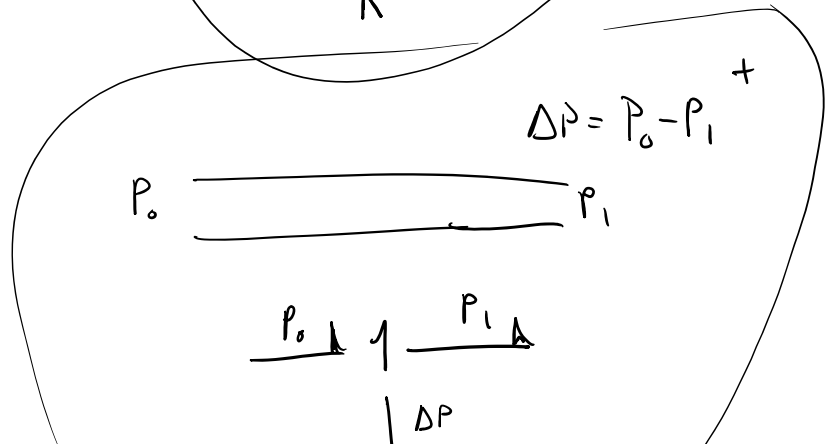
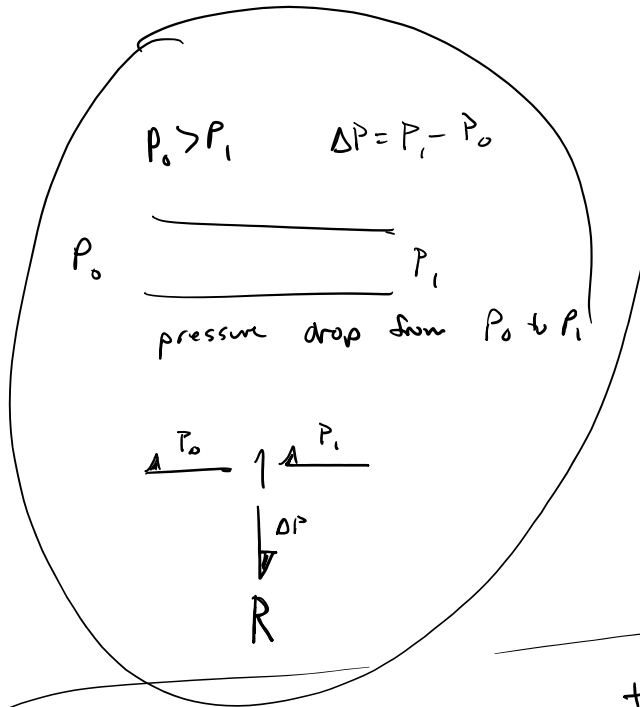
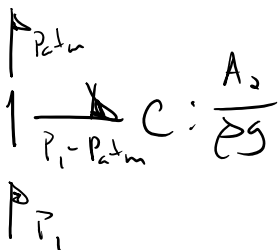
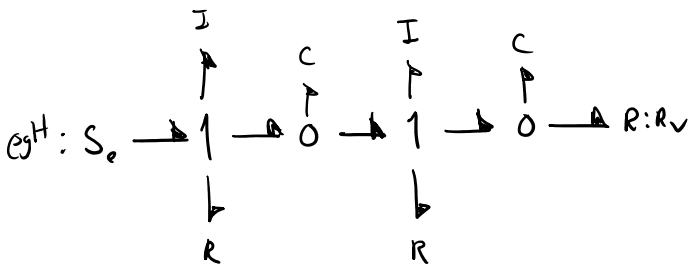
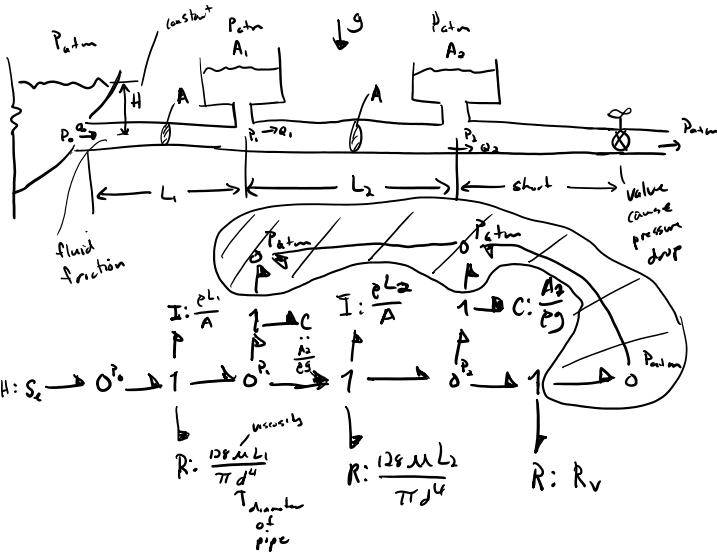
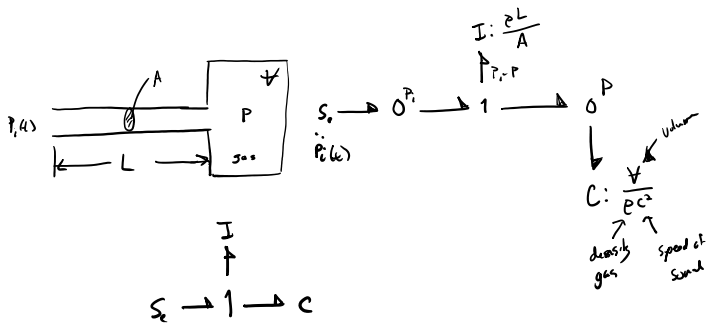


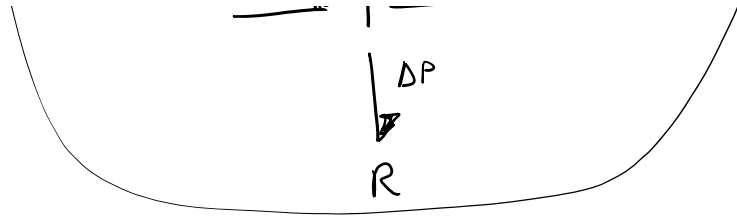
Hydraulic

1. Show P, Q signs
2. O-Junction for each pressure (O-J for atmospheric pressure)
3. Insert 4-Junctions between pressures (pressure drops)
4. Eliminate atmospheric juncs (converts to gage pressure)
5. Simplify

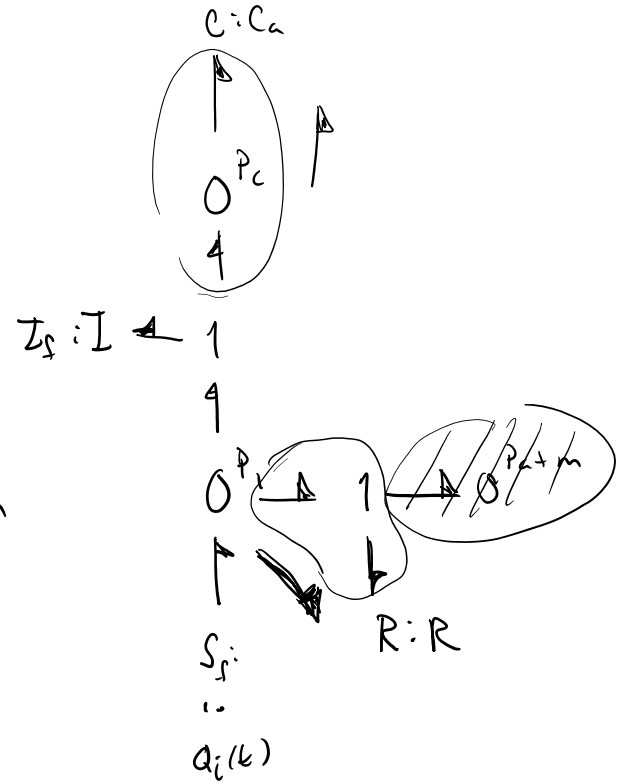
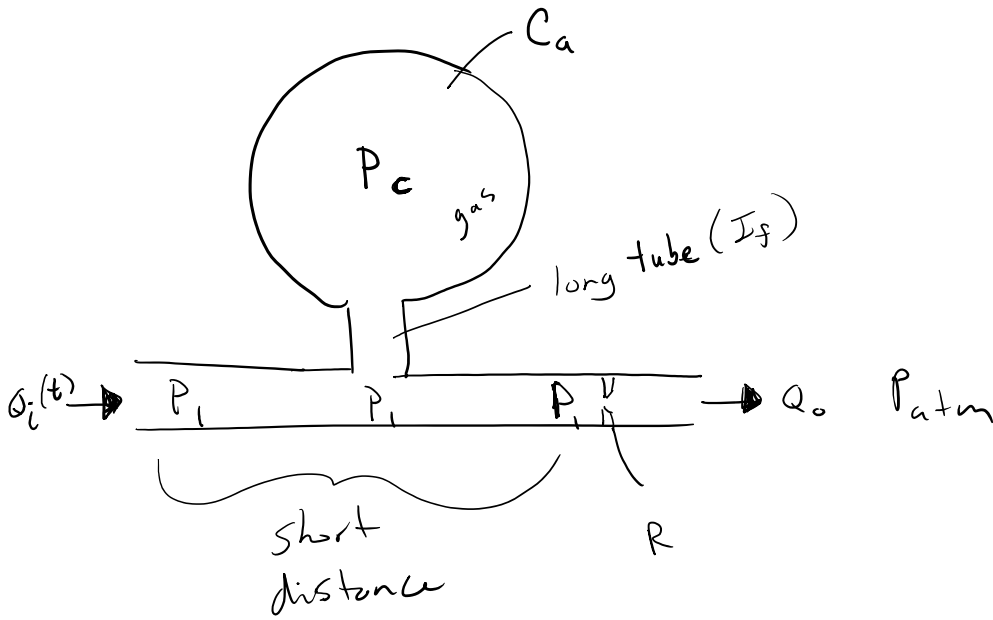
Helmholtz Oscillator



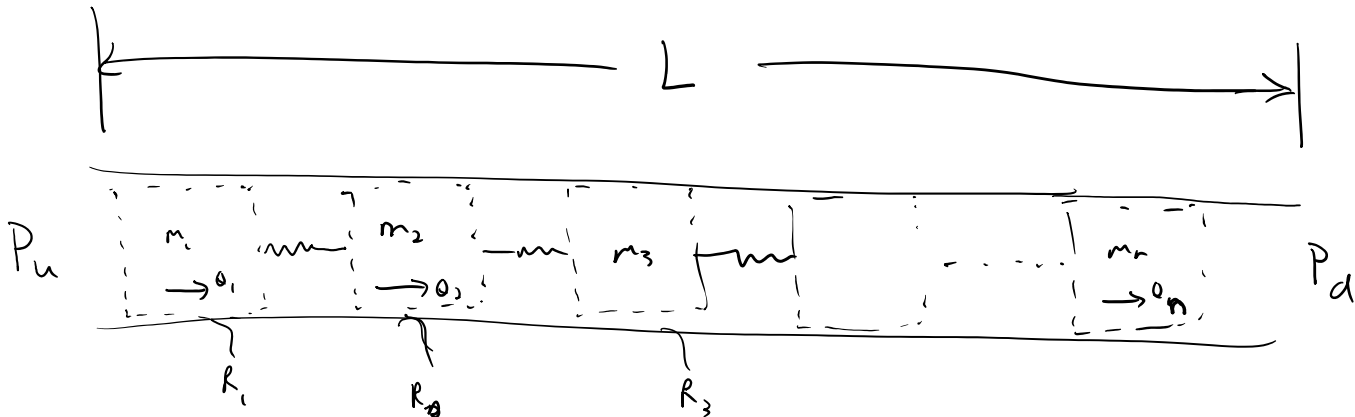
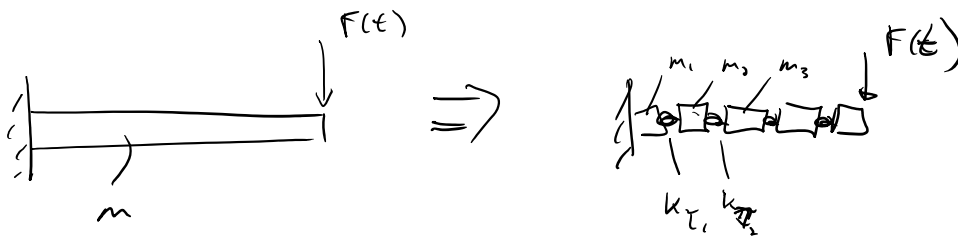
P_i

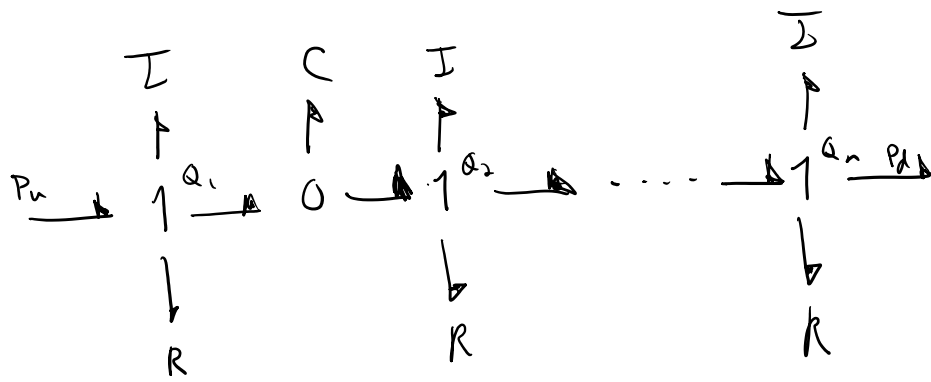


Example



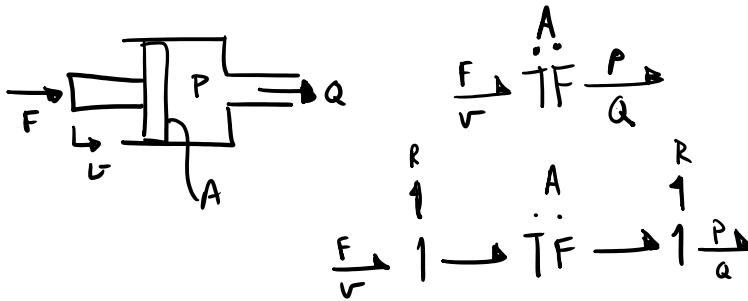
Lumped mass model of fluid in a line



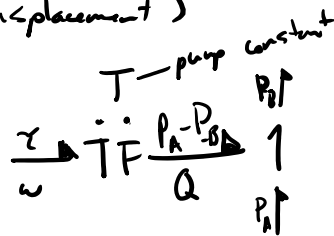
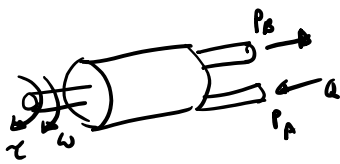


Transducers (connecting energy domains)

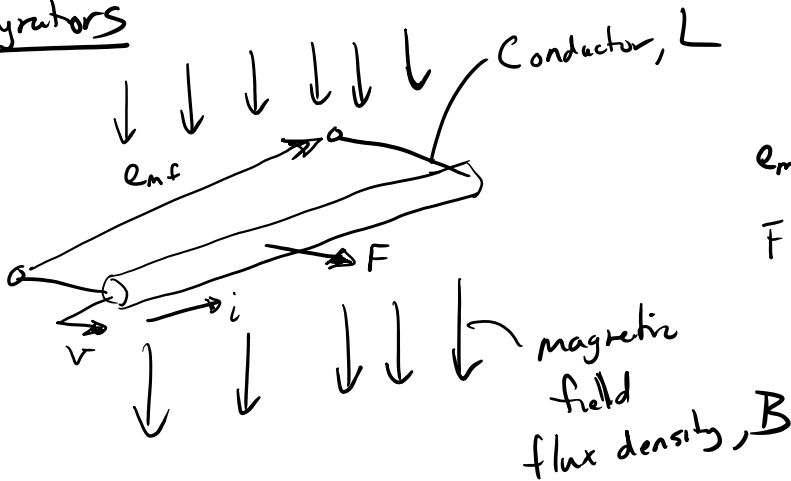
hydraulic ram (piston)



hydraulic pump (positive displacement)



Generators



$$e_{mf} = (BL) v \quad \text{Faraday's Law}$$

$$F = (BL) i \quad \text{Lorentz's Law}$$

$$\frac{e}{i} = \frac{BL}{v} \frac{F}{v}$$

Wound permanent magnet DC motor

$$\frac{e}{i} = \frac{T}{\omega} \frac{\tau}{\omega}$$

