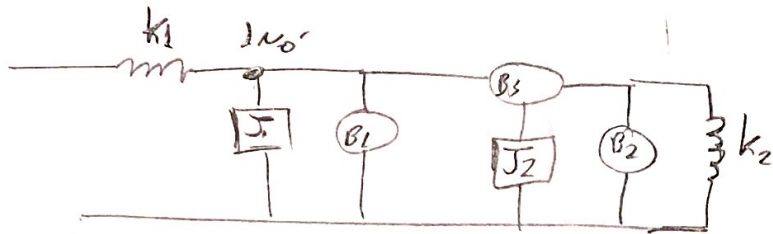


1ª Questão

(1) Circuito



• 1ª No: =

$$T = \frac{1}{L \cdot D} \cdot (\dot{\theta} - \dot{\theta}_2)$$

(ii) Fazer o circuito equivalente

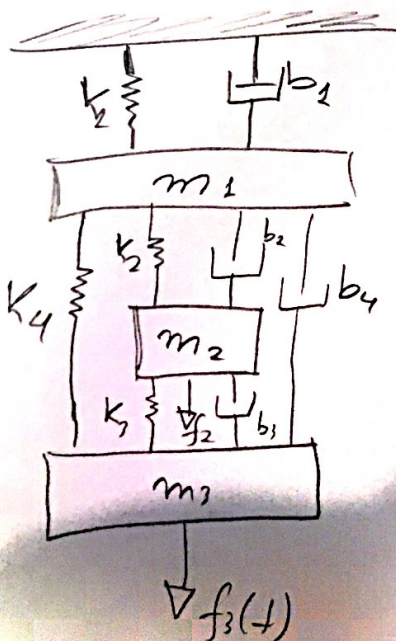
$k_1 \Rightarrow L_1 - m$ (inductance)

$J \Rightarrow R \text{ m.u.}$ (resistenc)

2ª No: $\frac{1}{L \cdot D} \cdot (\dot{\theta}_2 - \dot{\theta}_1) + \frac{1}{B_1} (\dot{\theta}_2 - \dot{\theta}_3) + \left(J_1 \cdot D + \frac{1}{B_2} \right) \cdot \dot{\theta}_2 = 0$

3ª No: $\frac{1}{B_2} (\dot{\theta}_3 - \dot{\theta}_2) + J_2 \left(D + \frac{1}{B_1} + \frac{1}{k_2 \cdot D} \right) \dot{\theta}_3 = 0$

2ª Questão



Sabe-se que

• $T = \frac{m_1 v_1^2}{2} + \frac{m_2 v_2^2}{2} + \frac{m_3 v_3^2}{2}$

• $R = \frac{b_1 v_1^2}{2} + \frac{b_2 (v_2 - v_1)^2}{2} + \frac{b_3 (v_3 - v_2)^2}{2} + \frac{b_4 (v_3 - v_1)^2}{2}$

• $V = \frac{k_1 x_1^2}{2} + \frac{k_2 (x_2 - x_1)^2}{2} + \frac{k_3 (x_3 - x_2)^2}{2} + \frac{k_4 (x_3 - x_1)^2}{2}$

por Lagrange

$\frac{\partial L}{\partial v_1} = m_1 v_1$ e a derivada seria $\frac{d}{dt} \left(\frac{\partial L}{\partial v_1} \right) = m_1 \dot{v}_1$

deformazione

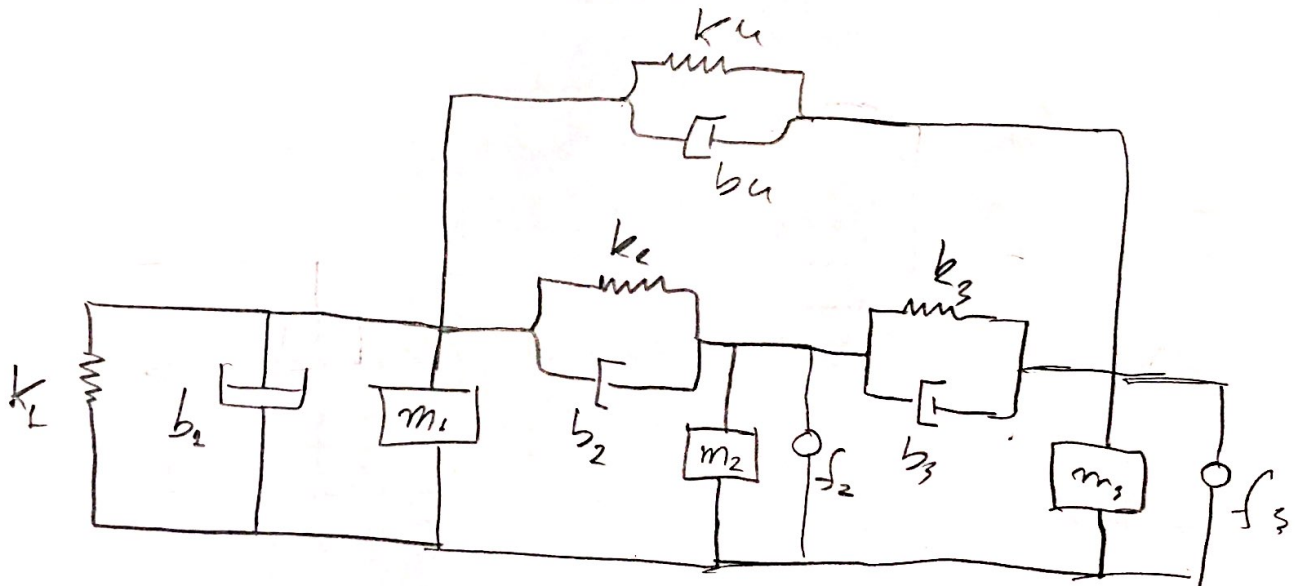
$$\therefore m_2 \ddot{x}_2 + k_2(x_2 - x_1) - k_3(x_3 - x_2) + b_2(\dot{x}_2 - \dot{x}_1) - b_3(\dot{x}_3 - \dot{x}_2) = f_2(t)$$

deformazione analogica

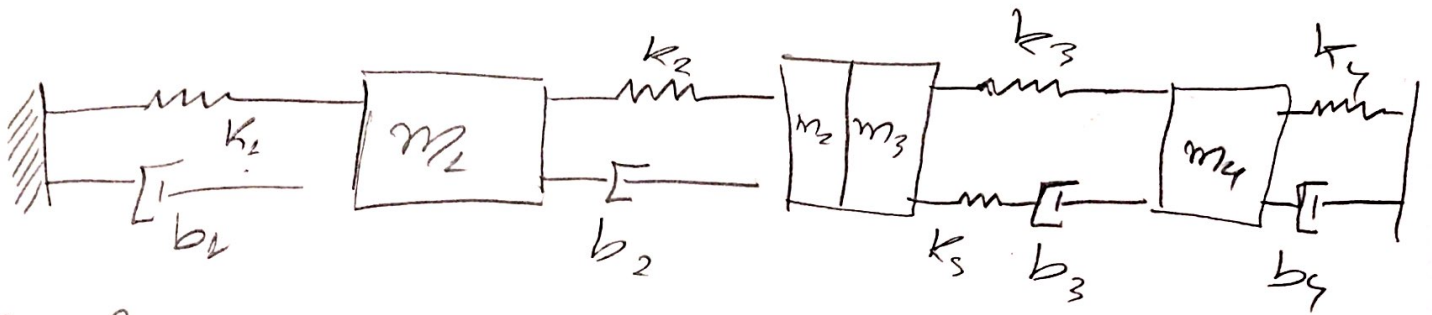
per $f_3(t)$

$$m_3 \ddot{x}_3 + k_3(x_3 - x_2) + k_4(x_3 - x_1) + b_3(\dot{x}_3 - \dot{x}_2) + b_4(\dot{x}_3 - \dot{x}_1) = f_3(t)$$

b) schema di circuito



3ª Questão



Perseguição de T, V, R

$$T = \frac{m_1 \dot{x}_1^2}{2} + \frac{(m_2 + m_3) \dot{x}_2^2}{2} + \frac{m_4 \dot{x}_3^2}{2}$$

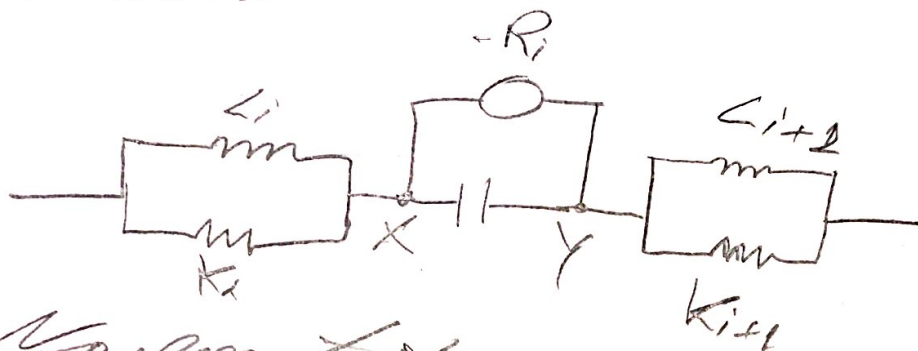
$$V = \frac{k_1 x_1^2}{2} + \frac{k_2 (x_2 - x_1)^2}{2} + \frac{k_3 (x_3 - x_2)^2}{2} + \frac{k_4 x_3^2}{2} + \frac{k_5 (x_3 - x_2)^2}{2}$$

$$R = \frac{b_1 \dot{x}_1^2}{2} + \frac{b_2 (\dot{x}_2 - \dot{x}_1)^2}{2} + \frac{b_3 (\dot{x}_3 - \dot{x}_2)^2}{2} + \frac{b_4 \dot{x}_3^2}{2}$$

$$m_4 \ddot{x}_3 + k_3 (x_3 - x_2) - k_4 x_3 - k_5 (x_3 - x_2) + b_3 (\dot{x}_3 - \dot{x}_2) + b_4 \dot{x}_3 = 0$$

7ª Questão

Nesse caso, tomemos o seguinte circuito

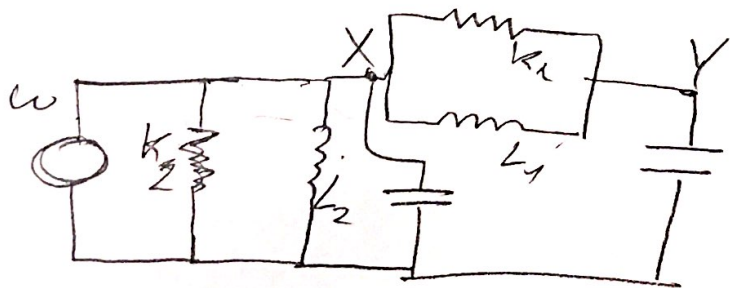


No ponto X

$$-R_L = \left(\frac{1}{L_i} + \frac{1}{k_i D} + m_i D \right) V_i - \left(\frac{1}{L_i} + \frac{1}{k_i D} \right) V_{i-1} - m_i D V_{i+1}$$

8ª Questão

Circuito elétrico (já fazendo a analogia)



$$\text{Em } Y: \left(\frac{1}{k_1 D} + \frac{1}{b_1} + m D \right) V_2 - \left(\frac{1}{k_1 D} + \frac{1}{b_1} \right) V_3 = 0$$

$$\text{Em } X: \left(\frac{1}{k_2 D} + \frac{1}{b_2} + m D + \frac{1}{k_1 D} + \frac{1}{b_1} \right) V_i - \left(\frac{1}{k_1 D} + \frac{1}{b_1} \right) V_2 = U(t)$$