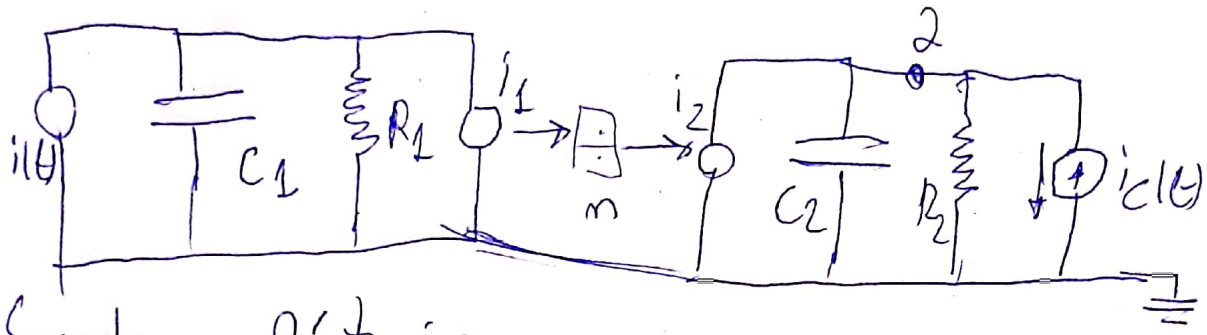
Nome: Paulo Mateus Corrêa Vianna

Nusp: 10772741

1) Realizando a analogia tipo 2:

a)



Sistema elétrico:

Nó 1: $V_1\left(C_1 D + \frac{1}{R_1}\right) = i_m - i_1$ $\quad i_2 = n\,i_1 \rightarrow V_2 = \frac{V_1}{n}$

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

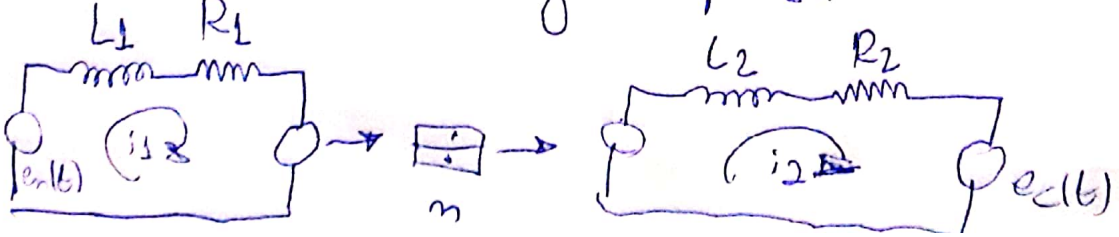
Sistema mecânico:

Nó 1: $\omega_1(J_1 D + B_1) = T_m - T_1 \rightarrow J_1\ddot{\theta}_1 + B_1\dot{\theta}_1 = T_m - T_1$

Nó 2: $\omega_2(J_2 D + B_2) = T_2 - T_c \rightarrow J_2\ddot{\theta}_2 + B_2\dot{\theta}_2 = T_2 - T_c$

$T_2 = n\,T_1 \rightarrow \theta_2 = \frac{\theta_1}{n}$

b) Realizando analogia tipo 1:



Malha 1: $(L_1 D + R_1) i_1 = e_m - e_1$

Malha 2: $(L_2 D + R_2) i_2 = e_2 - e_c$

← Circuito elétrico

$e_2 = n e_1$

$T_2 = n T_1$

Malha 1: $(J_1 D + B_1)\omega_1 = T_m - T_1$

Malha 2: $(J_2 D + B_2)\omega_2 = T_2 - T_c$

← Sistema Mecânico

$J_1 \ddot{\theta}_1 + B_1 \dot{\theta}_1 = T_m - T_1$

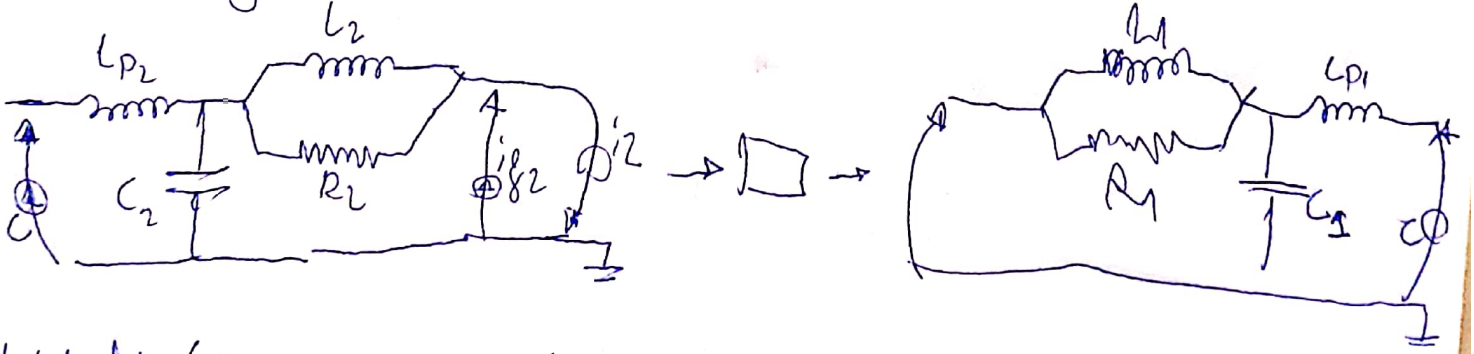
$J_2 \ddot{\theta}_2 + B_2 \dot{\theta}_2 = T_2 - T_c$

$\theta_2 = \frac{\theta_1}{n}$

Nó 3: $V_3\left(\frac{1}{R_1} + \frac{1}{L_1 D}\right) = i_1(t) + i_{g1}(t)$

Nó 4: $V_4\left(\frac{1}{R_2} + \frac{1}{L_2 D}\right) = i_2(t) + i_{g2}(t)$

② Analogia do tipo 2



Nó 1: $V_1\left(C_1 D + \frac{1}{R_1} + \frac{1}{L_1 D} + \frac{1}{L_{p1} D}\right) - c(t) - \frac{1}{L_{ip} D} - V_3\left(\frac{1}{R_1} + \frac{1}{L_1 D}\right) = 0$

Nó 2: $V_2\left(C_2 D + \frac{1}{R_2} + \frac{1}{L_2 D} + \frac{1}{L_{2p} D}\right) - e(t_a)\frac{1}{L_{2p}} - V_4\left(\frac{1}{R_2} - \frac{1}{L_{2p} D}\right) = 0$

Após rearranjar, obtemos as expressões:

$$m_1\ddot{x}_1 + b_1\dot{x}_1 + (k_1 + k_{1p})x_1 = k_{1p}z(t) + F_1(t) + F_{g_m}(t)$$

$$m_2\ddot{x}_2 + b_2\dot{x}_2 + (k_2 + k_{2p})x_2 = k_{2p}z(t-\omega) - F_2(t) + F_{g_2}(t)$$

③ $J_1\dot{\omega}_1 + B_1\omega_1 + T_1 = T_m$ $\quad T_e = nT_1 \quad \omega_1 = n\omega_2$

$J_2\dot{\omega}_2 + B_2\omega_2 + T_C = T_e$ $\quad T_1 = T_m - J_1\dot{\omega}_1 - B_1\omega_1$

$$J_2\dot{\omega}_2 + B_2\omega_2 + T_C = n(T_m - J_1\dot{\omega}_1 - B_1\omega_1)$$

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

$$(J_2 + nJ_1)\dot{\omega}_2 + (B_2 + n^2B_1)\omega_2 + T_C = nT_m$$

$$J_{eq_2}\dot{\omega}_2 + B_{eq_2}\omega_2 + T_C = nT_m$$