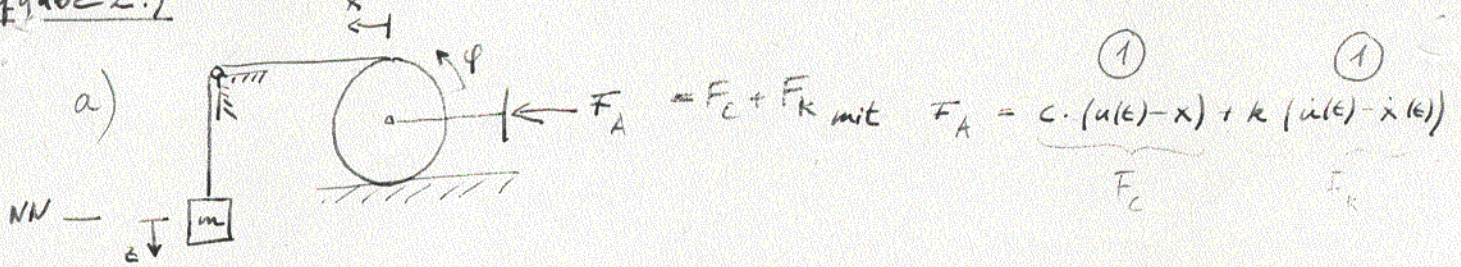


# Aufgabe 2.1



b)

$$E_{kin} = \frac{1}{2} M \cdot \dot{x}^2 + \frac{1}{2} \Theta^J \cdot \dot{\varphi}^2 + \frac{1}{2} m \cdot \dot{z}^2 \quad (1)$$

$$E_{pot} = -m \cdot g \cdot z \quad (1) \quad \text{bei nichtbeginn Vorzeichen}$$

generalisierk Koordinate x

Kinematik  $\varphi \cdot r = x \Rightarrow \dot{\varphi} = \frac{\dot{x}}{r} \quad (1)$

$z = 2 \cdot r \cdot \varphi = 2 \cdot x \quad 2x = z \Rightarrow \dot{z} = 2\dot{x} \quad (1)$

$$\begin{aligned} \Rightarrow L = E_{kin} - E_{pot} &= \frac{1}{2} M \cdot \dot{x}^2 + \frac{1}{2} \Theta^J \cdot \frac{\dot{x}^2}{r^2} + \frac{4}{2} m \cdot \dot{x}^2 + 2m \cdot g \cdot x \\ &= \frac{1}{2} \left( M + \frac{\Theta^J}{r^2} + 4m \right) \cdot \dot{x}^2 + 2m \cdot g \cdot x \\ &= \frac{1}{2} \left( \frac{3}{2} M + 4m \right) \cdot \dot{x}^2 + 2m \cdot g \cdot x \quad (1) \end{aligned}$$

c.)  $Q^* = F_A \cdot \frac{\partial x}{\partial x} = F_A \quad (1) \quad \left( Q_j^* = F^* \cdot \frac{\partial u}{\partial q_j} + \frac{M^*}{\partial q_j} \right)$

$$\frac{d}{dt} \left( \frac{\partial L}{\partial \dot{x}} \right) - \frac{\partial L}{\partial x} = Q^*$$

$$\underbrace{\left( \frac{3}{2} M + 4m \right) \ddot{x}}_{(1)} - \underbrace{2m \cdot g}_{(1)} = \underbrace{c \cdot (u(t) - x) + k \cdot (\dot{u}(t) - \dot{x})}_{(1)}$$

$$\left( \frac{3}{2} M + 4m \right) \ddot{x} + k \cdot \dot{x} + c \cdot x = c u(t) + k \dot{u}(t) + 2m \cdot g$$