PME-3380 - Modelagem de Sistemas Dinamicos

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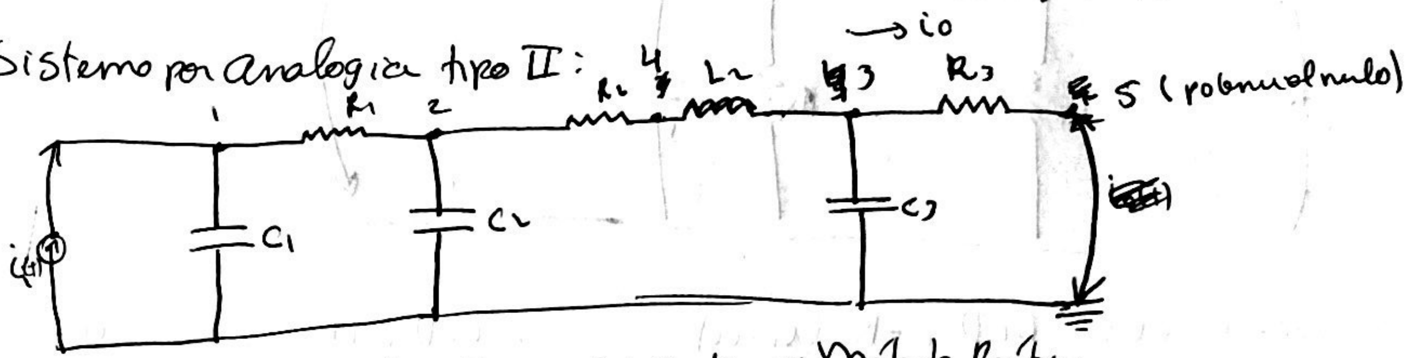
Sistema por analogia tipo II:



Desconhecemos as tensões em 1, 2, 3 e 4 → Método Prático

Nó 1: $V_1\left(C_1D + \frac{1}{R_1}\right) - V_2\frac{1}{R_1} = i_i(t)$

Nó 2: $V_2\left(C_2D + \frac{1}{R_1} + \frac{1}{R_2}\right) - V_1\frac{1}{R_1} - V_4\frac{1}{R_2} = 0$

$P \to V$; $Q \to i$

Nó 4: $V_4\left(\frac{1}{R_2} + \frac{1}{L_2D}\right) - V_2\frac{1}{R_2} - \frac{V_3}{L_2D}$

Nó 3: $V_3\left(C_3D + \frac{1}{L_2D} + \frac{1}{R_3}\right) - V_4\frac{1}{L_2D} = i_0(t)$

Aplicando analogia

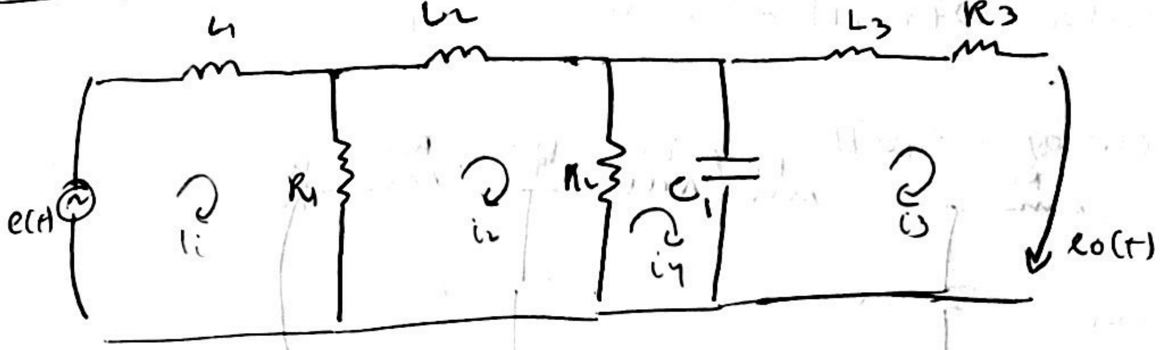
① $\frac{A_1}{\rho g}\frac{dp_1}{dt} + \frac{1}{\rho g R_1}p_1 - \frac{1}{\rho g R_1}p_2 = Q_i(t)$

② $\frac{A_2}{\rho g}\frac{dp_2}{dt} + \left(\frac{1}{\rho g R_1} + \frac{1}{\rho g R_2}\right)p_2 - \frac{p_1}{\rho g R_1} - \frac{p_4}{\rho g R_2} = 0$

④ $p_4\left(\frac{1}{\rho g R_2}\right) + \frac{a}{\rho L}\int p_4\,dt - \frac{p_2}{\rho g R_2} - \frac{a}{\rho \ell}\int p_3\,dt = 0$

③ $\frac{A_3}{\rho g}\frac{dp_3}{dt} + \frac{1}{\rho g R_3}p_3 + \frac{a}{\rho \ell}\int p_3\,dt - \frac{a}{\rho L}\int p_4\,dt = Q_0(t)$

Analogia tipo 1



malha 1: $e(t) - L_1 D i_1 - R_1 (i_1 - i_2) = 0 \rightarrow L_1 D i_1 + R_1 (i_1 - i_2) = e(t)$

malha 2: $-L_2 D i_2 - R_1 (i_2 - i) - R_2 (i_2 - i_4) = 0 \rightarrow L_2 D i_2 + R_1 (i_2 - i_1) + R_2 (i_2 - i_4)$

malha 3: $e_0(t) - (L_3 D + R_3) i_3 - \frac{1}{C_1 D} (i_3 - i_4) = 0 \rightarrow (L_3 D + R_3) i_3 + \frac{1}{C_1 D} (i_3 - i_4) = e_0(t)$

malha 4: $-R_2 (i_4 - i_2) - \frac{1}{C_1 D} (i_4 - i_3) = 0 \Rightarrow R_2 (i_4 - i_2) + \frac{1}{C_1 D} (i_4 - i_3) = 0$

Pela analogia tipo 1:

① $$\frac{A_1}{\rho g} \frac{dP_1}{dt} + \frac{1}{\rho g R_1} P_1 - \frac{1}{\rho g R_1} P_2 = Q(t)$$

② $$\frac{A_2}{\rho g} \frac{dP_2}{dt} + \frac{1}{\rho g R_1} (P_2 - P_1) + \frac{1}{\rho g R_2} (P_2 - P_4) = 0$$

③ $$\frac{A_3}{\rho g} \frac{dP_3}{dt} + \frac{1}{\rho g R_3} P_3 + \frac{a}{\rho l} \int P_3 dt - \frac{a}{\rho L} \int P_4 dt = Q_0(t)$$

④ $$\frac{1}{\rho g R_2} (P_4 - P_2) + \frac{a}{\rho l} \left[\int P_4 dt - \int P_3 dt \right] = 0$$

As equações tanto pra analogia 2 como 1 são equivalentes !!!