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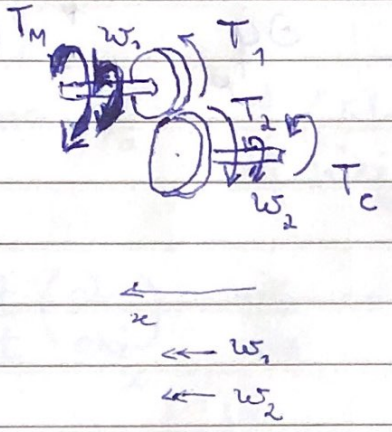
- Exercícios do dia 15/09 -



Eixo 1:

$$J_1\dot{\omega}_1 + B_1\omega_1 + T_1 = T_M \qquad (1)$$

Eixo 2:

$$J_2\cdot\dot{\omega}_2 + B_2\omega_2 + T_C = T_2$$

$$\Rightarrow J_2\cdot\dot{\omega}_2 + B_2\omega_2 + T_C = T_1\cdot n \qquad (2)$$

Isolando (1): $T_1 = -J_1\dot{\omega}_1 - B_1\omega_1 + T_M$

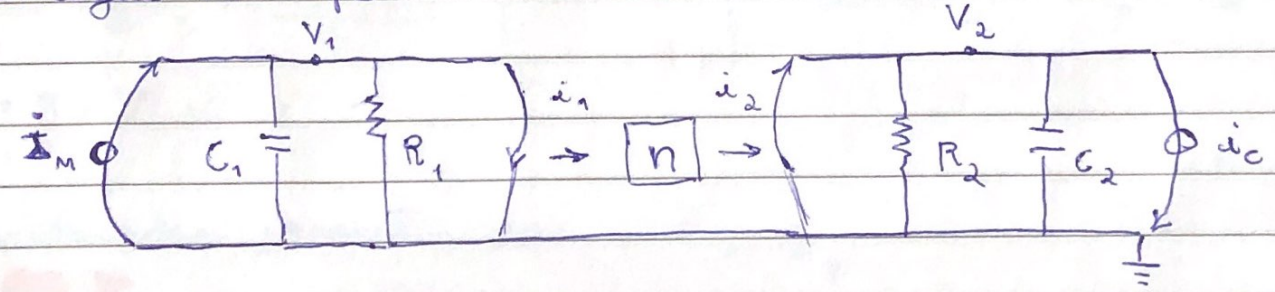
$$= -J_1 n\dot{\omega}_2 - B_1 n\omega_2 + T_M \qquad (3)$$

Substituindo (3) em (2):

$$J_2\cdot\dot{\omega}_2 + B_2\omega_2 + T_C = (-J_1 n\dot{\omega}_2 - B_1 n\omega_2 + T_M)\, n$$

$$\Rightarrow (J_2 + J_1 n^2)\dot{\omega}_2 + (B_2 + B_1 n^2)\omega_2 + (T_C - T_M n) = 0$$

Analogia do tipo 2:

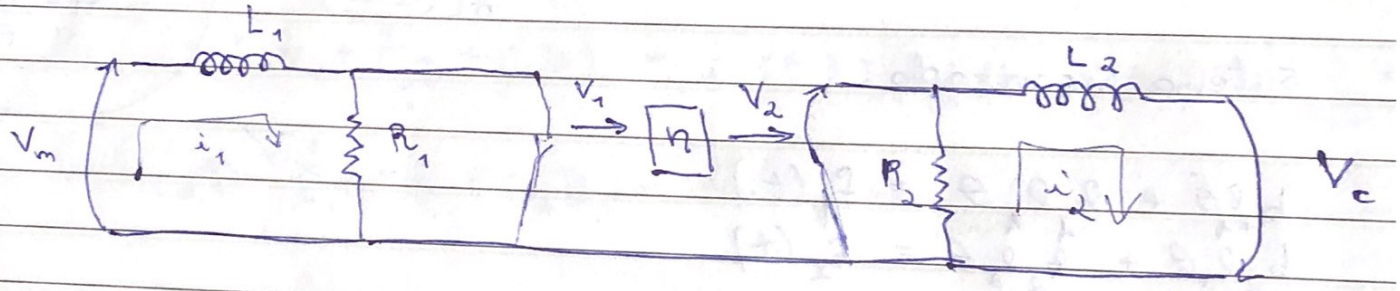


1: $V_1 \left(C_1 D + \frac{1}{R_1}\right) = i_m - i_1$

2: $V_2 \left(C_2 D + \frac{1}{R_2}\right) = i_2 - i_c$

$$\begin{cases} J_1 \dot{\omega}_1 + B_1 \omega_1 = T_M - T_1 \\ J_2 \dot{\omega}_2 + B_2 \omega_2 = T_2 - T_C \end{cases}$$

Analogia tipo 1:

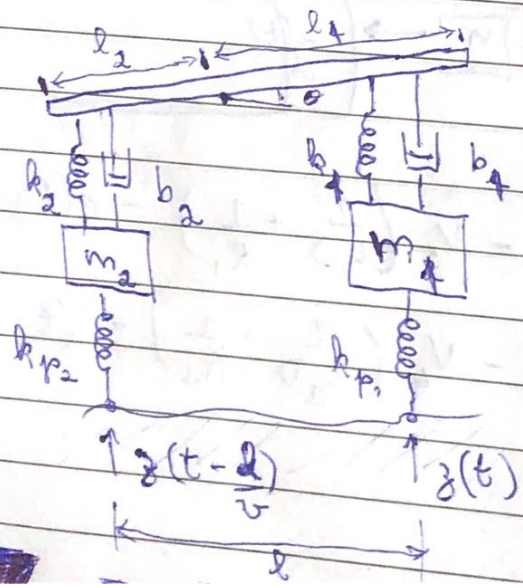


Malha 1: $L_1 D \cdot i_1 + R_1 i_1 = V_m - V_1$

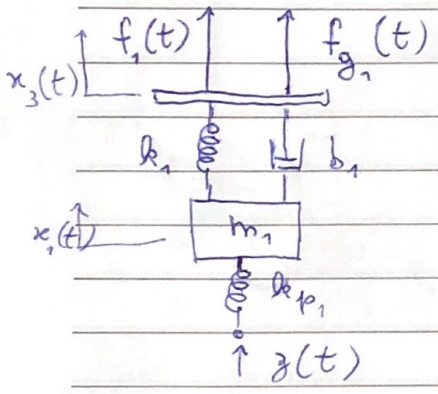
Malha 2: $R_2 i_2 + L_2 D i_2 = V_2 - V_C$

$$\begin{cases} J_1 \dot{\omega}_1 + B_1 \omega_1 = T_M - T_1 \\ J_2 \dot{\omega}_2 + B_2 \omega_2 = T_2 - T_C \end{cases}$$

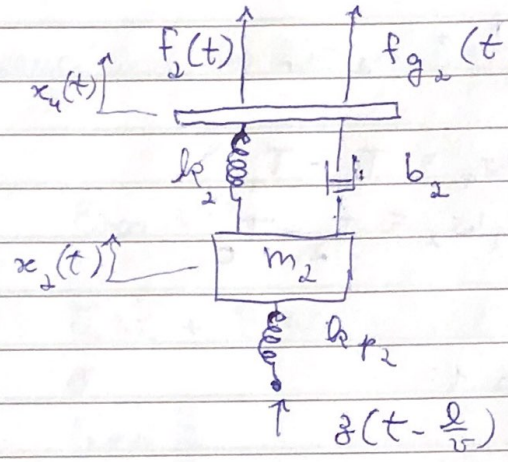
2-



Sistema 1:



Sistema 2:



$$n = \frac{l_2}{l_1}$$

$$F_1 l_1 \dot{\theta} = F_2 l_2 \dot{\theta}$$

$$\frac{l_2}{l_1} = \frac{F_1}{F_2}$$

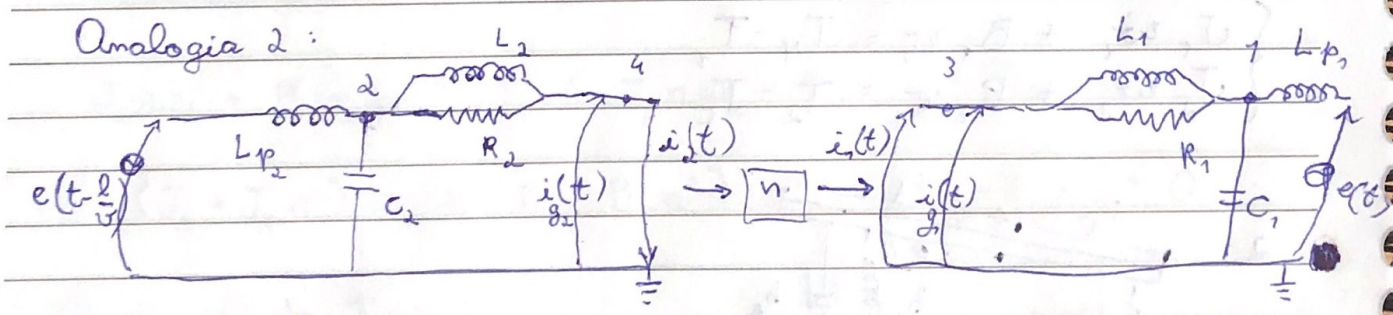
$$\therefore n = \frac{F_1}{F_2}$$

Sistema linearizado:

$$b_1 l_1 \dot{\theta} + k_1 l_1 \theta = f_1(t)$$
$$b_2 l_2 \dot{\theta} + k_2 l_2 \theta = f_2(t)$$

$$b_1 \dot{x}_G - b_1 \dot{x}_1 + k_1 x_G - k_1 x_1 = f_{g_1}(t)$$
$$b_2 \dot{x}_G - b_2 \dot{x}_2 + k_2 x_G - k_2 x_2 = f_{g_2}(t)$$

Analogia 2:



Nó 1: $$V_1\left(\frac{1}{L_1 D} + \frac{1}{R_1} + \frac{1}{L_{p_1} D} + C_1 D\right) - V_3\left(\frac{1}{L_1 D} + \frac{1}{R_1}\right) - e(t) \cdot \frac{1}{L_{p_1} D} = 0$$

Nó 2: $$V_2\left(\frac{1}{L_{p_2} D} + \frac{1}{L_2 D} + \frac{1}{R_2} + C_2 D\right) - V_4\left(\frac{1}{L_2 D} + \frac{1}{R_2}\right) - e\left(t - \frac{l}{v}\right) \cdot \frac{1}{L_{p_2} D} = 0$$

Nó 3: $V_3\left(\frac{1}{L_1 D} + \frac{1}{R_1}\right) - i_1(t) - i_{g_1}(t) = 0$

Nó 4: $V_4\left(\frac{1}{L_2 D} + \frac{1}{R_2}\right) - i_{g_2}(t) - i_2(t) = 0$

$$\Rightarrow \begin{cases} V_3\left(\frac{1}{L_1 D} + \frac{1}{R_1}\right) = i_1(t) + i_{g_1}(t) \\ V_4\left(\frac{1}{L_2 D} + \frac{1}{R_2}\right) = i_2(t) + i_{g_2}(t) \end{cases}$$

Substituindo nos nós 1 e 2:

$$\begin{cases} V_1\left(\frac{1}{L_1 D} + \frac{1}{R_1} + \frac{1}{L_{p_1} D} + C_1 D\right) - i_1(t) - i_{g_1}(t) - e(t)\cdot\frac{1}{L_{p_1} D} = 0 \\ V_2\left(\frac{1}{L_{p_2} D} + \frac{1}{L_2 D} + \frac{1}{R_2} + C_2 D\right) - i_2(t) - i_{g_2}(t) - e\left(t - \frac{l}{v}\right)\cdot\frac{1}{L_{p_2} D} = 0 \end{cases}$$

$$\begin{cases} v_1\left(\frac{k_1}{D} + b_1 + \frac{k_{p_1}}{D} + m_1 D\right) - f_1(t) - f_{g_1}(t) - j(t)\cdot\frac{k_{p_1}}{D} = 0 \\ v_2\left(\frac{k_{p_2}}{D} + \frac{k_2}{D} + b_2 + m_2 D\right) - f_2(t) - f_{g_2}(t) - j\left(t - \frac{l}{v}\right)\cdot\frac{k_{p_2}}{D} = 0 \end{cases}$$

$$\begin{cases} m_1 \ddot{x}_1 + b_1 \dot{x}_1 + (k_1 + k_{p_1}) x_1 = f_1(t) + f_{g_1}(t) + k_{p_1}\cdot j(t) \\ m_2 \ddot{x}_2 + b_2 \dot{x}_2 + (k_2 + k_{p_2}) x_2 = f_2(t) + f_{g_2}(t) + k_{p_2}\cdot j\left(t - \frac{l}{v}\right) \end{cases}$$

$$f_1 l_1 + f_{g_1} l_1 + f_{g_2} l_1 - f_2 l_2 = J_g \ddot{\theta}$$