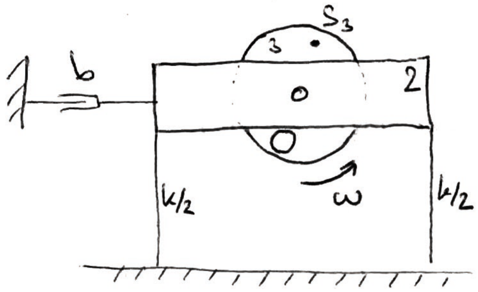
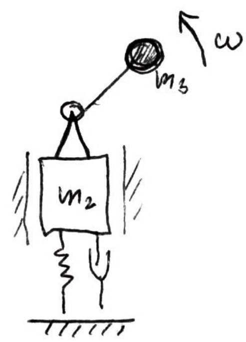
13/4 (Buzení rotující nevyváženou hmotou)



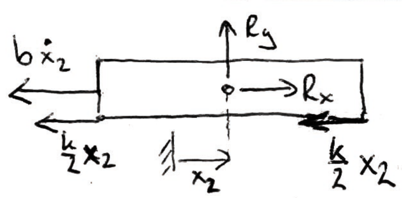
(pozn.: analogie

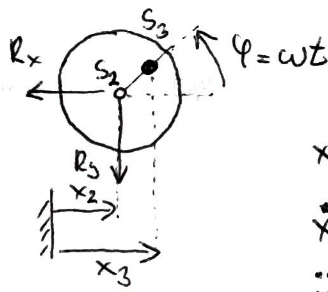


)

D: $m_2, m_3, k, b, \omega, e=\overline{S_2S_3}$

U: vpr. ve vodorovném směru, amplitudu síly do rámu





$$x_3 = x_2 + e\cos\omega t$$

$$\dot{x}_3 = \dot{x}_2 - e\omega\sin\omega t$$

$$\ddot{x}_3 = \ddot{x}_2 - e\omega^2\cos\omega t$$

zajímá nás jen směr x

$$m_2\ddot{x}_2 = -b\dot{x}_2 - 2\frac{k}{2}x_2 + R_x$$

$$m_3\ddot{x}_3 = -R_x$$

$$\rightarrow R_x = -m_3\ddot{x}_2 + m_3 e\omega^2\cos\omega t$$

$$(m_2+m_3)\ddot{x}_2 + b\cdot\dot{x}_2 + k\cdot x_2 = m_3 e\omega^2\cos\omega t$$

$$\ddot{x}_2 + 2b_r\Omega\dot{x}_2 + \Omega^2 x_2 = r_e\omega^2\cos\omega t$$

$$\Omega^2 = \frac{k}{m_2+m_3}, \quad b_r = \frac{b}{2\Omega(m_2+m_3)}$$

$$r_e = \frac{m_3 e}{m_2+m_3}$$ ... redukovaná excentricita

$$x_2 = x_h + x_p$$

ustálený stav ... $x_2 = x_p$

odhad: $x_p = r\cdot\cos(\omega t-\varphi)$

$\rightarrow \dot{x}_p = \ldots,\ \ddot{x}_p = \ldots,$ dosadit $\rightarrow$ $r = \dfrac{r_e\eta^2}{\sqrt{(1-\eta^2)^2+(2b_r\eta)^2}}$ $\qquad \eta = \dfrac{\omega}{\Omega}$

$$\operatorname{tg}\varphi = \frac{2b_r\eta}{1-\eta^2}$$

Síla do rámu:

$$F_R = k\cdot x_2 + b\dot{x}_2 = \underbrace{k\cdot r}_{F_{R0}\cos\varphi_R}\cos(\omega t-\varphi) - \underbrace{b\cdot r\cdot\omega}_{F_{R0}\sin\varphi_R}\sin(\omega t-\varphi) = F_{R0}\cdot\cos(\omega t-\varphi+\varphi_R)$$

$$F_{R0} = r\sqrt{k^2+b^2\omega^2}$$