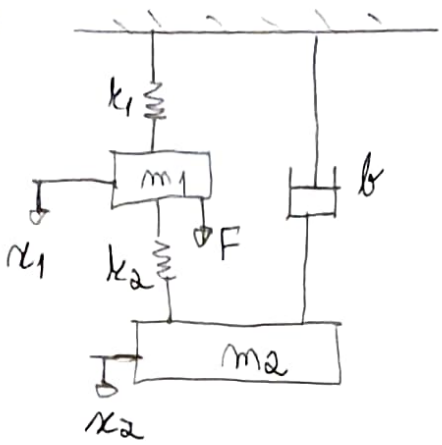
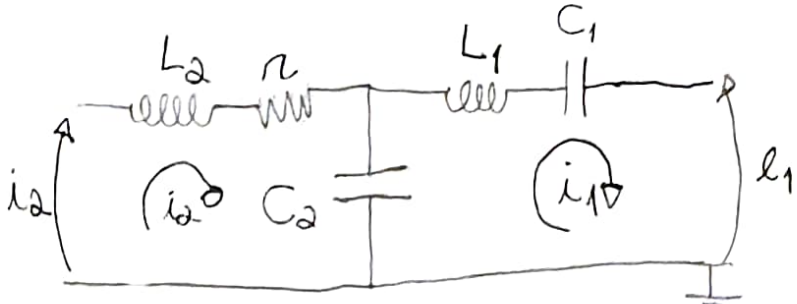
PME 3380 – Modelagem

Pedro Lionel J. Oliveira – NUSP 10335569

2)





$V \rightarrow F$; $i \rightarrow \vec{v}$

•) Malha 1: $\frac{(i_1 - i_2)}{C_2 \cdot D} + L_1 \cdot D \cdot i_1 + \frac{i_1}{C_1 D} = e_1$

$\Rightarrow (v_1 - v_2) \cdot \frac{k_2}{D} + m_1 \cdot v_1 \cdot D + v_1 \cdot \frac{k_1}{D} = F$

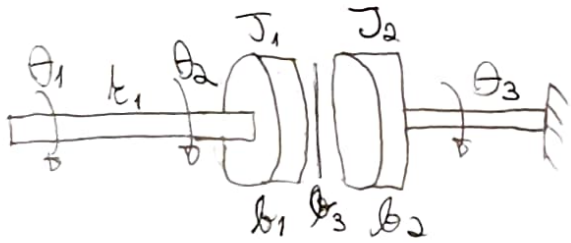
$\Rightarrow \underline{(x_1 - x_2) \cdot k_2 + m_1 \cdot \ddot{x}_1 + x_1 \cdot k_1 = F}$ //

•) Malha 2: $L_2 \cdot D \cdot i_2 + R \cdot i_2 + \frac{(i_2 - i_1)}{C_2 \cdot D} = 0$

$\Rightarrow m_2 v_2 D + b \cdot v_2 + \frac{(v_2 - v_1)}{D} \cdot k_2 = 0$

$\Rightarrow \underline{m_2 \ddot{x}_2 + b \cdot \dot{x}_2 + (x_2 - x_1) \cdot k_2 = 0}$ //

3)



$V \rightarrow F$; $i \rightarrow \vec{v}$

•) Malha 1: $e - \frac{(i_1 - i_2)}{C_2 \cdot D} \cdot = 0 \Rightarrow F - \frac{(v_1 - v_2)}{D} \cdot k_1 = 0 \Rightarrow \underline{(x_1 - x_2) k_1 = F}$

•) Malla 2:

$$\frac{(i_2 - i_1)}{C_2 \cdot D} + L_2 \cdot D\, i_2 + R_2 \cdot i_2 + (i_2 - i_3) \cdot R_4 = 0$$

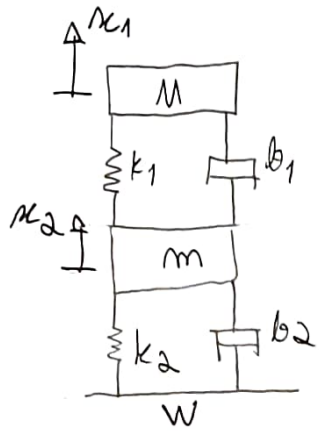
$$\Rightarrow (x_2 - x_1) \cdot k_1 + m_1 \ddot{x}_1 + b_1 \cdot v_1 + (v_1 - v_2) \cdot b_3 = 0$$

•) Malla 3:

$$(i_3 - i_2) \cdot R_4 + i_3 \cdot D \cdot L_3 + R_3 \cdot i_3 + \frac{i_3}{C_3 \cdot D} = 0$$

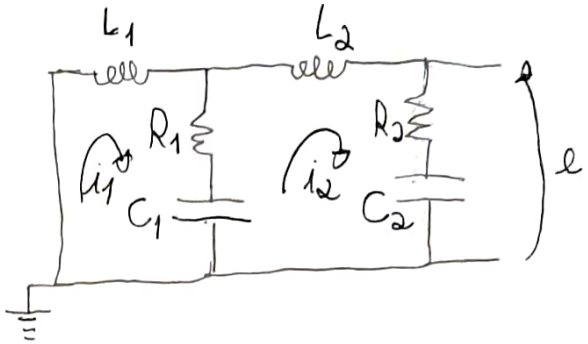
$$\Rightarrow (v_2 - v_1) \cdot b_3 + m_2 \cdot \ddot{x}_2 + b_2 \cdot v_2 + k_2 \cdot x_2 = 0$$

8)



$F \rightarrow V$

$\vec{v} \rightarrow i$



a) •) Malla 1: $i_1 \cdot L_1 \cdot D + (i_1 - i_2) \cdot \left(R_1 + \frac{1}{C_1 D}\right) = 0$

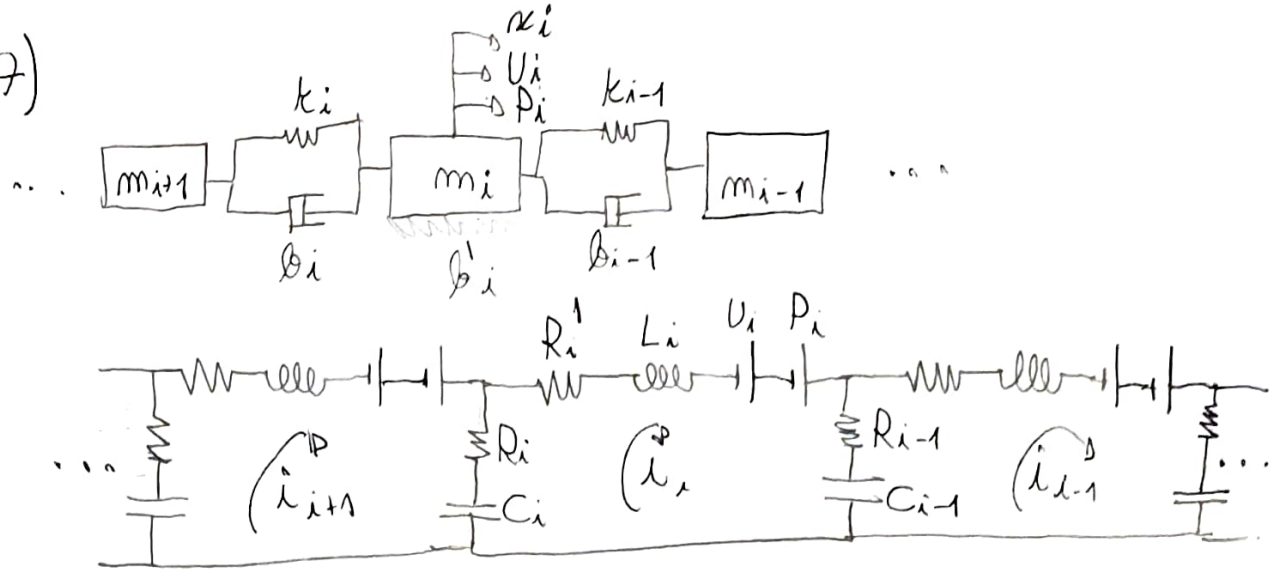
$$\Rightarrow m_1 \cdot \ddot{x}_1 + (v_1 - v_2)\, b_1 + (x_1 - x_2) \cdot k_1 = 0$$

•) Malla 2: $i_2 \cdot L_2 \cdot D + (i_2 - i_1) \cdot \left(R_2 + \frac{1}{C_2 D}\right) + (i_2 - i_1) \cdot \left(R_1 + \frac{1}{C_1 D}\right) = 0$

$$\Rightarrow m_2 \cdot \ddot{x}_2 + (v_2 - v_1)(b_2 + b_1) + (x_2 - x_1) \cdot (k_1 + k_2) = 0$$

b) $\Rightarrow m_2 \cdot \ddot{x}_2 + b_2 \cdot \dot{x}_2 + k_2 x_2 + (\dot{x}_2 - \dot{x}_1) b_1 + (x_2 - x_1) k_1 = W$

7)



•) Malla "i":

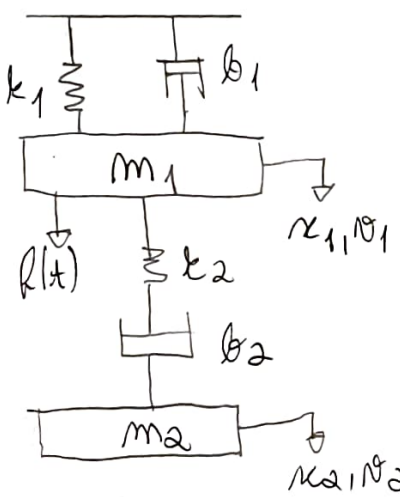
$$i_i \cdot R_i' + L_i D_i \cdot i_i - U_i - P_i + (i_i - i_{i-1}) \cdot \left(R_{i-1} + \frac{1}{C_{i-1} \cdot D}\right)$$

$$+ (i_i - i_{i+1}) \cdot \left(R_i + \frac{1}{C_i \cdot D}\right) = 0$$

$$\Rightarrow \dot{x}_i \cdot b_i' + m_i \cdot \ddot{x}_i + (\dot{x}_i - \dot{x}_{i-1}) \cdot b_{i-1} + (x_i - x_{i-1}) \cdot k_{i-1} +$$

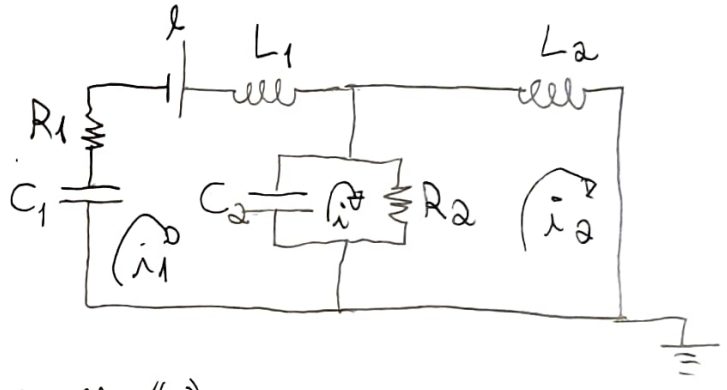
$$(\dot{x}_i - \dot{x}_{i+1}) \cdot b_i + (x_i - x_{i+1}) \cdot k_i = U_i + m \cdot g \cdot \operatorname{sen}\theta$$

6)



$F \rightarrow V$

$\vec{v} \rightarrow i$



• Malla "i":

$$(i - i_2) \cdot R_2 + (i - i_1) \cdot \frac{1}{C_2 \cdot D} = 0$$

$$\Rightarrow (\dot{x} - \dot{x}_2) \cdot b_2 + (x - x_1) \cdot k_2 = 0$$

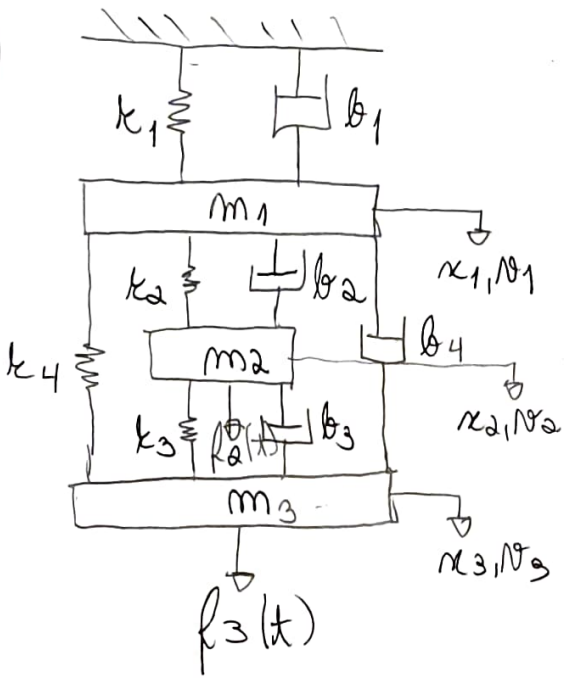
• Malla 1: $i_1 \cdot \frac{1}{D \cdot C_1} + i_1 \cdot R_1 + L_1 \cdot D \cdot i_1 + (i_1 - i) \cdot \frac{1}{C_3 \cdot D} = e$

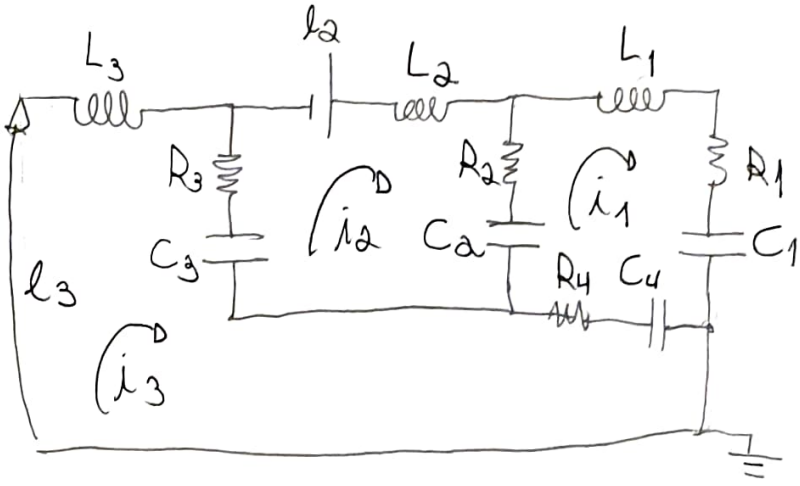
$\Rightarrow m_1 \cdot \ddot{x}_1 + b \dot{x}_1 + k \cdot x_1 + (x_1 - x) k_2 = f(t)$

• Malla 2: $i_2 \cdot L_2 \cdot D + (i_2 - i) \cdot R_2 = 0$

$\Rightarrow m_2 \cdot \ddot{x}_2 + (\dot{x}_2 - \dot{x}) \cdot b_2 = 0$

3)





•) Malla 1: $i_1 \left(L_1 \cdot D + R_1 + \frac{1}{C_1 \cdot D} \right) + (i_1 - i_3) \cdot \left(\frac{1}{C_4 D} + R_4 \right) + (i_1 - i_3) \cdot \left(R_2 + \frac{1}{C_2 D} \right) = 0$

$\Rightarrow m_1 \cdot \ddot{x}_1 + b_1 \cdot \dot{x}_1 + k_1 \cdot x_1 + (\dot{x}_1 - \dot{x}_3) \cdot b_4 + (\dot{x}_1 - \dot{x}_2) \cdot b_2 + (x_1 - x_3) k_4 + (x_1 - x_2) \cdot k_2 = 0$

•) Malla 2: $L_2 \cdot D \cdot i_2 + (i_2 - i_1) \cdot \left(\frac{1}{C_2 D} + R_2 \right) + (i_2 - i_3) \cdot \left(\frac{1}{C_3 D} + R_3 \right) = e_2$

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

•) Malla 3: $L_3 \cdot D \cdot i_3 + (i_3 - i_2) \cdot \left(\frac{1}{C_3 D} + R_3 \right) + (i_3 - i_1) \cdot \left(\frac{1}{C_4 \cdot D} + R_4 \right) = e_3$

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