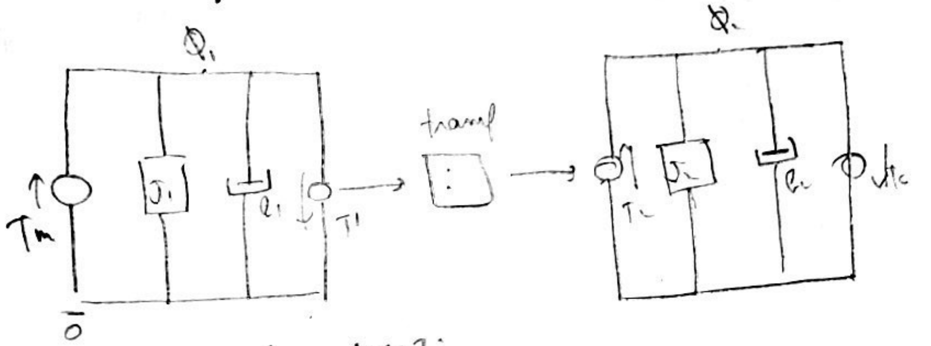
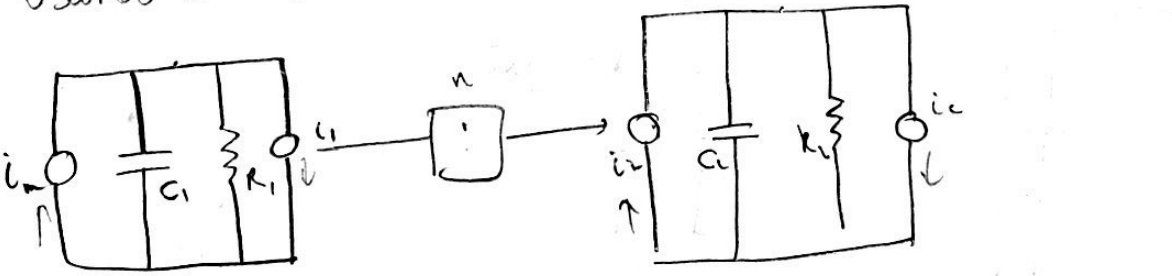
Modelagem de Sistemas Dinâmicos → 28/09/2020

Lucas Nigro Matheo - 10772911



→ enunciado

Usando analogia tipo 2:



nó 1: $(V_1-0)(C_1D+\frac{1}{R_1}) = i_m - i_1$; nó 2: $(V_2-0)(C_2D+\frac{1}{R_2}) = i_2 - i_c$

transformador: $i_2 = n\, i_1$

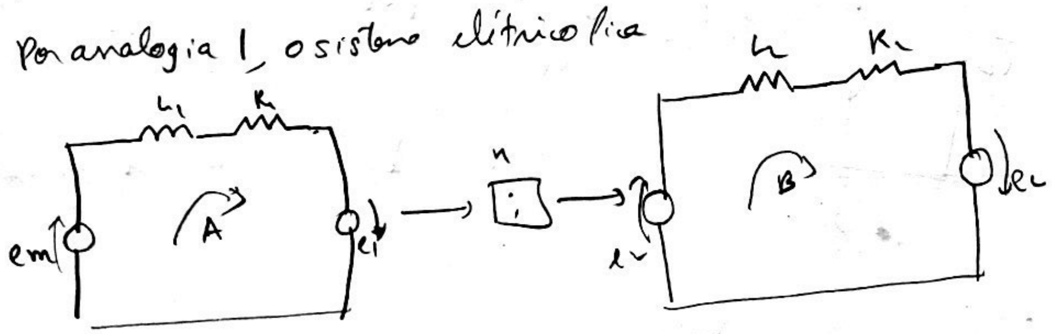
Usando a analogia tipo 2:

nó 1: $J_1\ddot{\theta}_1 + B_1\dot{\theta}_1 = T_m - T_1$; nó 2: $J_2\ddot{\theta}_2 + B_2\dot{\theta}_2 = T_2 - T_c$

Pela analogia (transformador) $\dot{\theta}_2 = \frac{1}{n}\dot{\theta}_1$

Item b: Resolver por analogia tipo 1

Por analogia 1, o sistema elétrico fica



Circ. A:

$e_m(t) - L_1Di_1 - R_1i_1 - e_1(t) = 0$

transformador $e_2 = n\, e_1$

Circ B:

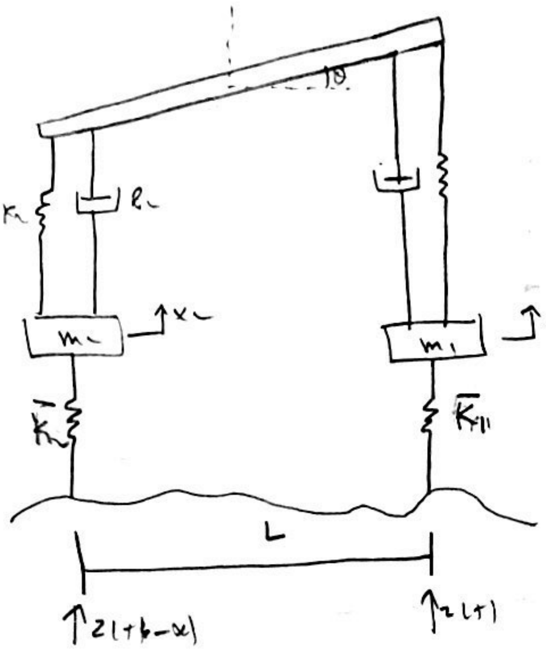
$e_2 - L_2Di_2 - R_2i_2 - e_c = 0$

Pelo analogia:

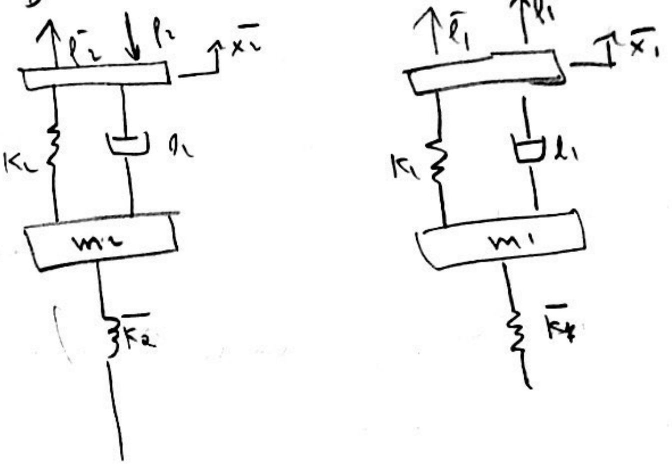
Ⓐ $T_m - J_1\ddot{\theta}_1 - \ell_1\dot{\theta}_1 - T_1 = 0 \Rightarrow J_1\ddot{\theta}_1 + \ell_1\dot{\theta}_1 = T_m - T_1$ //　　Transf: $T_2 = nT_1$

Ⓑ $T_2 - J_2\ddot{\theta}_2 - \ell_2\dot{\theta}_2 - T_c = 0 \Rightarrow J_2\ddot{\theta}_2 + \ell_2\dot{\theta}_2 = T_2 - T_c$ //

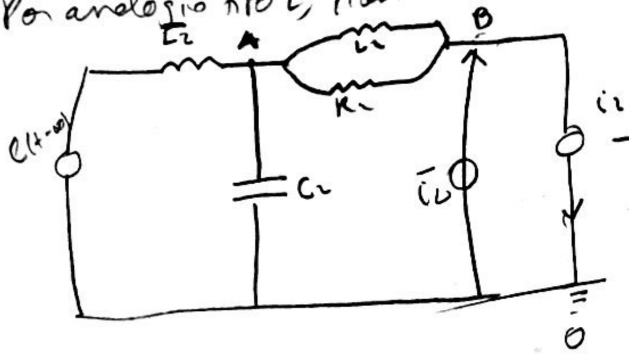
Exercício 2 → separar em 2 sistemas

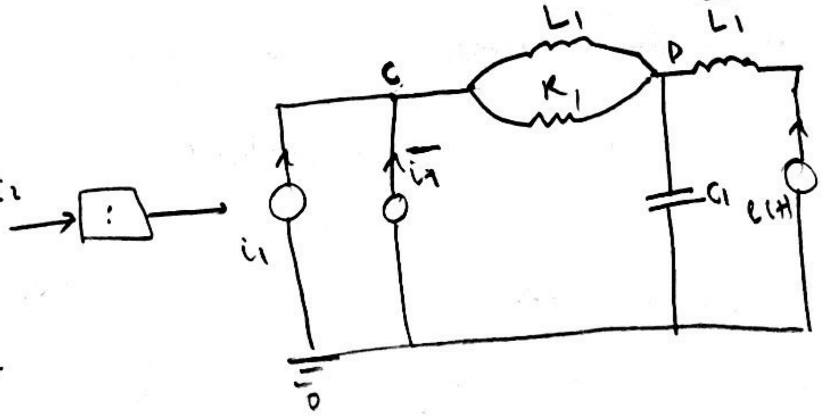


Dividindo



Por analogia tipo 2, ficamos com:





nó A:

$$(V_A - 0)(C_2D) + (V_A - e(t-x))\left(\frac{1}{\bar{L}_2D}\right) + (V_A - V_B)\left(\frac{1}{L_2D} + \frac{1}{R_2}\right) = 0$$

nó D:

$$(V_D - 0)(C_1D) + (V_D - e(t))\left(\frac{1}{\bar{L}_1D}\right) + (V_D - V_C)\left(\frac{1}{L_1D} + \frac{1}{R_1}\right) = 0$$

nó B:

$$V_B\left(\frac{1}{L_2D} + \frac{1}{R_2D}\right) = \bar{i}_2 - i_2$$

nó C

$$V_C\left(\frac{1}{L_1D} + \frac{1}{R_1}\right) = i_1 + \bar{i}_1$$

Ficamos com

nó A:

$$V_A\left(C_2D + \frac{1}{L_1D} + \frac{1}{R_2} + \frac{1}{\bar{L}_2D}\right) - e(t-\alpha)\frac{1}{\bar{L_2}D} = \bar{i_2} - i_2$$

nó D

$$V_D\left(C_1D + \frac{1}{L_1D} + \frac{1}{R_1} + \frac{1}{\bar{L}_1D}\right) - e(t)\frac{1}{\bar{L}_1D} = i_1 + \bar{i_1}$$

Isso gera:

$$\begin{cases} m_1\ddot{x}_1 + \ell_1\dot{x}_1 + (k_1+\bar{k}_1)x_1 - \bar{k}_1 z(t) = f_1 + \bar{f}_1 \\ m_2\ddot{x}_2 + \ell_2\dot{x}_2 + (k_2+\bar{k}_2)x_2 - \bar{k}_2 z(t-\alpha) = -f_2 + \bar{f}_2 \end{cases}$$

temos que

$f_1 = e_1(k_1\theta + \ell_1\dot{\theta})$; $f_2 = e_2(k_2\theta + e_2\dot{\theta})$

$\bar{f}_1 = (x_G - x_1)k_1 + \ell_1(\dot{x}_G - \dot{x}_1)$ $\quad \bar{f}_2 = (x_G - x_2)k_2 + \ell_2(\dot{x}_G - \dot{x}_2)$