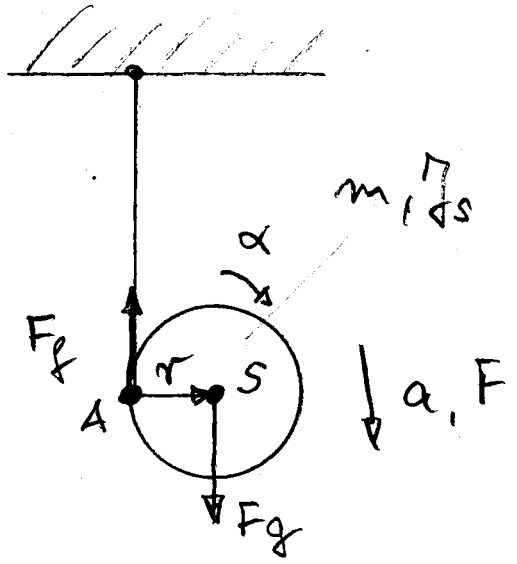
§ 7.07 ②



$$a = r\alpha \qquad (1)$$

$$F = F_g - F_f = ma \qquad (2)$$

Gewicht Federn

geg: r, m, J_S, F_g ges: a, F_f

gel: a) Drehachse S (Schwerpunkt)

Bewegungsgleichung

$$J_S\alpha = M_S = rF_f \overset{(1)}{=} \frac{J_S}{r}a$$

$$\boxed{F_f = \frac{J_S}{r^2}a} \qquad (3)$$

$$F_g \overset{(2)}{=} ma + F_f \overset{(3)}{=} ma + \frac{J_S}{r^2}a$$

$$\boxed{F_g = \left(m + \frac{J_S}{r^2}\right)a} \qquad (4) \qquad a = \frac{1}{m + J_S/r^2}F_g$$

$$F_f = \frac{J_S/r^2}{m + J_S/r^2}F_g$$

b) Drehachse A

$$J_A\alpha = M_A = rF_g \overset{(1)}{=} \frac{J_A}{r}a$$

Steiner

$$F_g = \frac{J_A}{r^2}a \overset{\downarrow}{=} \frac{J_S + mr^2}{r^2}a = \left(m + \frac{J_S}{r^2}\right)a \ldots$$

c) Arbeit, Energie

$$dW = F_g\, ds = F_g\, v\, dt$$

$$= dE_{kin} + dE_{rot}$$

$$= \frac{m}{2}\, dv^2 + \frac{J_s}{2}\, d\omega^2 \qquad (1) \Rightarrow \omega = v/r$$

$$= m\, v\, dv + J_s\, \omega\, d\omega$$

$$= \left(m + \frac{J_s}{r^2}\right) v\, dv$$

$$F_g\, dt = \left(m + \frac{J_s}{r^2}\right) dv$$

$$a = \frac{dv}{dt} = \frac{1}{m + J_s/r^2}\, F_g$$

Trägheitsmoment wirkt wie zusätzliche Masse

$$\boxed{m_{rot} = J_s/r^2} \qquad (5)$$