Hydraulik

TECHNISCHE UNIVERSITÄT DARMSTADT

FLUID SYSTEM TECHNIK

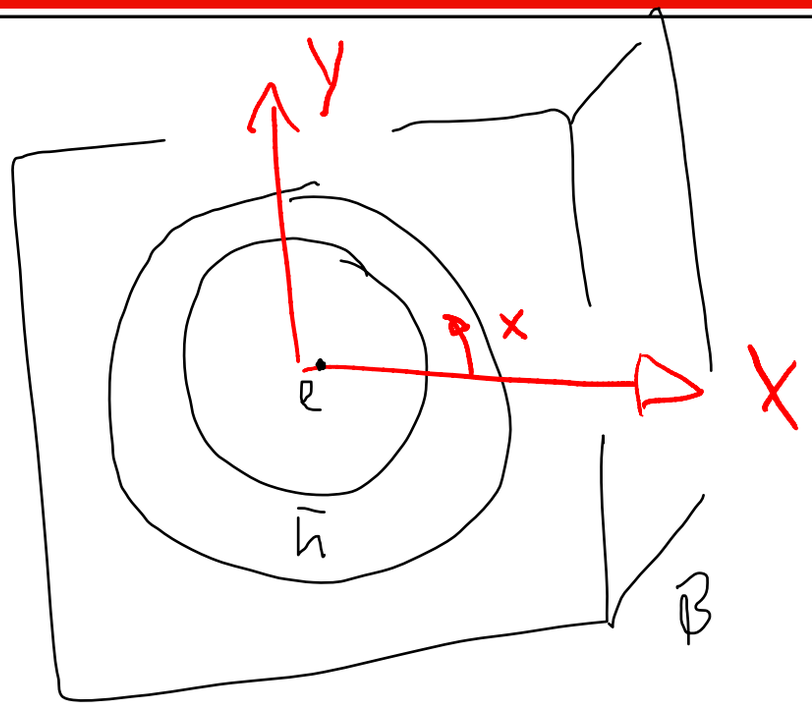
Prof. Dr. Ing. Peter Pelz

Wintersemester 2011/12

Technische Fluidsysteme

Vorlesung 4

22.11.2011



$$F_y = \int_0^{2\pi} -p \cdot \sin\varphi \, d\varphi \; R_B$$

$$\varphi R = x$$

Reynolds - Gleichung

$$\frac{\partial}{\partial x}\left(\frac{h^3}{\eta}\frac{\partial p}{\partial x}\right) + \frac{\partial}{\partial z}\left(\frac{h^3}{\eta}\frac{\partial p}{\partial z}\right) = 6\frac{\partial}{\partial x}(Uh) + 6\frac{\partial}{\partial z}(Wh) + 12\frac{\partial h}{\partial t}$$

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Spezialfall langes Lager $\quad \frac{\partial}{\partial x}\left(\frac{h^3}{\eta}\frac{\partial p}{\partial x}\right) = 6\frac{\partial}{\partial x}(h\Omega R)$

$x = R\varphi$

$h = \bar{h}\,h^+$

$p = \frac{F_y}{RB}\,p^+$

$$\frac{1}{R}\frac{\partial}{\partial\varphi}\left(\frac{\bar{h}^3}{\eta}h^{+3}\frac{1}{R}\frac{\partial p}{\partial\varphi}\right) = 6\bar{h}\frac{1}{R}\frac{\partial}{\partial\varphi}(h^+\Omega R)$$

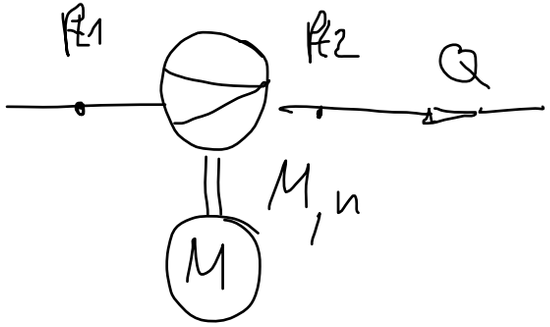
$$\frac{1}{R^2}\frac{\bar{h}^2}{\frac{F_y}{RB}\eta\Omega}\frac{\partial}{\partial\varphi}\left(h^{+3}\frac{\partial}{\partial\varphi}p^+\right) = 6\frac{\partial}{\partial\varphi}(h^+)$$

$$So = \frac{F_y}{\eta\Omega RB}\psi^2 \qquad \psi = \frac{\bar{h}}{R}$$

$$So\,\frac{\partial}{\partial\varphi}\left(h^{+3}\frac{\partial}{\partial\varphi}p^+\right) = 6\frac{\partial}{\partial\varphi}h^+$$

$$h^+ = \frac{h}{\bar{h}} = \frac{\bar{h} + e\cos\varphi}{\bar{h}} = 1 - \varepsilon\cos\varphi$$

$\varepsilon = f(So) \qquad So = f(\varepsilon)$



$$\Delta p = p_{t2} - p_{t1}$$

Hydraulische Leistung $P_{hyp} = \Delta p\, Q$

Mech. Antriebsleistung $P_{mech} = M\omega \qquad \omega = 2\pi n$

V geometrisches Volumen

$$\eta = \frac{\Delta p\, Q}{M \cdot 2\pi n} = \frac{\Delta p\, V\, Q}{2\pi M \cdot V_h} = \underbrace{\frac{\Delta p\, V}{2\pi M}}_{\eta_{hm}} \cdot \underbrace{\frac{Q}{V_h}}_{\eta_v}$$

$$\eta_v = \frac{Q}{V_h} = \frac{V_h - Q_L}{V_h}$$

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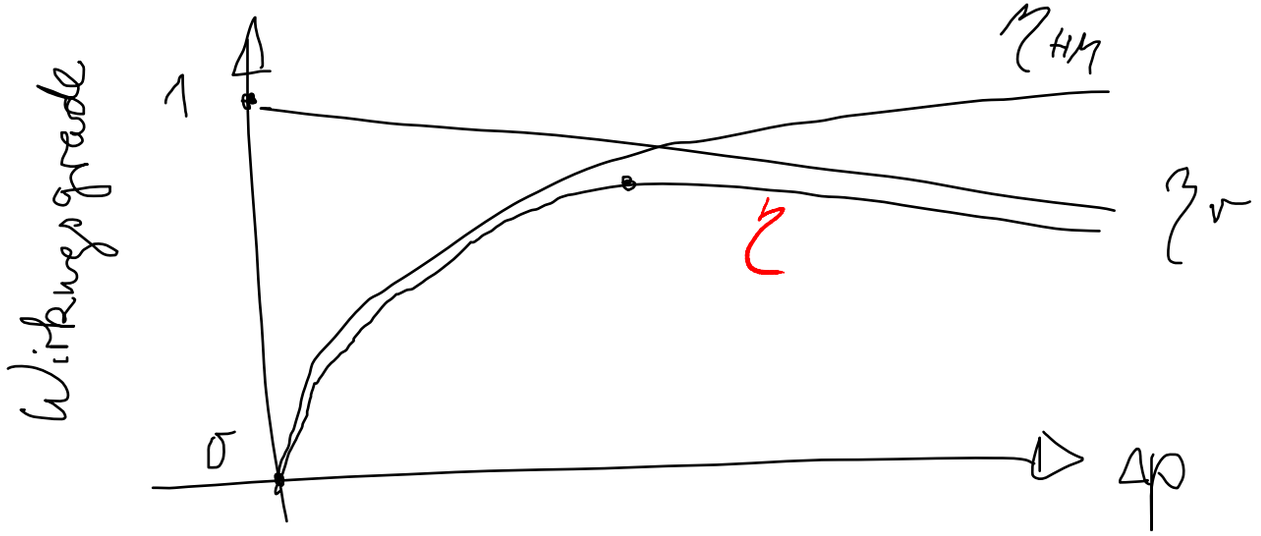
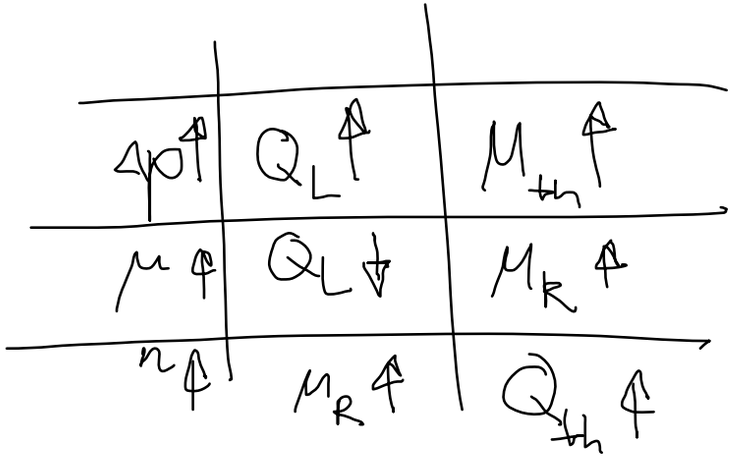
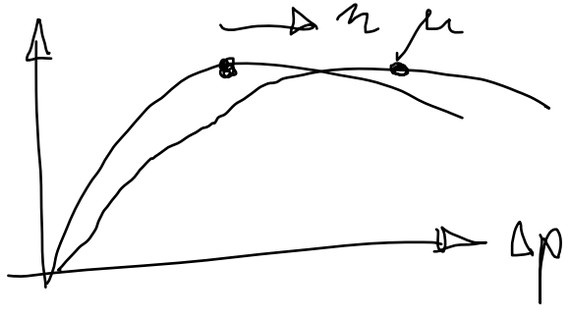
$$\eta_{HM} = \frac{\Delta p\, V}{2\pi M} = \frac{M_{th}}{M_{real}} = \frac{M_{th}}{M_{th} + M_{reib}}$$

$$M_{th} = \frac{\Delta p\, V}{2\pi}$$





	η_{HM}	η_V
Δp	↑	↓
μ	↓	↓↑
n	↓	↑



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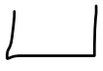
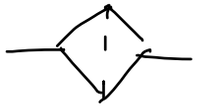


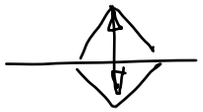
Tank

Pumpe

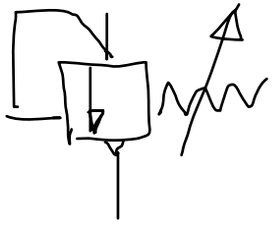
Motor



Ölfilter



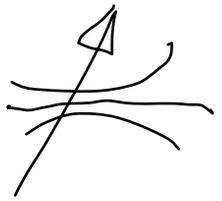
Wärmetauscher



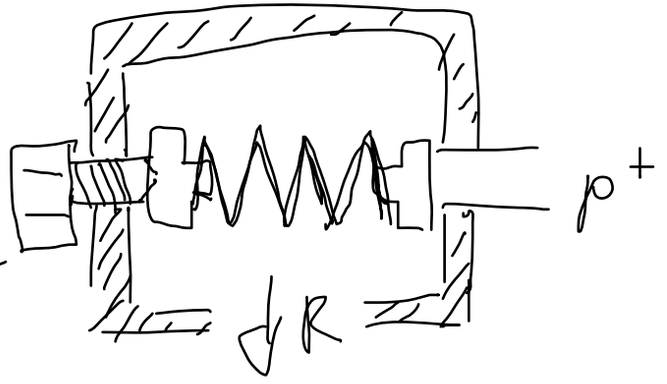
Druckbegrenzungsventil

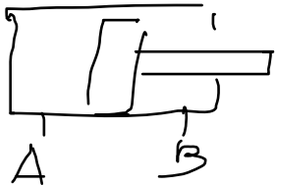
Speicher

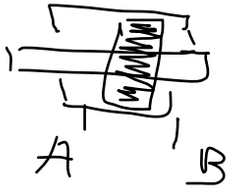
Absperrventil



einfachwirkender Zylinder





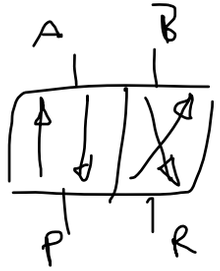


doppeltwirkender Zylinder

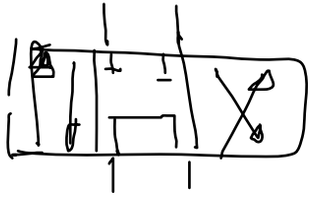
22.11.2011

Wegeventile

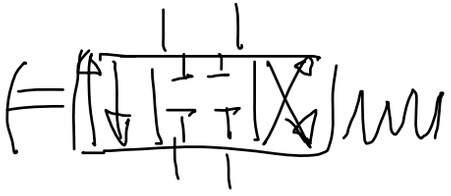
1 Kästchen pro Schaltzustand



4/2 Wegeventil



4/3 Wegeventil



Federrückstellung

manuell

Hebel

Pedal

elektrisch

durch hyd Druckleitung

pneumatisch

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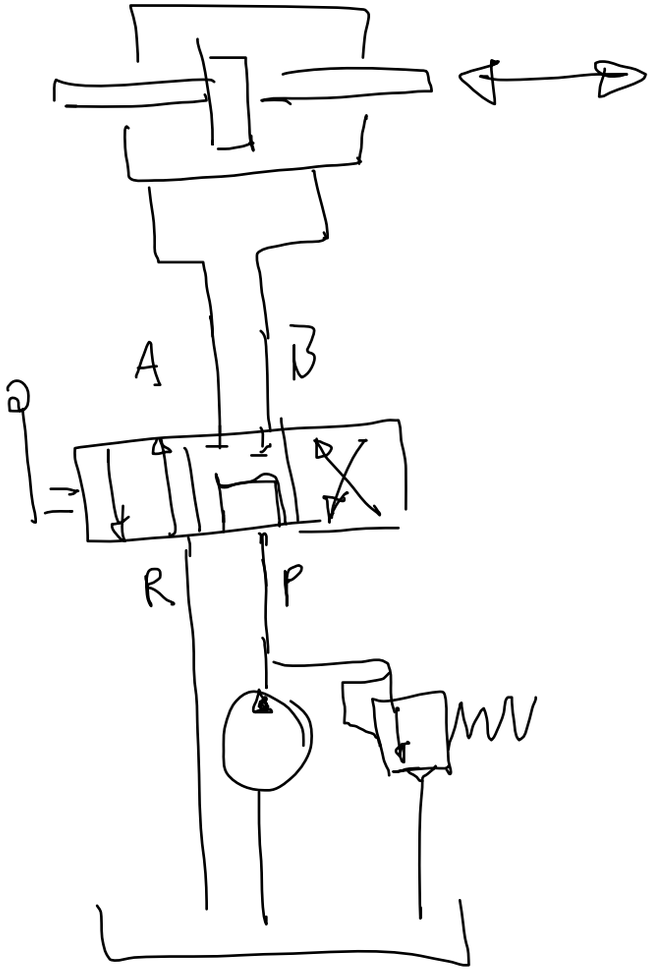
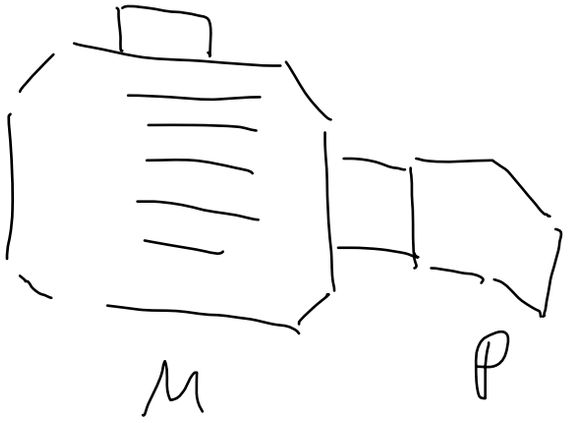
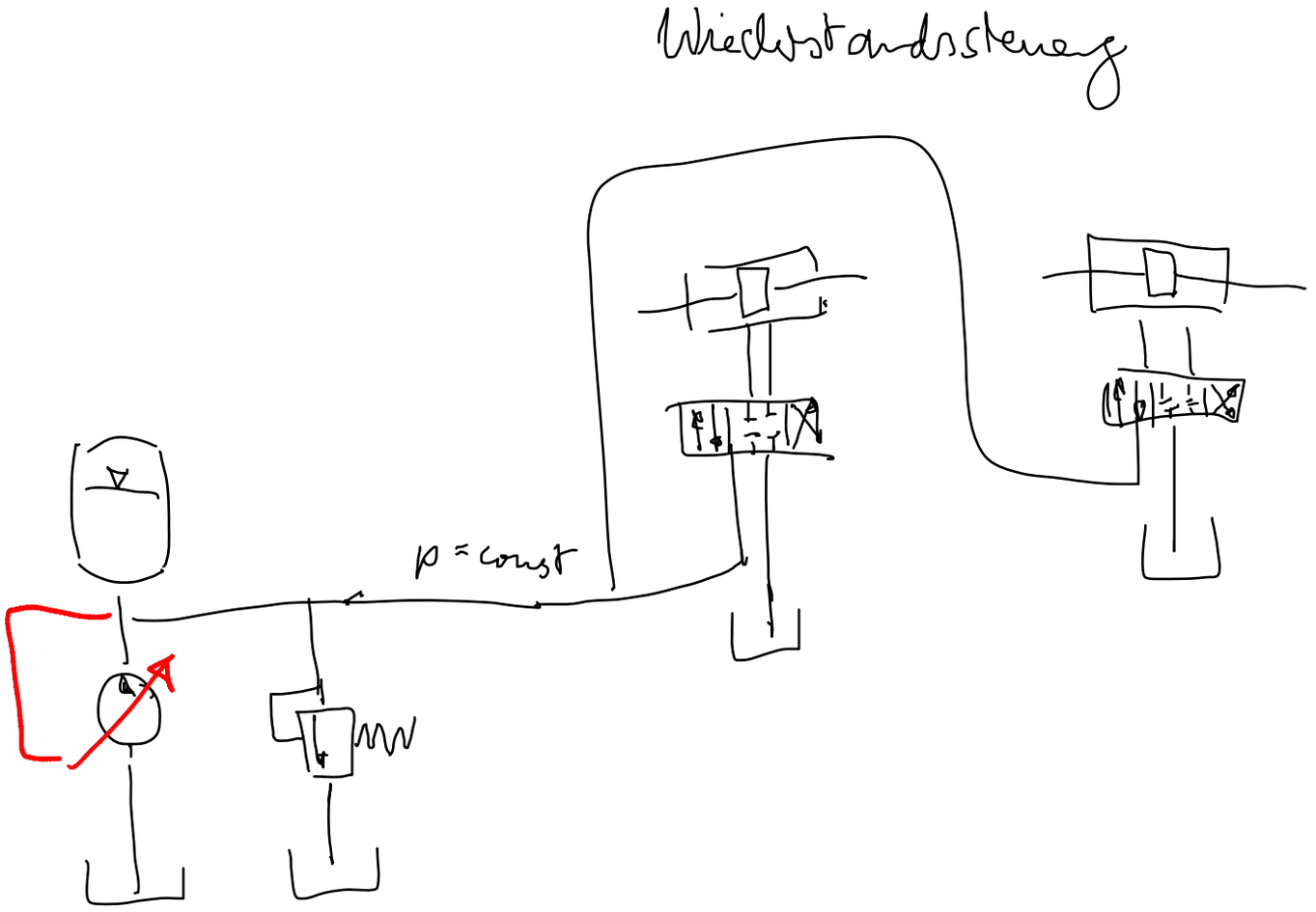
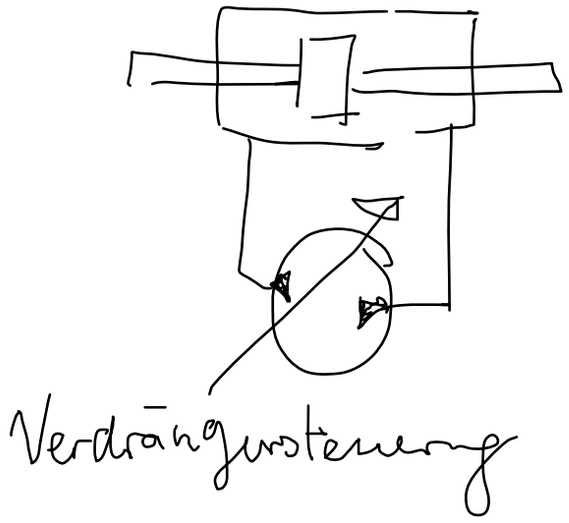
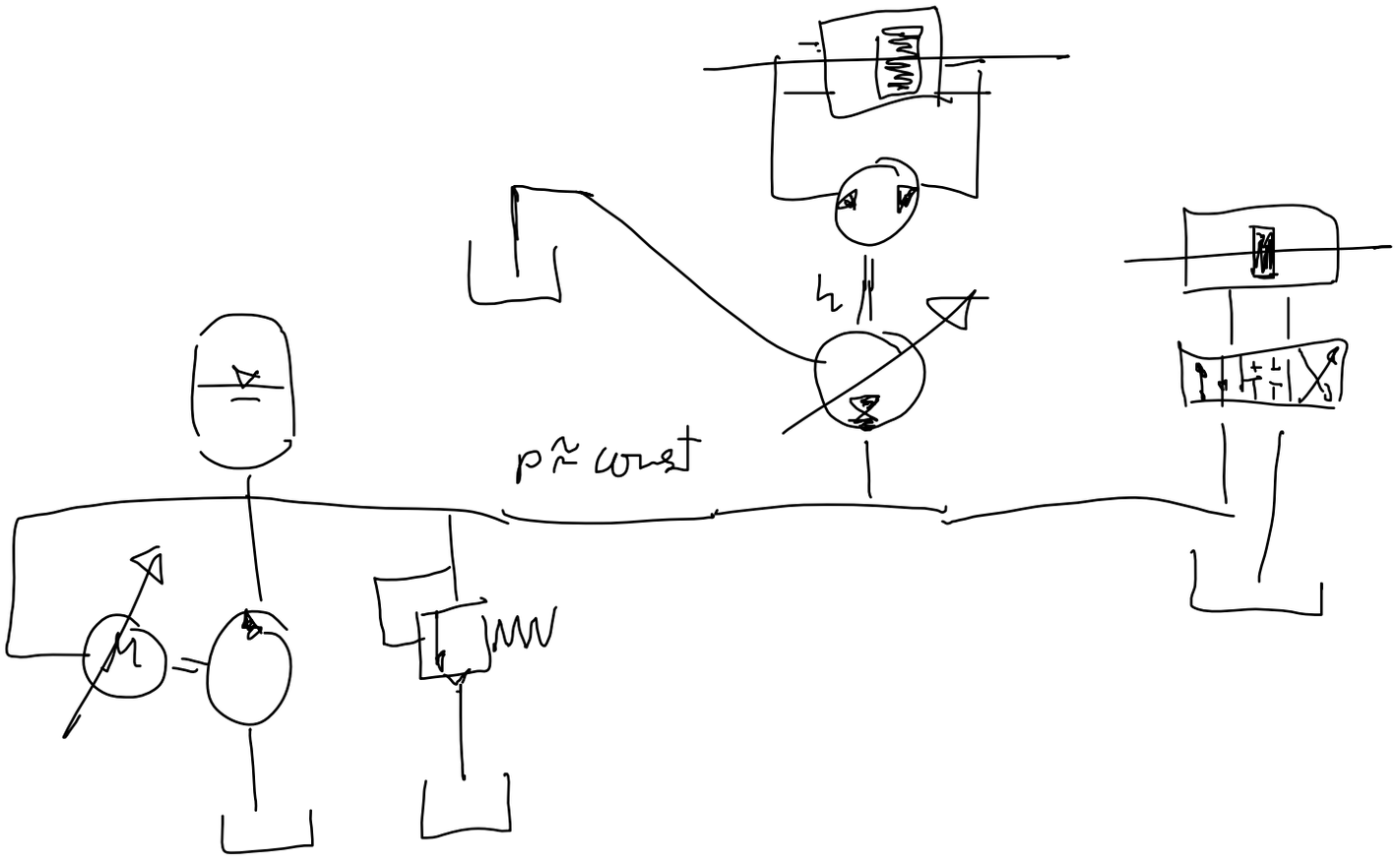

A
B
P
R
P


M
P


Widerstandssteuerung
p = const


Verdrängersteuerung


p ≈ const