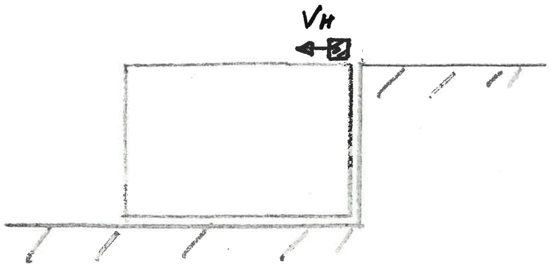
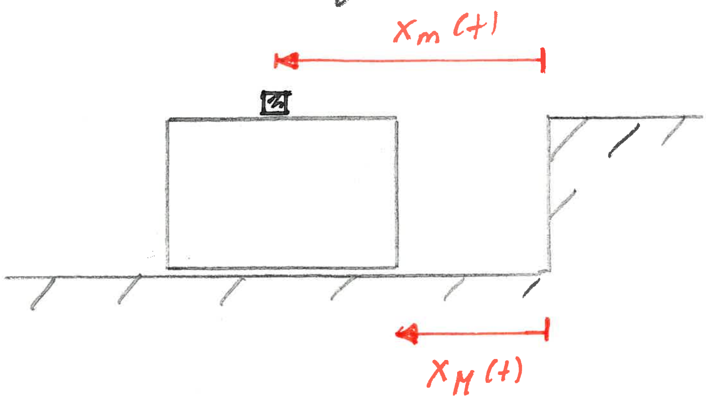
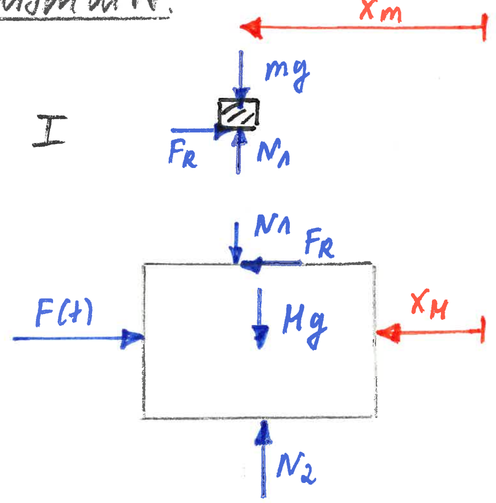
Anfangszustand: "$t=0$"

Momentanzustand: "t"





Freischnitt:



2. Newtonsches Grundgesetz:

I $\quad m\ddot{x}_m = -F_R = -\mu N_1$

mit $N_1 = mg$

$\Rightarrow \quad \ddot{x}_m(t) = -\mu g \quad (9)$

Integration von (9):

$\dot{x}_m(t) - v_M = -\mu g t$

$\dot{x}_m(t) = v_M - \mu g t \quad (10)$

II $\quad M\ddot{x}_M = -F(t) + F_R = -F(t) + \mu m g$

$$\dot{x}_M(t) = -\int_0^t \frac{1}{M} F(\tilde{t})\, d\tilde{t} + \mu m g t$$

$$\dot{x}_M(t) = -\frac{1}{8}\frac{m}{M} g \sqrt{\frac{g}{R}} \int_0^t \tilde{t}\, d\tilde{t} + \mu \frac{m}{M} g t$$

$$\dot{x}_M(t) = -\frac{1}{16}\frac{m}{M} g \sqrt{\frac{g}{R}}\, t^2 + \mu \frac{m}{M} g t \quad (11)$$

Forderung: $\dot{x}_m(T) = \dot{x}_M(t)$

$$\Rightarrow \quad \sqrt{gR} - \mu g T = -\frac{1}{16}\frac{m}{M} g \sqrt{\frac{g}{R}}\, T^2 + \mu \frac{m}{M} g T$$

$$+\frac{1}{16}\frac{m}{M}g\sqrt{\frac{g}{R}}T^2-\mu g\left(1+\frac{m}{M}\right)T+\sqrt{gR}=0$$

mit der Vorgabe $M=\frac{1}{2}m$ folgt

$$\frac{1}{8}g\sqrt{\frac{g}{R}}T^2-3\mu g T+\sqrt{gR}=0 \quad // \cdot \frac{8\sqrt{R}}{g\cdot\sqrt{g}}$$

$$T^2-24\mu\sqrt{\frac{R}{g}}T+\frac{8R}{g}=0$$

$$T_{1/2}=+12\mu\sqrt{\frac{R}{g}}\pm\sqrt{\left(12\mu\sqrt{\frac{R}{g}}\right)^2-\frac{8R}{g}}$$

mit $\mu=\frac{1}{4}$: $$T_{1/2}=3\sqrt{\frac{R}{g}}\pm\sqrt{9\frac{R}{g}-\frac{8R}{g}}$$

$$T_{1/2}=3\sqrt{\frac{R}{g}}\pm\sqrt{\frac{R}{g}}$$

$$T_1=4\sqrt{\frac{R}{g}}$$

$$\boxed{T_2=2\sqrt{\frac{R}{g}}}$$

Lsg., denn wenn das 1. Mal M und m gleiche Geschwindigkeit haben, dann haften sie aufeinander!

T_2 in (10) einsetzen

$$\Rightarrow \quad \dot{x}_M(T_2)=\dot{x}_m(T_2)=\sqrt{gR}-\mu g T_2$$

$$=\sqrt{gR}-\frac{1}{4}g\,2\sqrt{\frac{R}{g}}=\frac{1}{2}\sqrt{gR}$$