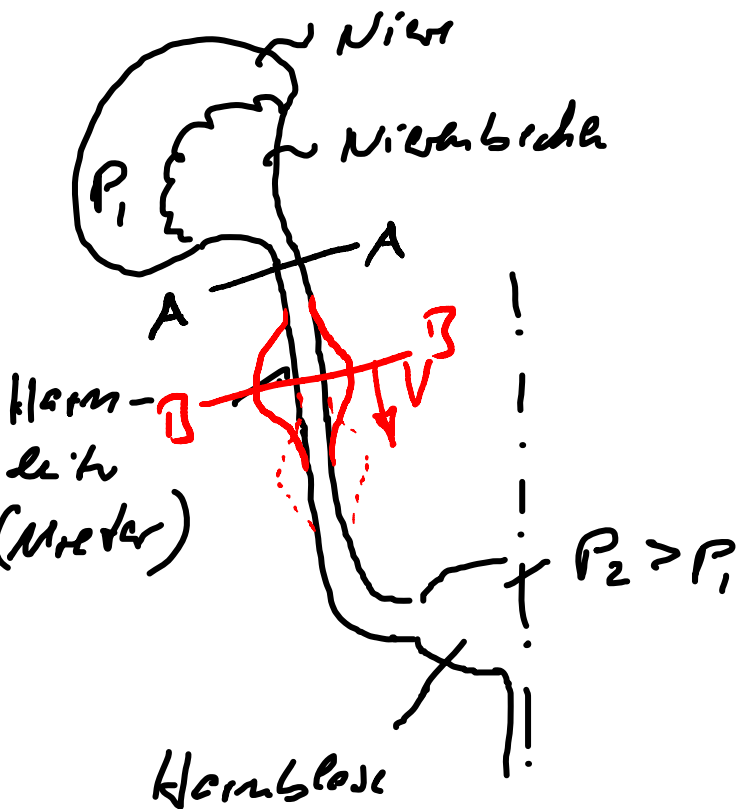




Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

Peristaltische Pumpen sind häufig in biologische Systemen anzutreffen.

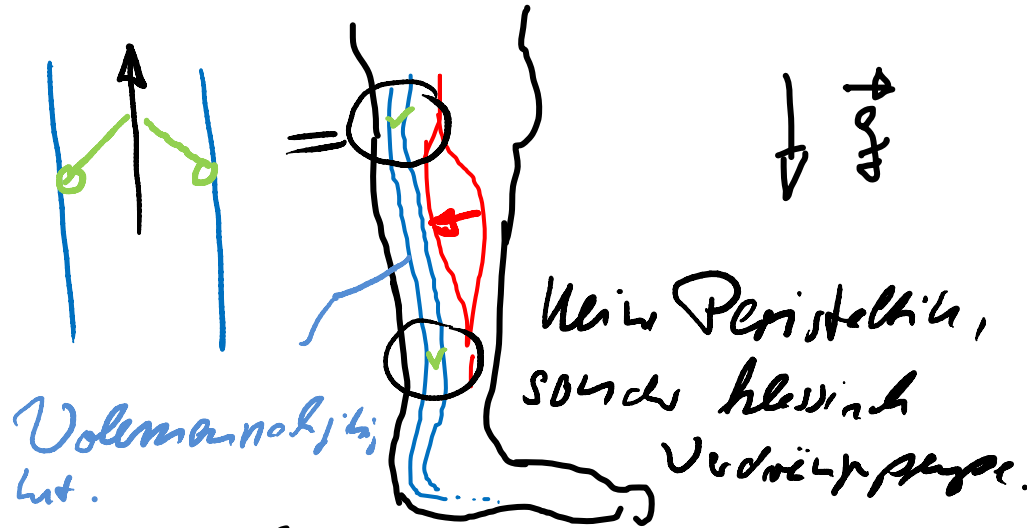
Beispiele Harnleiter



Andere Beispiele:

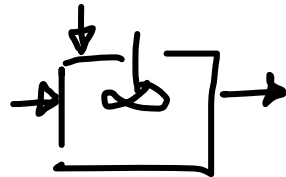
Darm

Eileiter ...

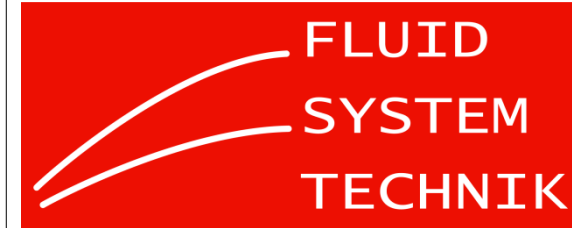


Hohe Interaktion von Funktionen

- Material transportieren
- Energie einbringen
- Mischen
- Reaktor



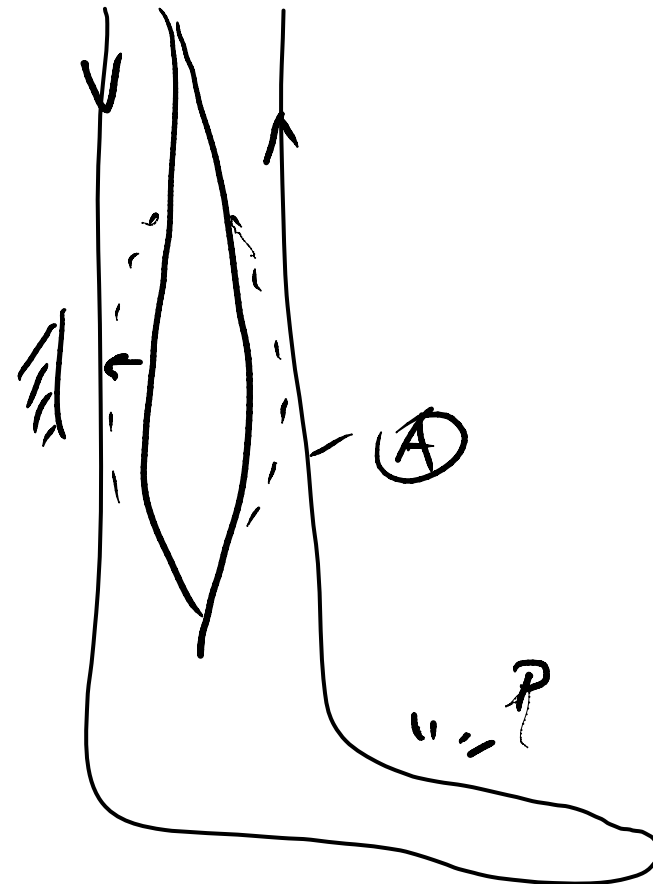
TECHNISCHE
UNIVERSITÄT
DARMSTADT



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9



1. P_v
2. Muskel- p
- 3.

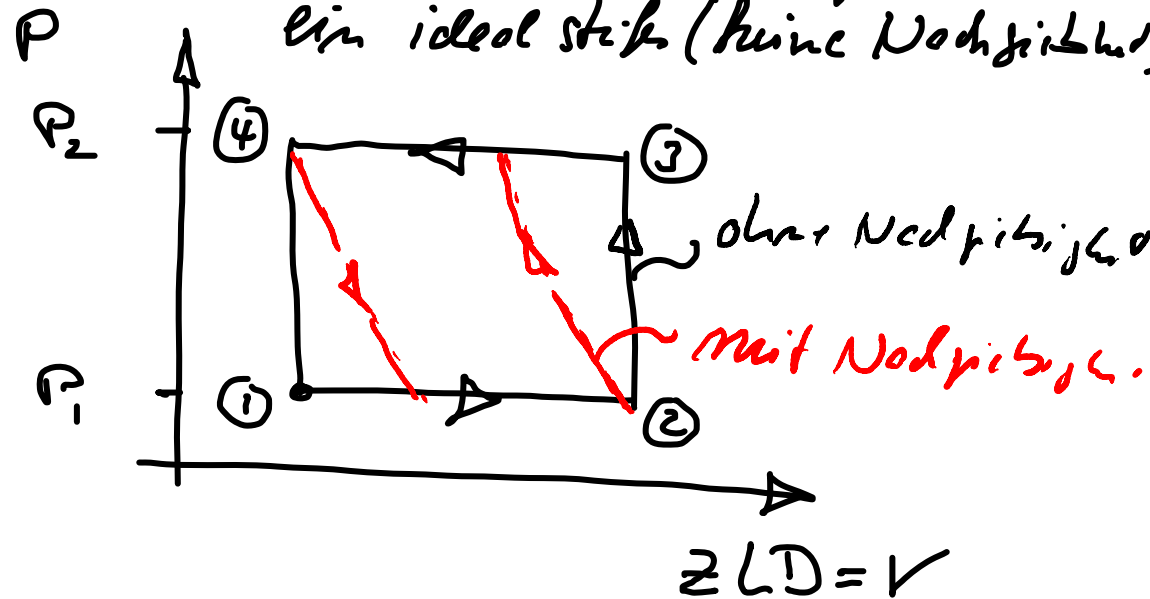
19 mm Hg

Puls



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

Indikatordiagramm für
ein ideales Fluid (keine Viskosität)



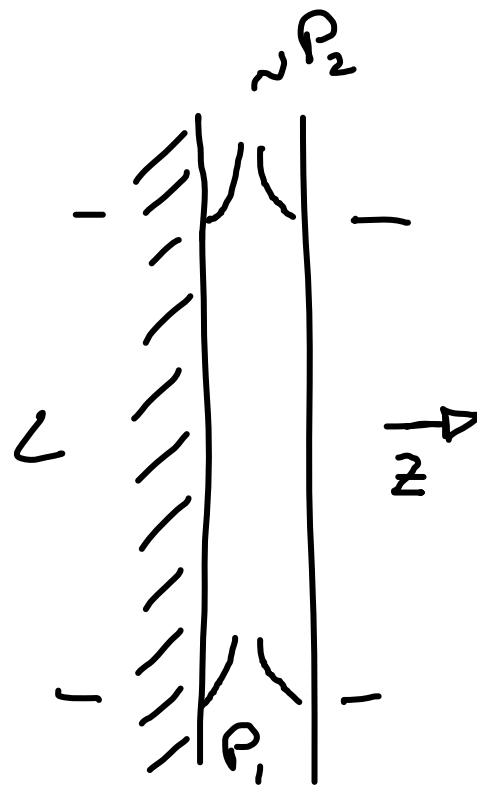
① → ② Ansaug

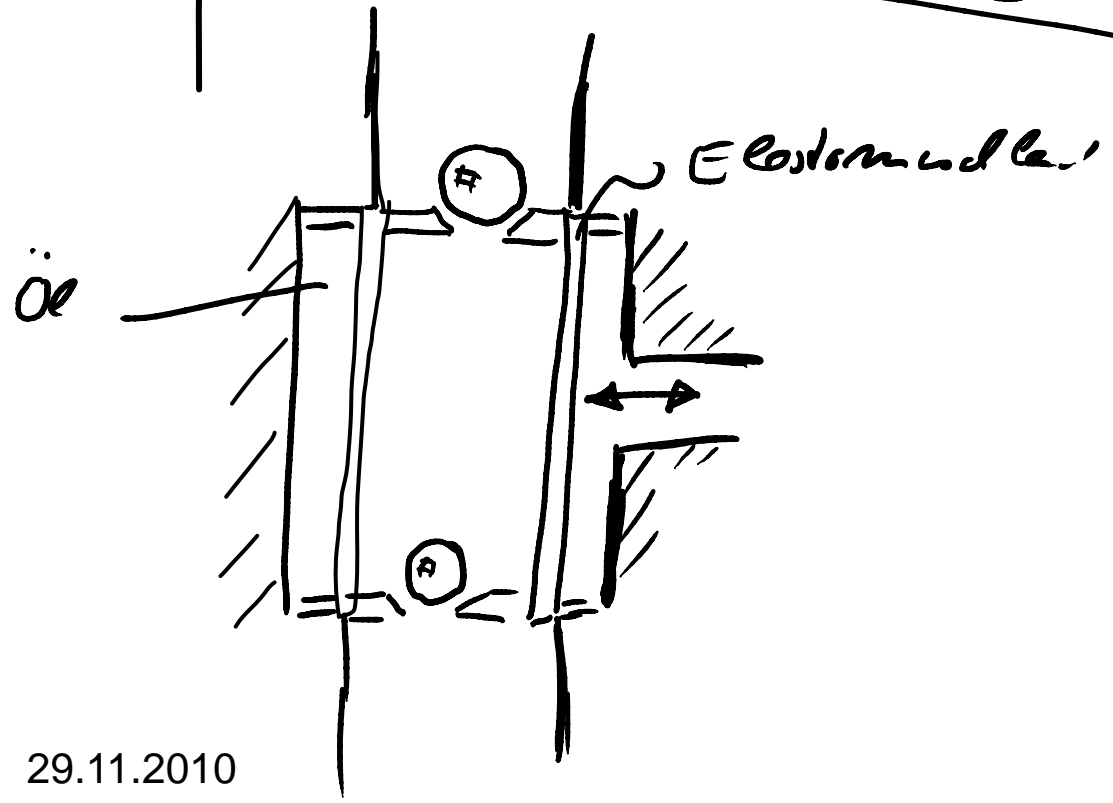
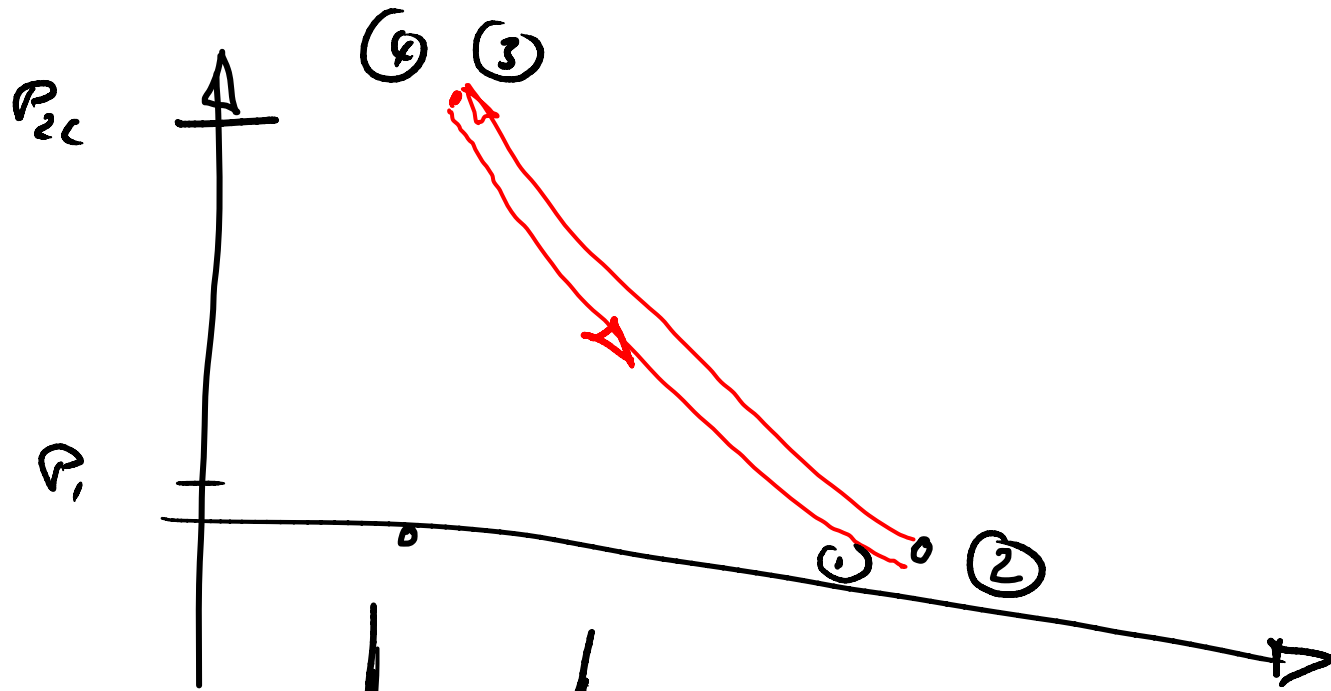
② → ③ Kompression

③ → ④ Ausdehnung

④ → ① Expansion

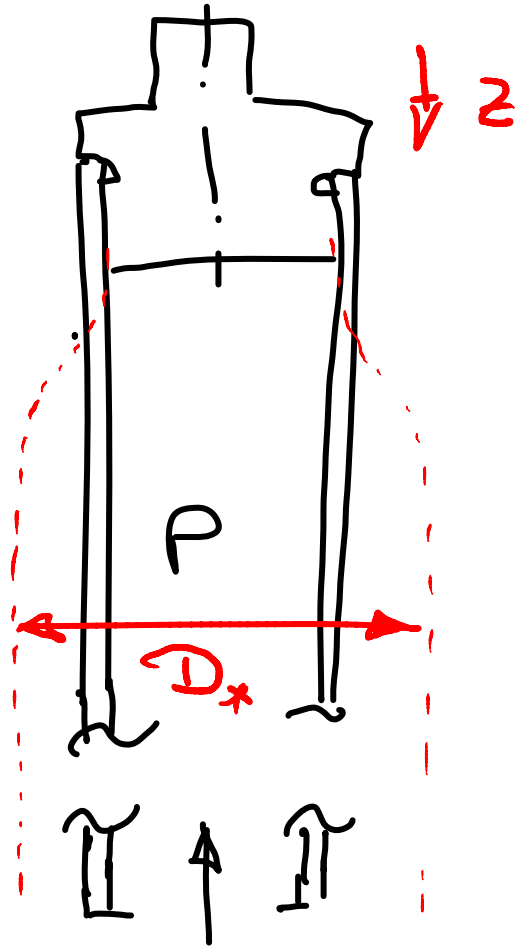
Hydrostatische Pumpe (keine Peristaltik)





Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

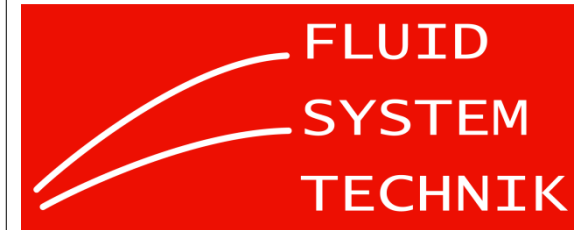
Künstliche Herzklappe FA. FESSTO.



D^* Gleiches $d_1, d_2, d_3, d_4, d_5, d_6, d_7, d_8, d_9, d_{10}, d_{11}, d_{12}, d_{13}, d_{14}, d_{15}, d_{16}, d_{17}, d_{18}, d_{19}, d_{20}, d_{21}, d_{22}, d_{23}, d_{24}, d_{25}, d_{26}, d_{27}, d_{28}, d_{29}, d_{30}, d_{31}, d_{32}, d_{33}, d_{34}, d_{35}, d_{36}, d_{37}, d_{38}, d_{39}, d_{40}, d_{41}, d_{42}, d_{43}, d_{44}, d_{45}, d_{46}, d_{47}, d_{48}, d_{49}, d_{50}, d_{51}, d_{52}, d_{53}, d_{54}, d_{55}, d_{56}, d_{57}, d_{58}, d_{59}, d_{60}, d_{61}, d_{62}, d_{63}, d_{64}, d_{65}, d_{66}, d_{67}, d_{68}, d_{69}, d_{70}, d_{71}, d_{72}, d_{73}, d_{74}, d_{75}, d_{76}, d_{77}, d_{78}, d_{79}, d_{80}, d_{81}, d_{82}, d_{83}, d_{84}, d_{85}, d_{86}, d_{87}, d_{88}, d_{89}, d_{90}, d_{91}, d_{92}, d_{93}, d_{94}, d_{95}, d_{96}, d_{97}, d_{98}, d_{99}, d_{100}$



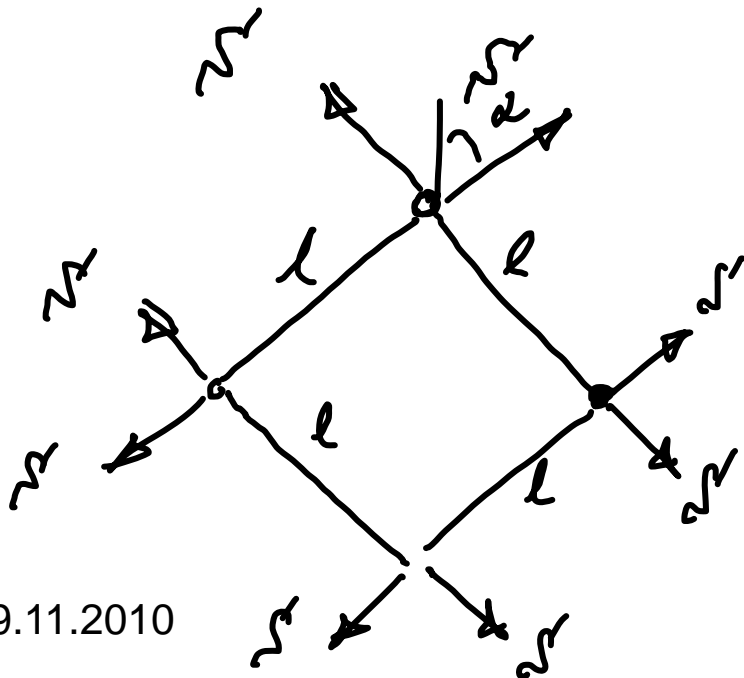
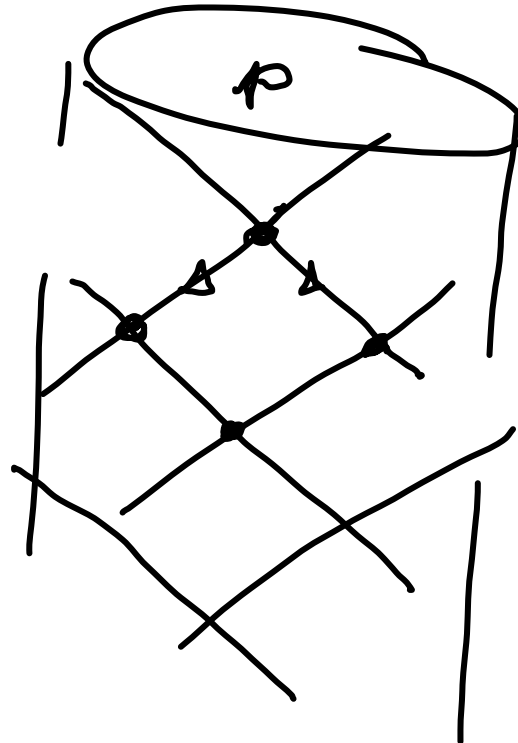
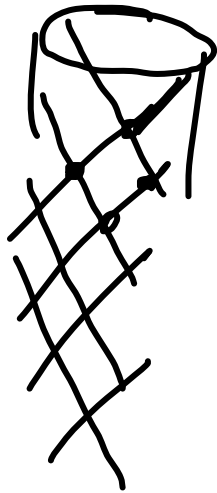
TECHNISCHE
UNIVERSITÄT
DARMSTADT



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

Zahl der Fäden pro Muffe N

$$\frac{\pi}{4} P D^2 = 2 N \cos \alpha \cdot r$$



→ Slip nicht mit α .



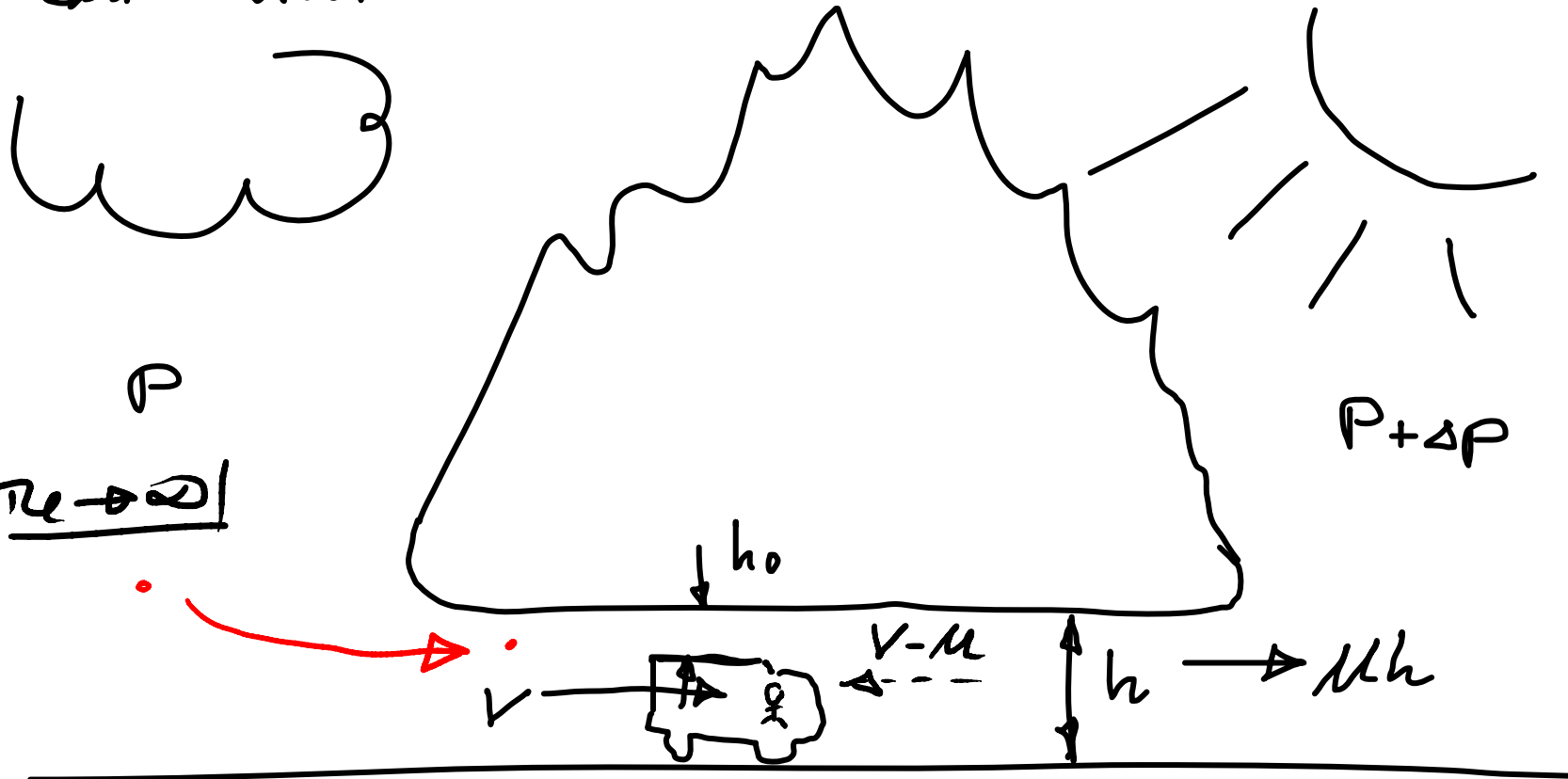
TECHNISCHE
UNIVERSITÄT
DARMSTADT

FLUID
SYSTEM
TECHNIK



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

Zur Peristole. Beispiel für ein Tropfenström



Coriolis Beschleun.



Druckänderung infolge
Eink.

Druckänderung infolge
Beschl.



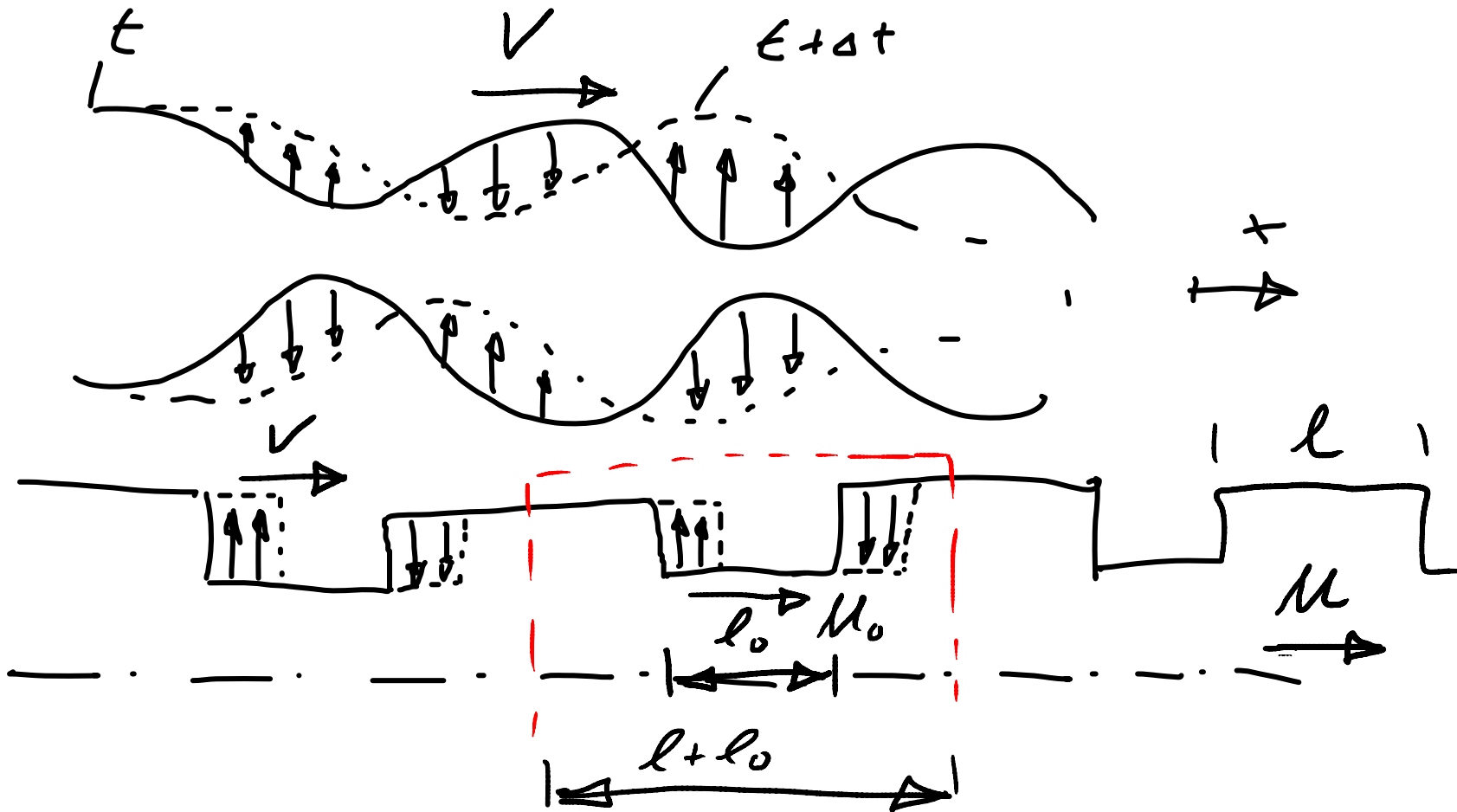
TECHNISCHE
UNIVERSITÄT
DARMSTADT

FLUID
SYSTEM
TECHNIK

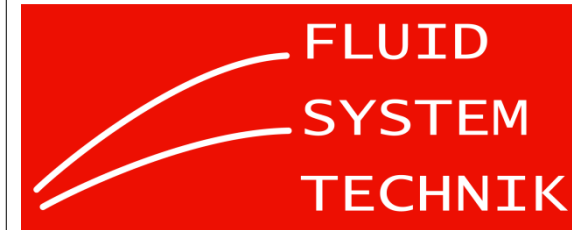


Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

I.d.R. $Re \ll 1$ bei Peristaltik.



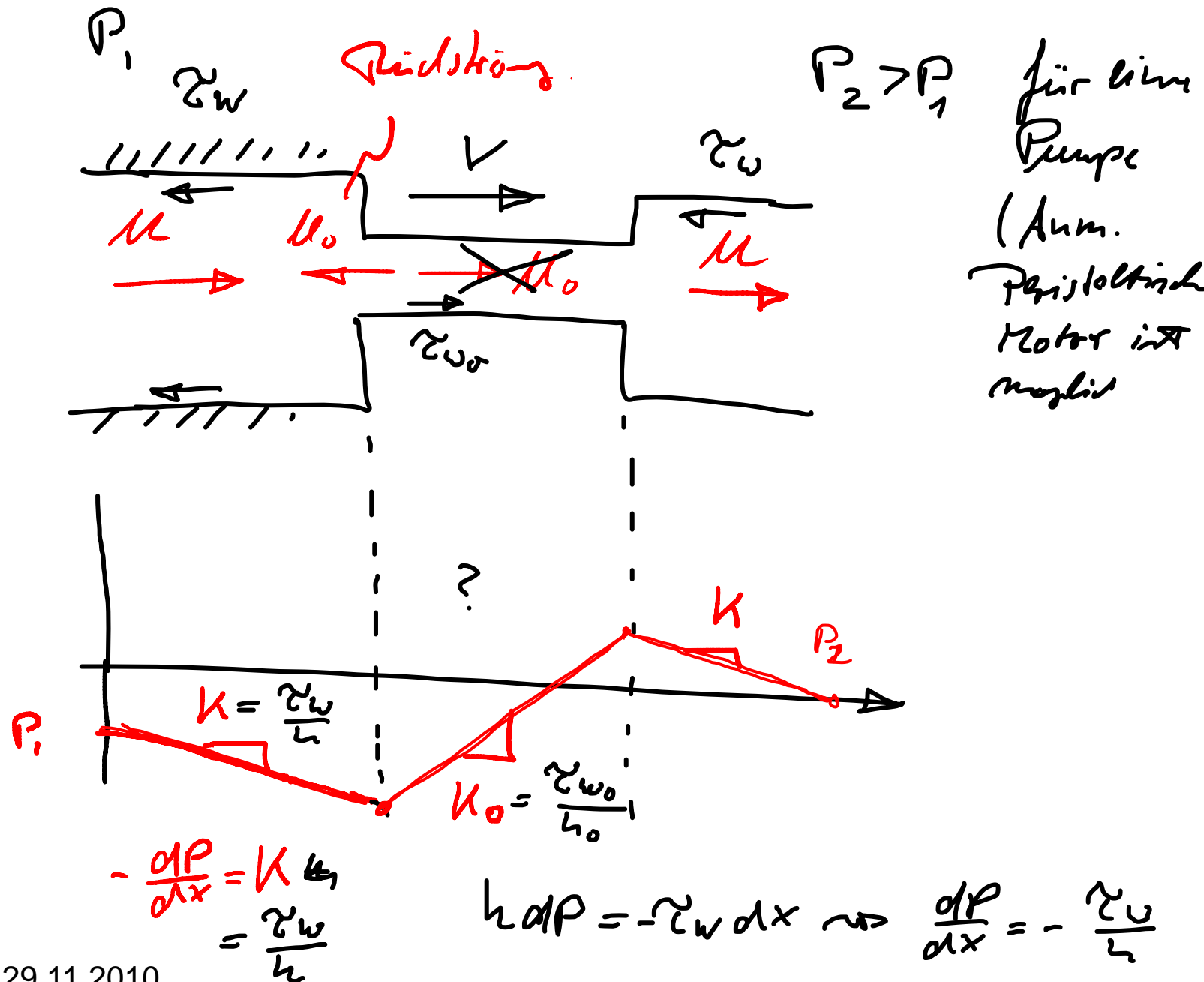
TECHNISCHE
UNIVERSITÄT
DARMSTADT



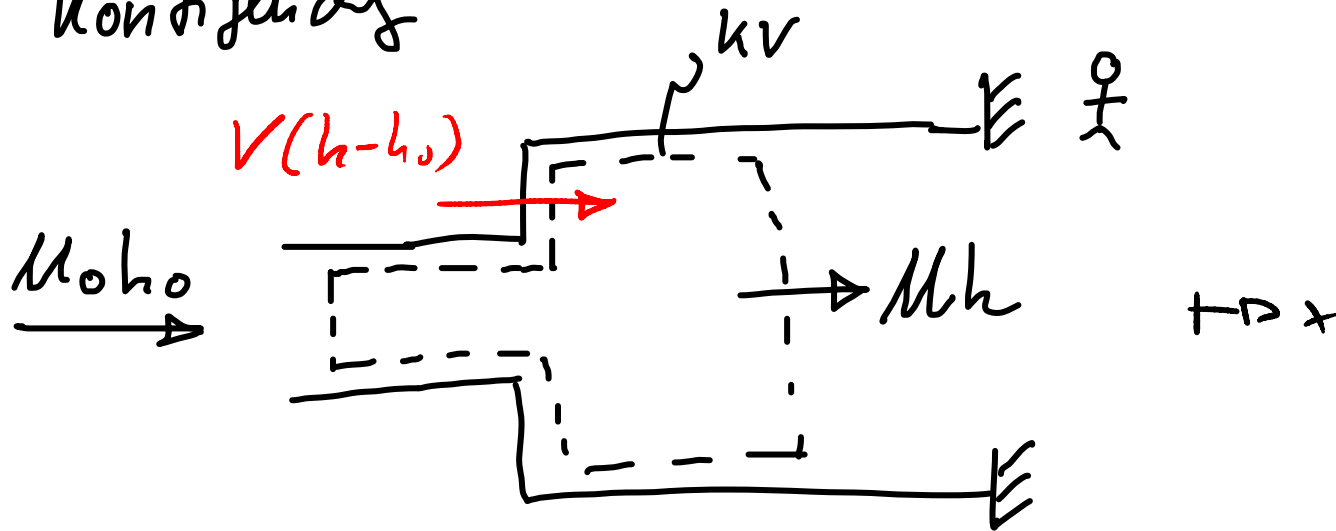
Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9



Kontinuitätsgleichung



Anm: M_0 soll positiv in positive x -Richtung.

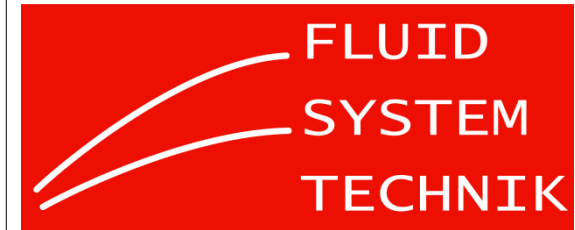
$$-M_0 h_0 - V(h-h_0) + M h = 0$$

$$\underline{M_0} = (\underline{M} - \underline{V} H) \frac{h}{h_0}, \text{ mit}$$

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

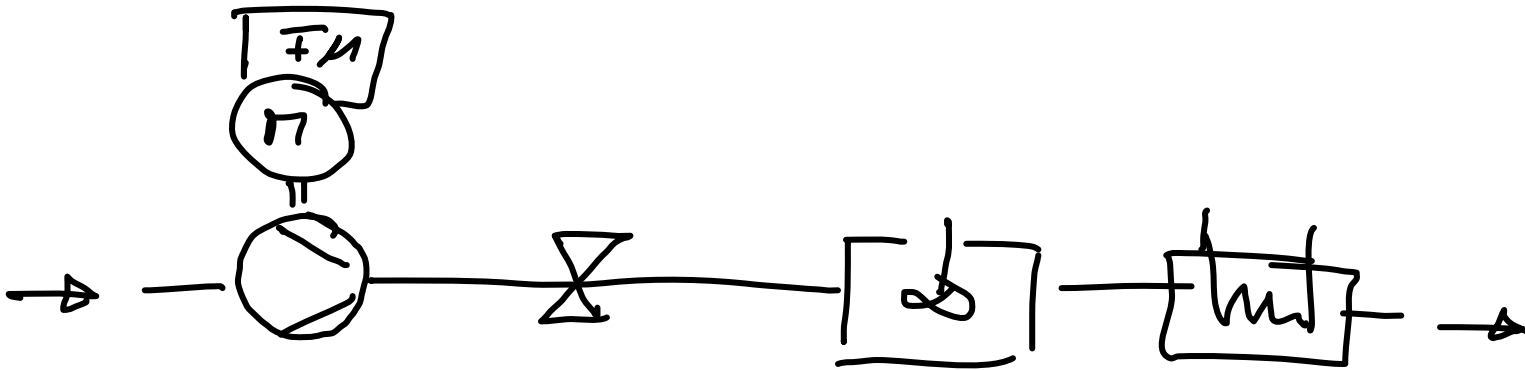


TECHNISCHE
UNIVERSITÄT
DARMSTADT



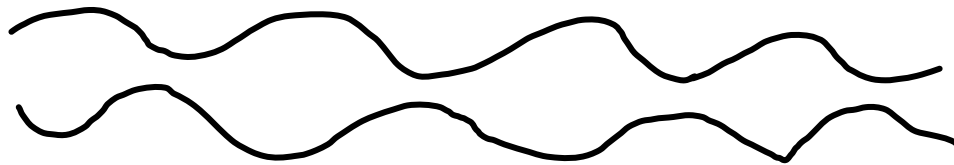
Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

Klassisches System im Nachhinein

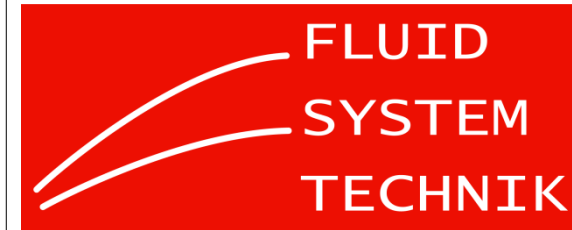


Discrete Einwirkung.

In der Natur: Hohe Frequenzstörgrößen.



TECHNISCHE
UNIVERSITÄT
DARMSTADT



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

Gesamte Druckänderung

$$P_1 - P_2 = K_L + K_0 l_0 + \Delta P_{\text{inertial}} \quad (1)$$

Trennleitungsdurchmesser.

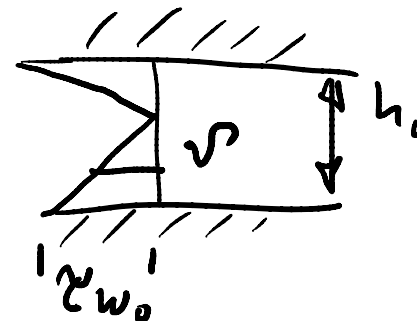
Widerstandsformel
für ein viskoses Strömung

$$K_0 = 12 \mu \frac{\mu_0}{h_0^2} \left(1 - \frac{3}{2} \beta_0 + \frac{1}{2} \beta_0^3 \right) \mu \text{ dynamisch}$$

viskosität.

Poiseuille-
Anteil

$$\beta_0 = \frac{v}{c_{w0}}$$



vgl. Spurkband

29.11.2010 Kap. 5 Schichtstr.



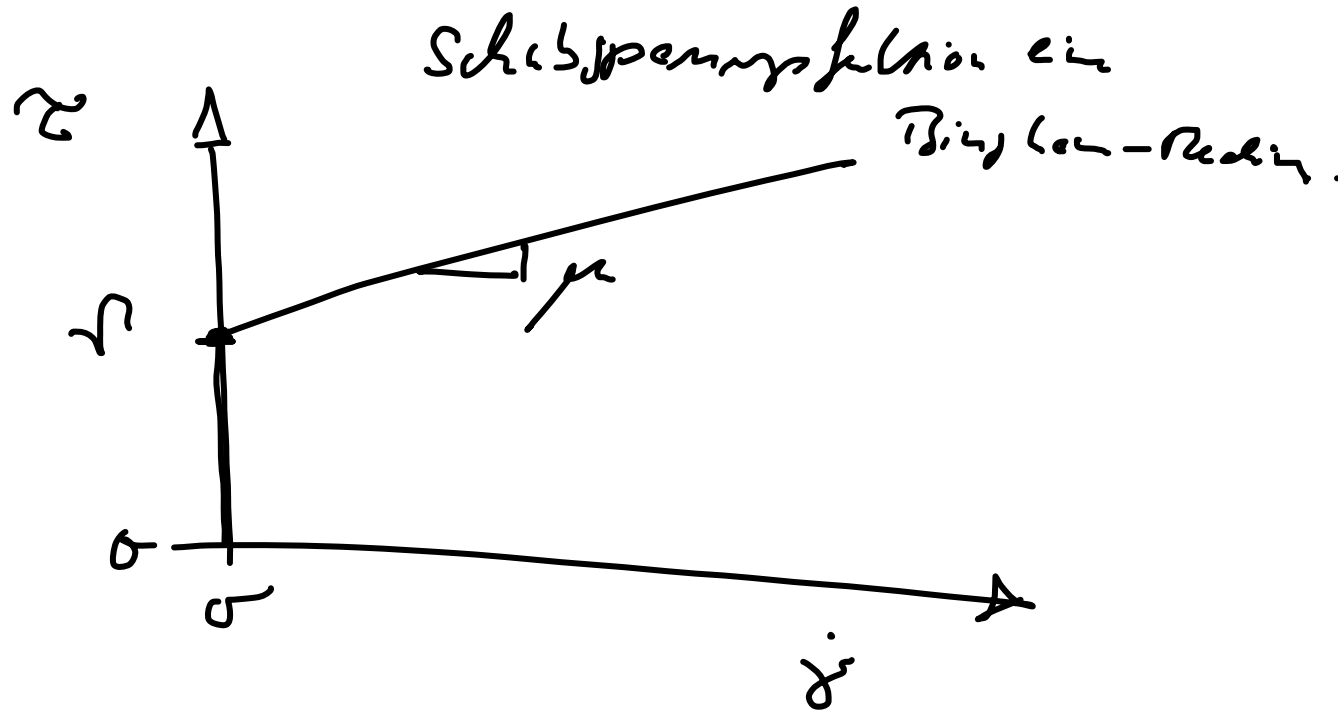
Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9



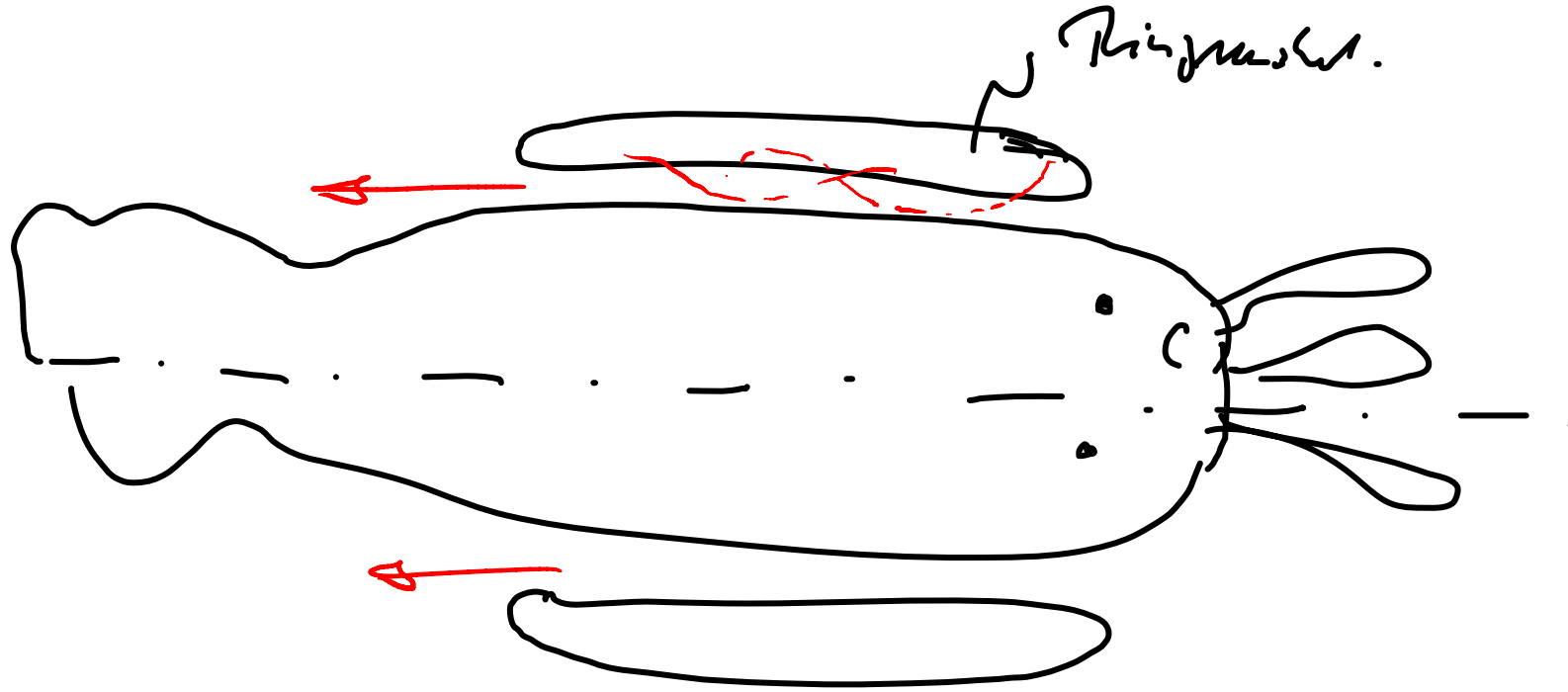
Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9

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

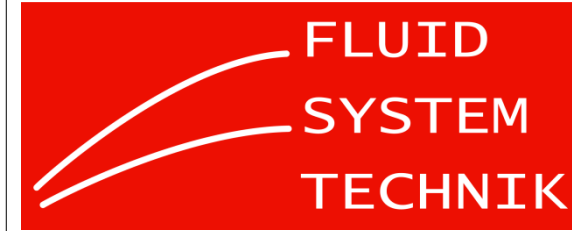
$$B = \frac{\tau_w}{\tau_0}$$



PL 221



TECHNISCHE
UNIVERSITÄT
DARMSTADT



Prof. Dr. Ing. Peter Pelz
Wintersemester 2010/11
Biofluidmechanik
Vorlesung 9