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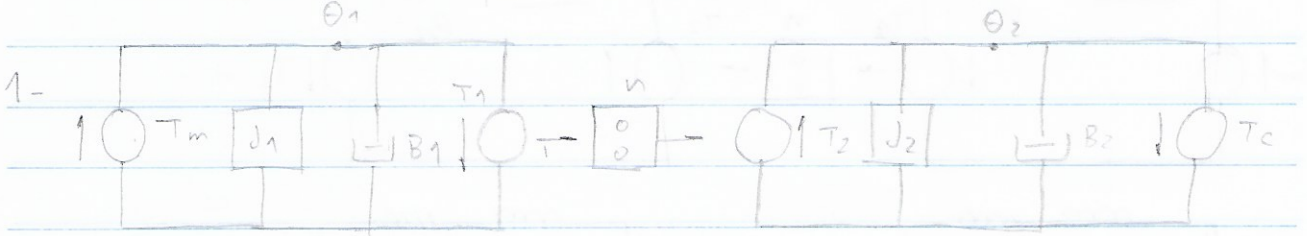
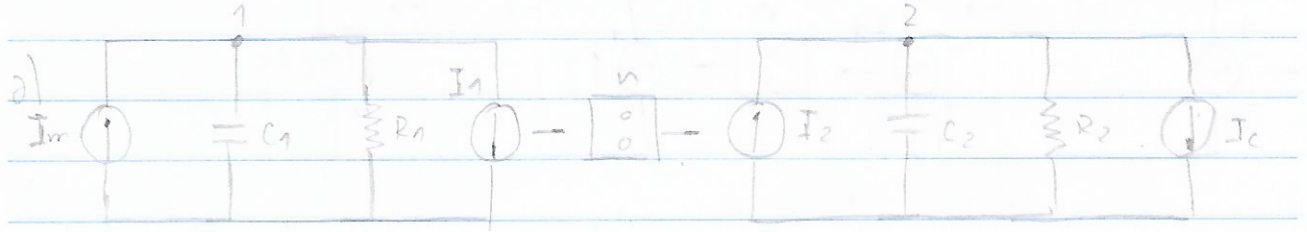
Transformadores

1-



2)



$V_1(C_1D + R_1) = I_m - I_1 \Rightarrow \dot{\theta}_1(J_1D + B_1) = T_m - T_1 \Rightarrow$

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

$V_2(C_2D + R_2) = I_2 - I_c \Rightarrow \dot{\theta}_2(J_2D + B_2) = T_2 - T_c \Rightarrow$

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

$T_1 = \frac{T_2}{n} \Rightarrow J_1\ddot{\theta}_1 + B_1\dot{\theta}_1 + \frac{T_2}{n} = T_m \Rightarrow$

$\Rightarrow J_1\ddot{\theta}_1 + B_1\dot{\theta}_1 + \frac{1}{n}(J_2\ddot{\theta}_2 + B_2\dot{\theta}_2 + T_c) = T_m$

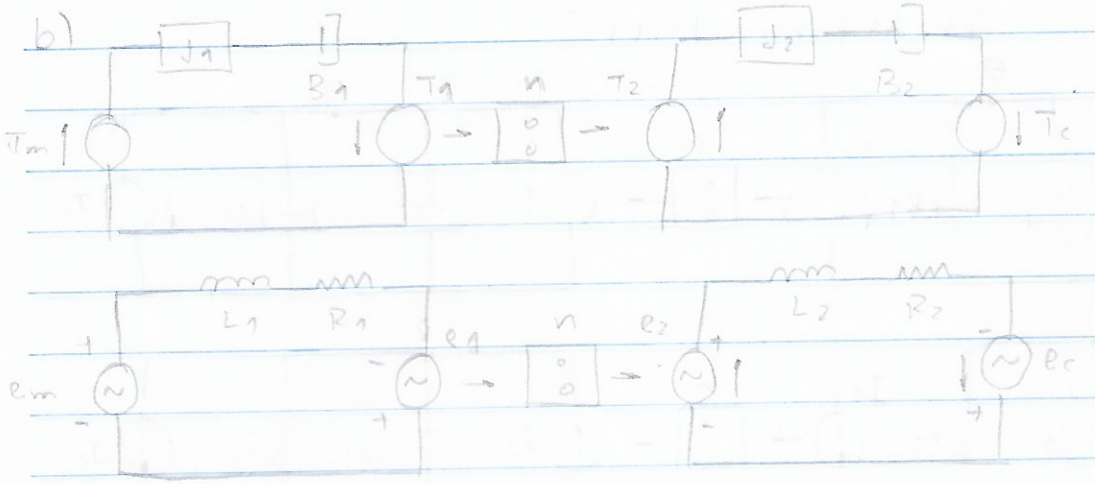
$\dot{\theta}_2 = \frac{\dot{\theta}_1}{n} \Rightarrow \ddot{\theta}_1\left(J_1 + \frac{J_2}{n^2}\right) + \dot{\theta}_1\left(B_1 + \frac{B_2}{n^2}\right) + \frac{T_c}{n} = T_m \Rightarrow$

$$\Rightarrow \boxed{J_{eq_1}\ddot{\theta}_1 + B_{eq_1}\dot{\theta}_1 + \frac{T_c}{n} = T_m}$$

$J_2\ddot{\theta}_2 + B_2\dot{\theta}_2 + T_c = T_1 n \Rightarrow J_2\ddot{\theta}_2 + B_2\dot{\theta}_2 + T_c = n(-J_1\ddot{\theta}_1 - B_1\dot{\theta}_1 + T_m) \Rightarrow$

$$\Rightarrow \boxed{\ddot{\theta}_2(J_2 + J_1n^2) + \dot{\theta}_2(B_2 + B_1n^2) + T_c = nT_m}$$

b)



$V_{L_1} + V_{R_1} = e_m - e_1 \Rightarrow L_1 \frac{dI_1}{dt} + R_1 I_1 = e_m - e_1 \Rightarrow$

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

$V_{L_2} + V_{R_2} = e_2 - e_c \Rightarrow L_2 \frac{dI_2}{dt} + R_2 I_2 = e_2 - e_c \Rightarrow$

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

$n = \frac{\dot{\theta}_1}{\dot{\theta}_2} = \frac{I_2}{T_1}$

$$J_{eq_1} \ddot{\theta}_1 + B_{eq_1} \dot{\theta}_1 + \frac{T_c}{n} = T_m$$

$$J_{eq_2} \ddot{\theta}_2 + B_{eq_2} \dot{\theta}_2 + T_c = n T_m$$