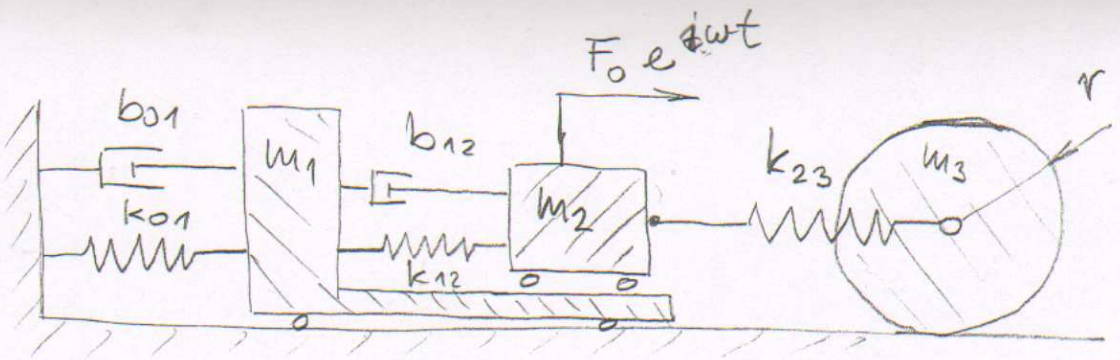


D: m_1, m_2, m_3, r

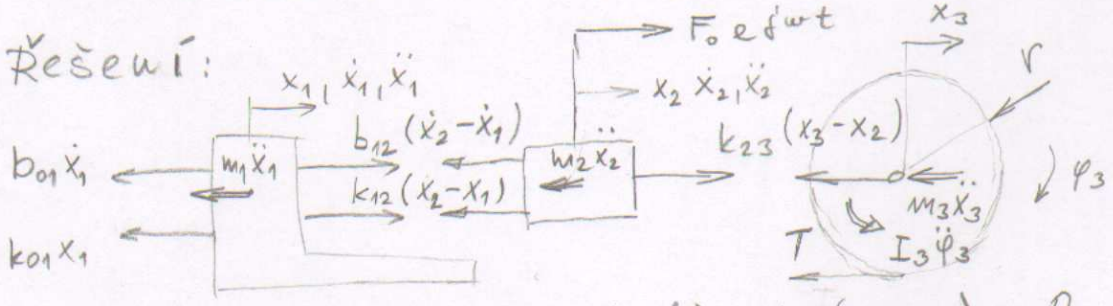
$b_{01}, b_{12}, k_{01}, k_{12}, k_{23}$

F_0, ω

Určete:

1. Soustavu pohybových rovnic
2. Soustavu pohybových rovnic v maticovém tvaru
3. Výpočet vlastních frekvencí v maticovém tvaru
4. Výpočet amplitud ustálených vynucených kmitů v maticovém tvaru

Řešení:



$I_3\ddot{\varphi}_3 - T \cdot r = 0$

$m_3\ddot{x}_3 + k_{23}(x_3-x_2) + T = 0$

$r\varphi_3 = x_3$

1. $m_1\ddot{x}_1 + b_{01}\dot{x}_1 + k_{01}x_1 - b_{12}(\dot{x}_2-\dot{x}_1) - k_{12}(x_2-x_1) = 0$

$m_2\ddot{x}_2 + b_{12}(\dot{x}_2-\dot{x}_1) + k_{12}(x_2-x_1) - k_{23}(x_3-x_2) = F_0 e^{i\omega t}$

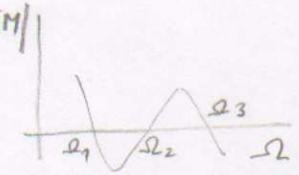
$(m_3 + \frac{1}{2}m_3)\ddot{x}_3 + k_{23}(x_3-x_2) = 0$

2. $$\begin{pmatrix} m_1 & 0 & 0 \\ 0 & m_2 & 0 \\ 0 & 0 & \frac{3}{2}m_3 \end{pmatrix}\begin{pmatrix} \ddot{x}_1 \\ \ddot{x}_2 \\ \ddot{x}_3 \end{pmatrix} + \begin{pmatrix} b_{01}+b_{12} & -b_{12} & 0 \\ -b_{12} & b_{12} & 0 \\ 0 & 0 & 0 \end{pmatrix}\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{pmatrix} + \begin{pmatrix} k_{01}+k_{12} & -k_{12} & 0 \\ -k_{12} & k_{12}+k_{23} & -k_{23} \\ 0 & -k_{23} & k_{23} \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 0 \\ F_0 \\ 0 \end{pmatrix} e^{i\omega t}$$

$$M \cdot \ddot{q} + B \cdot \dot{q} + K \cdot q = f_0 e^{i\omega t}$$

3. Ω: $B = 0, f_0 = 0$

$|K - \Omega^2 M| = 0$



$q = q_0 e^{i\Omega t}$

$\ddot{q} = -\Omega^2 q$

4. $B \neq 0, f_0 \neq 0$

$(-\omega^2 M\tilde{q}_0 + K\tilde{q}_0 + i\omega B\tilde{q}_0) = f_0 \quad \tilde{q}_0 = R^{-1}f_0$

$\tilde{q} = \tilde{q}_0 e^{i\omega t} \quad \dot{\tilde{q}} = i\omega\tilde{q}_0 e^{i\omega t}$

$\ddot{\tilde{q}} = -\omega^2\tilde{q}_0 e^{i\omega t}$