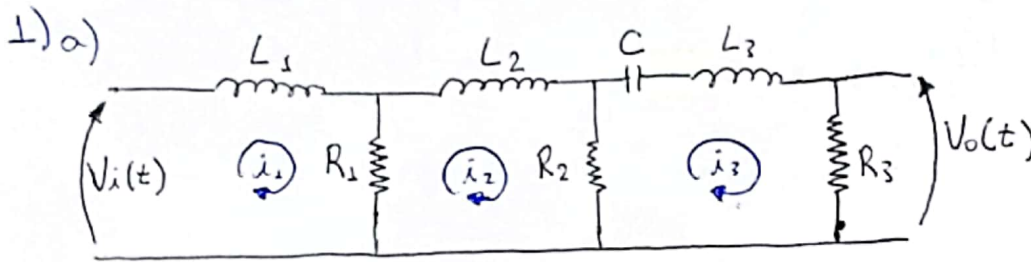


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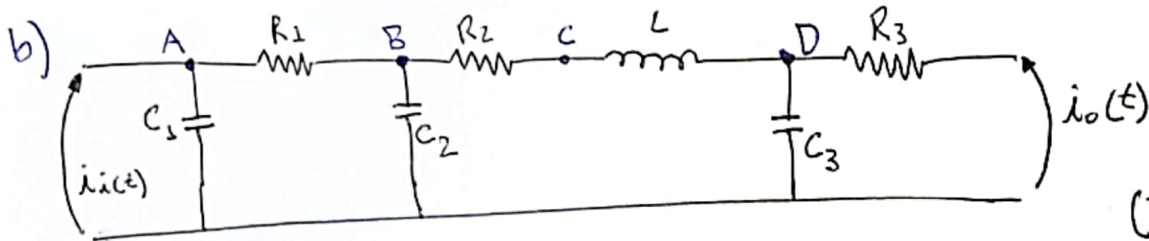
$Q \rightarrow V$
 $C_S \rightarrow L$
 $\frac{1}{R_S} \rightarrow R$
 $\frac{1}{L_S} \rightarrow \frac{1}{C}$

Malha 1: $(L_1 D + R_1) i_1 - R_1 i_2 = V_i(t)$

Malha 2: $(R_1 + L_2 D + R_2) i_2 - R_2 i_3 - R_1 i_1 = 0$

Malha 3: $(L_3 D + R_3 + R_2 + \frac{1}{C_2 D}) i_3 - R_2 i_2 = V_o(t)$

(Tipo 1)



(Tipo 2)

Nó A: $(C_1 D + \frac{1}{R_1}) V_1 - (\frac{1}{R_2}) V_2 = i_i(t)$

Nó B: $(C_2 D + \frac{1}{R_1} + \frac{1}{R_2}) V_2 - (\frac{1}{R_1}) V_1 - (\frac{1}{R_2}) V_3 = 0$

Nó C: $(\frac{1}{R_2} + \frac{1}{L D}) V_3 - (\frac{1}{L D}) V_2 - (\frac{1}{R_2}) V_2 = 0$

Nó D: $(C_3 D + \frac{1}{L D} + \frac{1}{R_3}) V_3 - (\frac{1}{L D}) V_2 = i_o(t)$

c) Modelo hidráulico

(Tipo 1) $\rightarrow \bar{R}_S = \frac{1}{\rho g R_S}$; $C_S = \frac{A}{\rho g}$; $L_S = \frac{\rho L}{A}$

$$\begin{cases} C_{S1} \dot{p}_1 + \bar{R}_{S1} p_1 - R_{S1} p_2 = Q_i(t) \\ \bar{R}_{S1} p_2 + C_{S2} \dot{p}_2 + \bar{R}_{S2} p_2 - \bar{R}_{S2} p_3 - \bar{R}_{S1} p_1 = 0 \\ C_{S3} \dot{p}_3 + \bar{R}_{S3} p_3 + R_{S2} p_3 + \frac{1}{L_S} (\int p_3 dt) - R_{S2} p_2 = Q_o(t) \end{cases}$$

$$\begin{cases} \dot{h}_1 A_1 + \frac{1}{R_{S1}} (h_1 - h_2) = Q_i(t) \\ \dot{h}_2 A_2 + \frac{1}{R_{S2}} (h_2 - h_3) + \frac{1}{R_{S1}} (h_2 - h_1) = 0 \\ \dot{h}_3 A_3 + \frac{1}{R_{S3}} (h_3) + \frac{1}{R_{S2}} (h_3 - h_2) = Q_o(t) - Q_2 \end{cases}$$

(Tipo 2) $C_s = \frac{A}{\rho g}$; $\bar{R}_s = \rho g R_s$; $L_s = \frac{\rho l}{A}$

$$\left\{ \begin{array}{l} C_{s1} \dot{p}_1 + \frac{1}{R_{s1}} (p_1 - p_2) = Q_i(t) \\ C_{s2} \dot{p}_2 + \frac{1}{R_{s1}} (p_2 - p_1) + \frac{1}{R_{s2}} (p_2 - p_a) = 0 \\ \frac{1}{R_{s2}} (p_a - p_2) + \frac{1}{L_s D_t} (p_a - p_2) = 0 \\ C_{s3} \dot{p}_3 + \frac{1}{L_s D} (p_3 - p_a) + \frac{1}{R_{s3}} p_3 = Q_o(t) \end{array} \right.$$

$$A_1 \dot{h}_1 + \frac{1}{R_{s1}} (h_1 - h_2) = Q_i(t)$$

$$A_2 \dot{h}_2 + \frac{1}{R_{s1}} (h_2 - h_1) + \frac{1}{R_{s2}} (h_2 - h_a) = 0$$

$$\frac{1}{R_{s2}} (h_a - h_2) = \dot{Q}_2 - \dot{Q}_a$$

$$A_3 \dot{h}_3 + \frac{1}{R_{s3}} h_3 = Q_o(t) + \dot{Q}_a - \dot{Q}_3$$