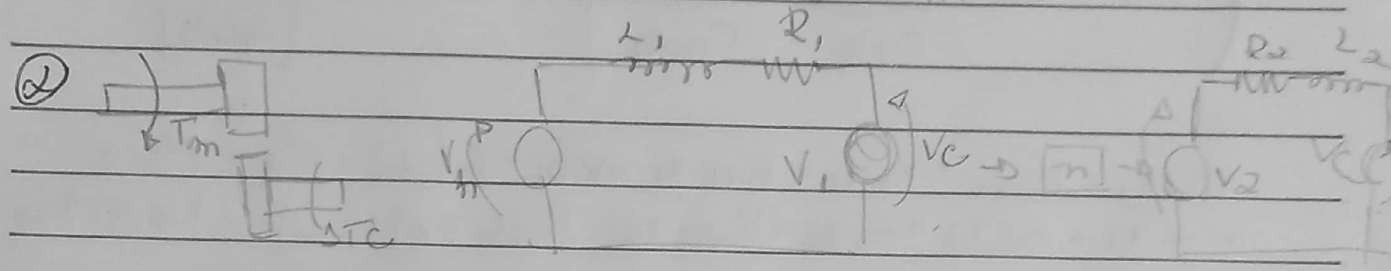


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①  $J_1 \dot{w}_1 + B_1 w_1 + T_1 = T_m$   
 $J_2 \dot{w}_2 + B_2 w_2 + T_2 = T_2 = n T_1$   
 $J_2 \dot{w}_2 + B_2 w_2 + T_2 = n (T_m - J_1 \dot{w}_1 - B_1 w_1)$   
 $J_2 \dot{w}_2 + B_2 w_2 + T_2 = n (T_m - J_1 n \dot{w}_2 - B_1 n w_2)$   
 $w_2 (J_2 + n^2 J_1) + w_2 (B_2 + n^2 B_1) + T_2 = n T_m$   
 $J_2 n \dot{w}_2 + B_2 n w_2 + T_2 = T_m n$

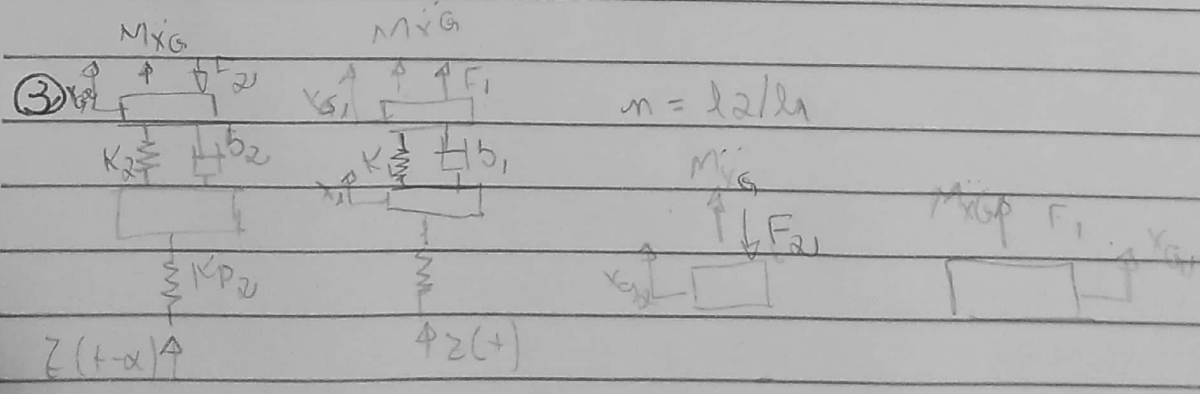


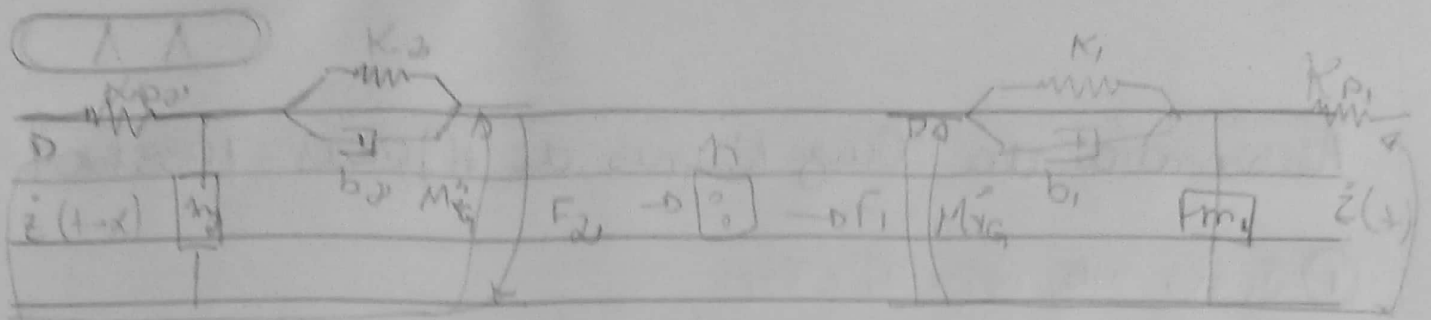
Lei das malhas

$V_m - L_1 \dot{i} - R_1 i - V_1 = 0$   
 $V_2 - R_2 i - L_2 \dot{i} - V_C = 0$

$T_m - J_1 \dot{w}_1 - B_1 w_1 - T_1 = 0$   
 $T_2 - B_2 w_2 - J_2 \dot{w}_2 - T_2 = 0$

$J_1 \dot{w}_1 + B_1 w_1 + T_1 = T_m$   
 $J_2 \dot{w}_2 + B_2 w_2 + T_2 = T_2$





$$1: \dot{x}_1 \left( L_1 D + R_1 + \frac{1}{C_1 D} + \frac{1}{C_{p1} D} - \dot{x}_2(t) \left( \frac{1}{C_{p1} D} \right) = V_{F_1} + V_g \right)$$

$$2: \dot{x}_2 \left( L_2 D + R_2 + \frac{1}{C_2 D} + \frac{1}{C_{p2} D} \right) - \dot{x}_1(t-\alpha) \left( \frac{1}{C_{p2} D} \right) = V_{F_2} - V_{F_1}$$

$$m_1 \ddot{x}_1 + b_1 \dot{x}_1 + K_1 x_1 + K_{p1} x_1 - K_{p1} \cdot z(t) = F_1 + M_1 \ddot{z}_g$$

$$m_2 \ddot{x}_2 + b_2 \dot{x}_2 + K_2 x_2 + K_{p2} x_2 - K_{p2} \cdot z(t-\alpha) = F_2 + M_2 \ddot{z}_g$$