PME 3380 - Modelagem de Sistemas Dinâmicos

Exercício Aula 22/09/2020

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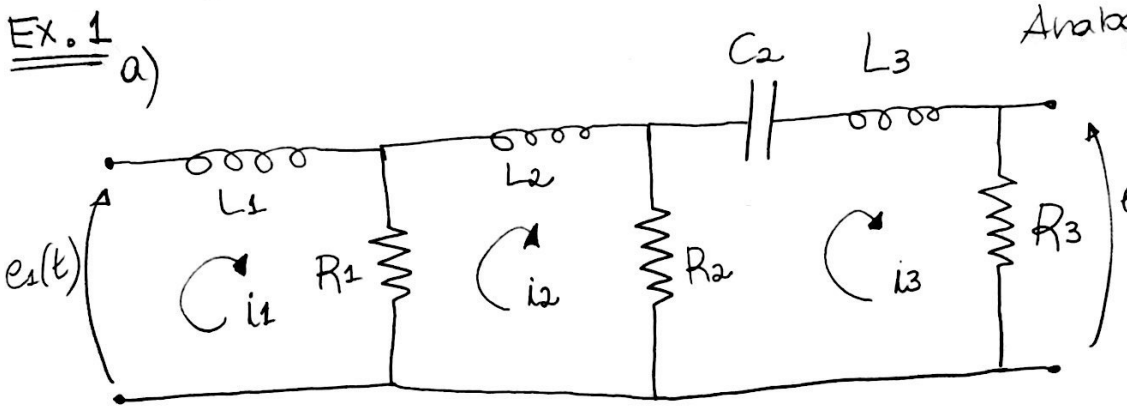
Ex. 1

a)



Analogia Tipo 1

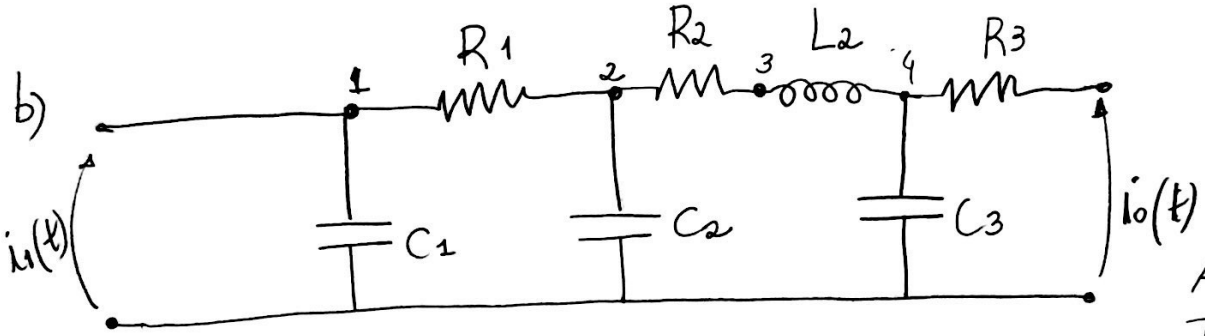
Cp → i

Q(t) → e(t)

1/Rf → R

1/Lf → 1/C

b)



Analogia Tipo 2

c) • Analogia Tipo 1:

$i \rightarrow C_p = A/\rho g$

$R \rightarrow 1/Rf = \rho . g\, Rf$

$C \rightarrow Lf = \rho l / A$

(1): $e_1(t) = (R_1 + L_1 D) i_1 - R_1 i_2$

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

(3): $e_0(t) = (R_2 + 1/C_2 D + L_3 D + R_3) i_3 - R_2 i_2$

(1) → $Q_1(t) = \ddot{h}_1 A + \frac{1}{Rf_1}(\dot{h}_1 - \dot{h}_2)$

(2) → $0 = \dot{h}_2 A + \frac{1}{Rf_1}(\dot{h}_2 - \dot{h}_1) + 1/Rf_2 (\dot{h}_2 - \dot{h}_3)$

(3) → $Q_0(t) = \ddot{h}_3 A + \frac{1}{Rf_2}(\dot{h}_3 - \dot{h}_2) + \dot{Q}_2(t) + 1/Rf_3 (\dot{h}_3)$

• Analogia Tipo 2:

(1): $i_1(t) = (C_1 D + 1/R_1) V_1 - (1/R_1) V_2$

(2): $0 = (1/R_1 + C_2 D + 1/R_2) V_2 - 1/R_1 V_1 - 1/R_2 V_3$

(3): $0 = (1/R_2 + 1/L_2 D) V_3 - 1/R_2 V_2 - 1/L_2 D V_4$

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$$(4): \left(\frac{1}{L_2 D} + C_3 D + \frac{1}{R_3}\right) V_4 - \frac{1}{L_2 D} V_3 = 0$$

Analogia Tipo 2:

$V \rightarrow P = \rho g h$ $\quad R \rightarrow R_f = \rho g R_f$ $\quad C \rightarrow C_f = A/\rho g$

$i \rightarrow Q$ $\quad L \rightarrow L_f = \frac{\rho L}{g}$

$$\Rightarrow Q_i(t) = A_1 \ddot{h}_1 + \frac{(\dot{h}_1 - \dot{h}_2)}{R_{f1}} \quad (1)$$

$$\Rightarrow 0 = A_2 \ddot{h}_2 + \frac{(\dot{h}_2 - \dot{h}_1)}{R_{f1}} + \frac{(\dot{h}_2 - \dot{h}_3)}{R_{f2}} \quad (2)$$

$$\Rightarrow 0 = \frac{(h_4 - h_3)}{L_{f2}} + \frac{(\dot{h}_3 - \dot{h}_2)}{R_{f2}} \quad (3)$$

$$\Rightarrow 0 = \frac{(h_4 - h_3)}{L_{f2}} + A_3 \ddot{h}_4 + \frac{\dot{h}_4}{R_{f3}} \quad (4)$$

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