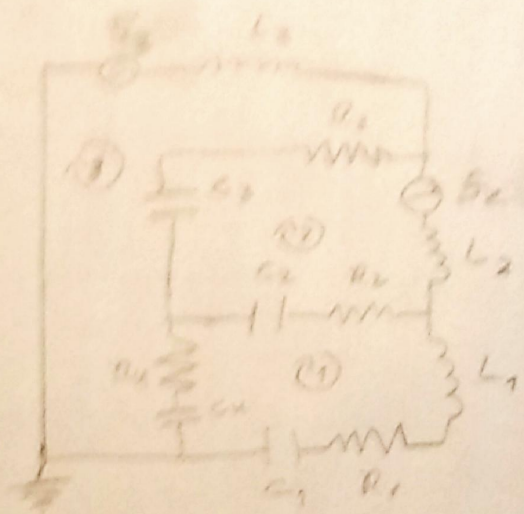
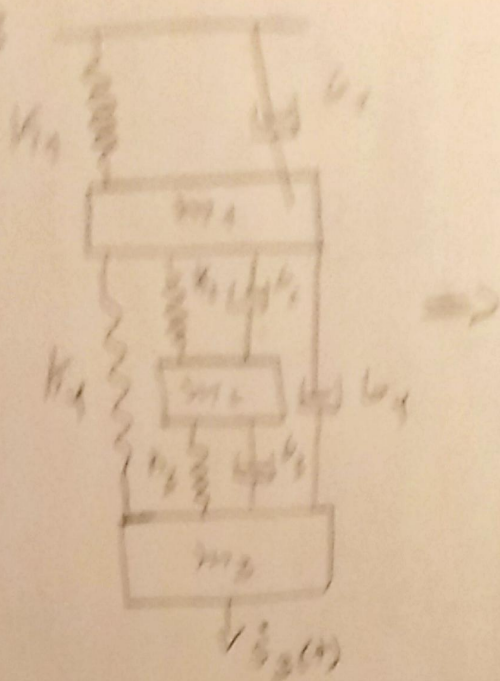


Ex 3.1

ANALOGIA



① = $i_1 \rightarrow$

$$\frac{i_1}{C_{20}} + \frac{i_1}{C_{40}} + \frac{i_1}{C_{40}} + R_{11}i_1 + R_{12}i_1 + R_{13}i_1 + L_{10}di_1 - \frac{i_2}{C_{20}} - R_{12}i_2 - R_{14}i_3 - \frac{i_3}{C_{40}} = 0$$

$\Downarrow$

$$m_1 \ddot{x}_1 + b_1 \dot{x}_1 + b_2 \dot{x}_1 + b_4 \dot{x}_1 + k_{11}x_1 + k_{12}x_1 + k_{14}x_1 - b_2 \dot{x}_2 - k_{12}x_2 - b_4 \dot{x}_3 - k_{14}x_3 = 0$$

② = $i_2 \rightarrow$

$$\frac{i_2}{C_{20}} + \frac{i_2}{C_{20}} + i_2 L_2 D + i_2 R_2 + i_2 R_3 - i_1 R_2 - \frac{i_1}{C_{20}} - \frac{i_3}{C_{30}} - i_3 R_3 = f_2$$

$\Downarrow$

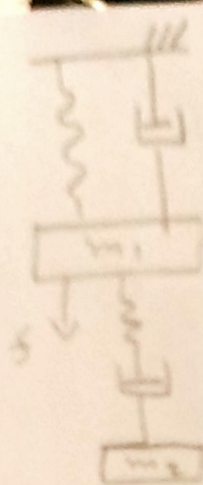
$$m_2 \ddot{x}_2 + k_{12}x_2 + k_{13}x_2 + b_2 \dot{x}_2 + b_3 \dot{x}_2 - b_2 \dot{x}_1 - k_{12}x_1 - b_3 \dot{x}_3 - k_{13}x_3 = f_2$$

③ = $i_3 \rightarrow$

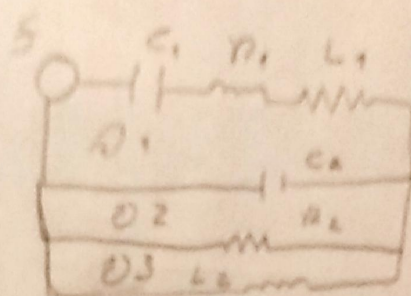
$$\frac{i_3}{C_{30}} + \frac{i_3}{C_{40}} + i_3 L_3 D + R_3 i_3 + R_4 i_3 - R_3 i_2 - R_4 i_1 - \frac{i_2}{C_{30}} - \frac{i_1}{C_{40}} = f_3$$

$$m_3 \ddot{x}_3 + k_{13}x_3 + k_{14}x_3 + b_3 \dot{x}_3 + b_4 \dot{x}_3 - b_4 \dot{x}_1 - b_4 \dot{x}_1 - k_{13}x_2 - b_3 \dot{x}_2 = f_3$$

Ex 6:



Analogia



① = $\dot{q}_1 \rightarrow$

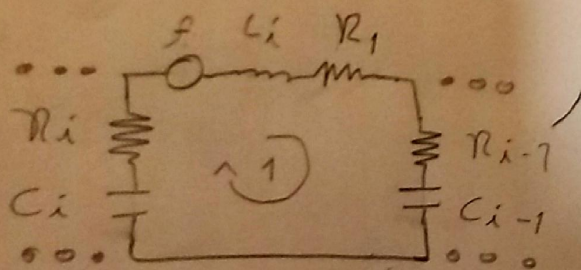
$$\left\{ \begin{array}{l} \frac{\dot{q}_1}{C_1 D} + \dot{q}_1 R_1 - \frac{\dot{q}_2}{C_2 D} + \dot{q}_1 R_1 = f \\ \frac{\dot{q}_2}{C_2 D} + R_2 \dot{q}_2 - \frac{\dot{q}_1}{C_2 D} - \dot{q}_3 R_2 = 0 \end{array} \right. \quad \text{②} = \dot{q}_2 \rightarrow$$

③ = $\dot{q}_3 \rightarrow$

$$\dot{q}_3 R_2 + \dot{q}_3 L_2 D - \dot{q}_2 R_2 = 0$$

Ex 7: PROBLEMA do TREM

1 VAGÃO:



① = $\dot{q}_i \rightarrow$

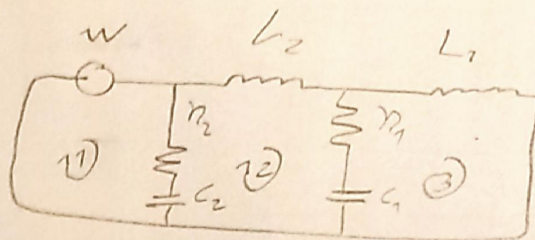
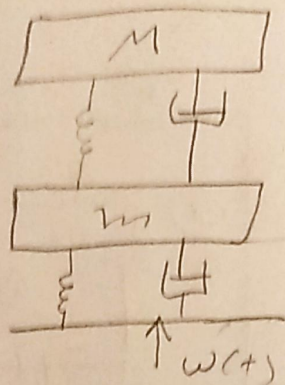
$$f = \frac{\dot{q}_i}{C_{i-1} D} + \frac{\dot{q}_i}{C_i D} + \dot{q}_i R_1 + \dot{q}_i R_{i-1} + \dot{q}_i R_i + L_i D \dot{q}_i - \frac{\dot{q}_{i-1}}{C_{i-1} D} - \dot{q}_{i-1} R_{i-1} \dots$$

$$- \dot{q}_{i+1} R_i - \frac{\dot{q}_{i+1}}{C_{i+1} D}$$

$$f = m_i \ddot{x}_i + \dot{x}_i b_i + \dot{x}_i d_i + \dot{x}_{i-1} d_{i-1} + K_i x_i + K_{i-1} x_i - K_{i-1} x_{i-1} - b_{i-1} \dot{x}_{i-1} \dots$$

$$- K_i x_i - b_{i-1} \dot{x}_{i-1}$$

Ex 8:



$$\begin{aligned} \textcircled{1} = \dot{i}_1 \downarrow \quad \textcircled{2} = \dot{i}_2 \downarrow \\ \dot{i}_1 = w(t) \quad \left\{ \begin{aligned} \dot{i}_2 R_2 + \dot{i}_2 R_1 + \frac{\dot{i}_2}{C_2 D} + \frac{\dot{i}_2}{C_1 D} + \dot{i}_2 L_2 D - \frac{\dot{i}_1}{C_2 D} - \frac{\dot{i}_1}{R_2} \dots \end{aligned} \right. \end{aligned}$$

$$- \frac{\dot{i}_3}{C_1 D} - \dot{i}_3 R_1 = 0$$

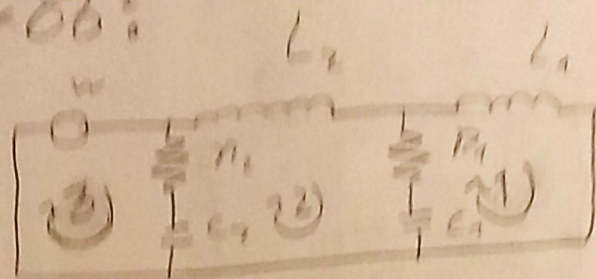
$$\textcircled{3} = \dot{i}_3 \downarrow$$

$$\dot{i}_3 L_1 D + \frac{\dot{i}_3}{C_1 D} - \frac{\dot{i}_2}{C_1 D} + \dot{i}_3 R_1 - \dot{i}_2 R_1 = 0$$

$$m_2 \ddot{x}_2 + b_1 \dot{x}_2 + b_2 \dot{x}_2 + k_1 x_2 + k_2 x_2 - b_1 \dot{x}_1 - k_1 x_1 - \frac{1}{2} w(t) - \frac{1}{2} \dot{w}(t) = 0$$

$$M \ddot{x}_1 + b_1 \dot{x}_1 + k_1 x_1 - b_1 \dot{x}_2 - k_1 x_2 = 0$$

Ex 8.6.1



$$L_2 D i_2 + R_1 i_2 - R_1 i_1 + \frac{L_{12}}{C_{1D}} \dot{i}_2 - \frac{L_{12}}{C_{1D}} \dot{i}_1 + R_2 i_2 - R_2 i_3 + \frac{L_2}{C_{2D}} \dot{i}_2 - \frac{L_2}{C_{2D}} \dot{i}_3 = 0$$

$$L_1 D i_1 + R_1 i_1 - R_1 i_2 + \frac{L_{12}}{C_{1D}} \dot{i}_1 - \frac{L_{12}}{C_{1D}} \dot{i}_2 = 0$$

$$M \ddot{x}_1 + b_1 \dot{x}_1 + K_1 x_1 - b_1 \dot{x}_2 - K_1 x_2 = 0$$

$$m \ddot{x}_2 + b_1 \dot{x}_2 + K_1 x_2 - K_2 x_1 - b_1 \dot{x}_1 = w(t)$$