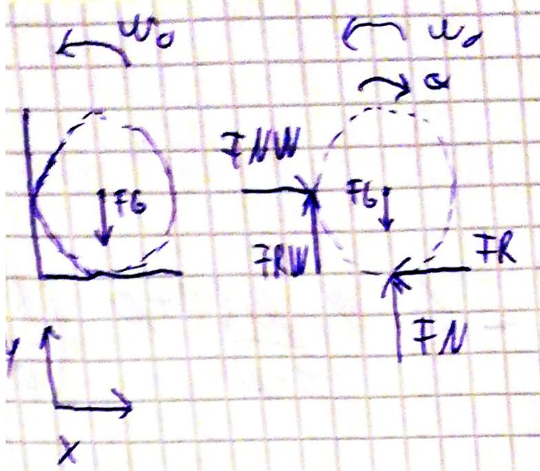

$$\Sigma F_X = 0 = F_{NW} - F_R$$

$$\Sigma F_Y = 0 = F_N + F_{RW} - m \cdot g$$

$$F_{NW} = F_R$$

$$F_R = F_N \cdot \mu$$

$$F_{RW} = F_{NW} \cdot \mu$$

$$F_{RW} = F_N \cdot \mu^2$$

$$\Sigma F_Y = 0 = F_N + F_N \cdot \mu^2 - m \cdot g$$

$$F_N = \frac{m \cdot g}{(1+\mu^2)}$$

$$F_{NW} = F_R = m \cdot g \cdot \frac{\mu}{1+\mu^2} \qquad F_{RW} = m \cdot g \cdot \frac{\mu^2}{1+\mu^2}$$

$$\overset{+}{\curvearrowleft}$$

$$\Sigma M = I \cdot \alpha = -F_R \cdot R - F_{RW} \cdot R$$

$$= m \cdot R^2 \cdot \alpha = R(F_R + F_{RW})$$

$$m \cdot R^2 \alpha = R\left(m \cdot g \cdot \frac{\mu}{1+\mu^2} + m \cdot g \cdot \frac{\mu^2}{1+\mu^2}\right)$$

$$m \cdot R^2 \cdot \alpha = R \cdot m \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu)$$

$$\alpha = \frac{1}{R} \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu)$$

$$\alpha(t) = -\alpha = -\frac{1}{R} \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu)$$

$$\omega(t) = \int \alpha(t)\,dt = \omega_0 - \frac{1}{R} \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu) \cdot t$$

$$\varphi(t) \int \omega(t)\,dt = \omega_0 \cdot t - \frac{1}{2R} \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu)\,t^2$$

$$\omega(t_{end}) = 0 = \omega_0 - \frac{1}{R} \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu) \cdot t_e$$

$$t_e = \frac{\omega_0}{\frac{1}{R} \cdot g \cdot \frac{\mu}{1+\mu^2}(1+\mu)} = \frac{\omega_0 \cdot R \cdot (1+\mu^2)}{g \cdot \mu(1+\mu)}$$

$$t_e = \frac{R \cdot \omega_0 (1+\mu^2)}{g \cdot \mu (1+\mu)}$$

$$\mu\, \varphi(t_e) = \frac{\omega_0^2 \cdot R \cdot (1+\mu^2)}{g \cdot \mu (1+\mu)} - \frac{1}{2R} \cdot g \cdot \frac{\mu (1+\mu)}{1+\mu^2} \cdot \left(\frac{R \cdot \omega_0 \cdot (1+\mu^2)}{g \cdot \mu (1+\mu)} \right)^2$$

$$\text{Umdrehungen} = \frac{\mu(t_e)}{2\pi}$$