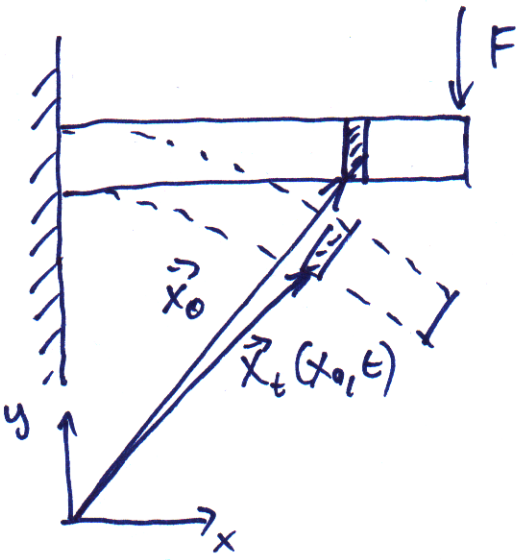
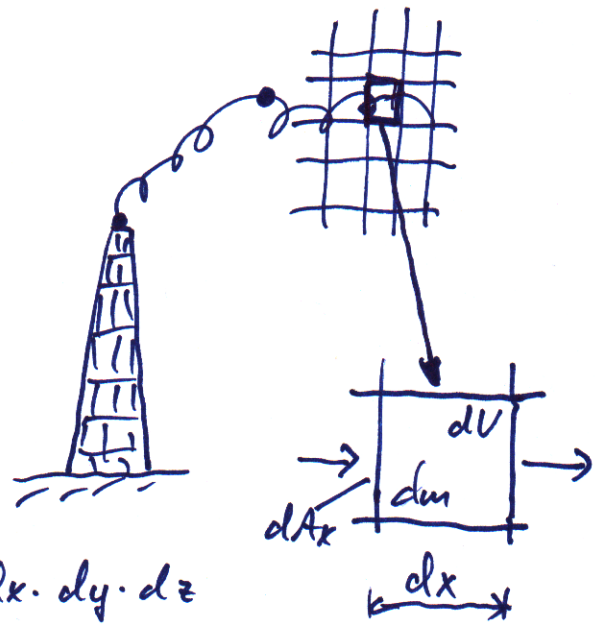
Räumliche und zeitliche Abhängigkeiten:

$$\frac{\partial \phi}{\partial t}, \frac{\partial \phi}{\partial x}, \frac{\partial \phi}{\partial y}, \frac{\partial \phi}{\partial z} \qquad \left(\frac{\partial}{\partial x_i} \to \nabla\right)$$

$m = \rho \cdot V$; für die Strömungen ρ ist wichtig: $\rho = \frac{m}{V}$

Lagrange $\Leftrightarrow$ Euler





$dV = dx \cdot dy \cdot dz$

$dA_x = dy \cdot dz$

Kontr. in x: $\rho v_x \rightarrow [\,dm\,] \rightarrow \rho v_x - d(\rho v_x)$

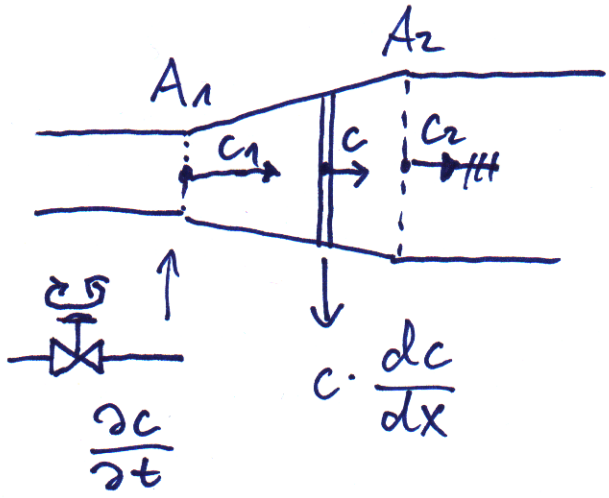
$$\frac{dm}{dt} = \frac{d\rho V}{dt} = dA_x \left[\left(\rho v_x - d(\rho v_x) \right) - \rho v_x \right]$$

$$\frac{d\rho}{dt} = \frac{dA_x}{dV} \left(-d(\rho v_x)\right) = -\frac{d(\rho v_x)}{dx}$$

$$\to \frac{d\rho}{dt} + \frac{d\,\rho v_x}{dx} = 0$$

$$\frac{d\phi}{dt} = \frac{\partial \phi}{\partial t} + v \frac{\partial \phi}{\partial x}$$

lokale konvektive Beschl.



Konti.:

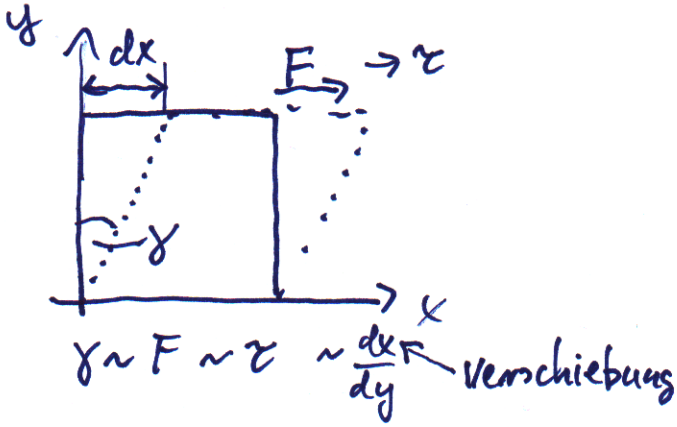
$\dot{m} = \text{konst}$

$\dot{m} = \rho \cdot \dot{V} = \rho \cdot c \cdot A$

inkomp.: $\rho = \text{konst.}$

$\rightarrow \; c \cdot A = \text{konst.}$

Festkörper



Fluid