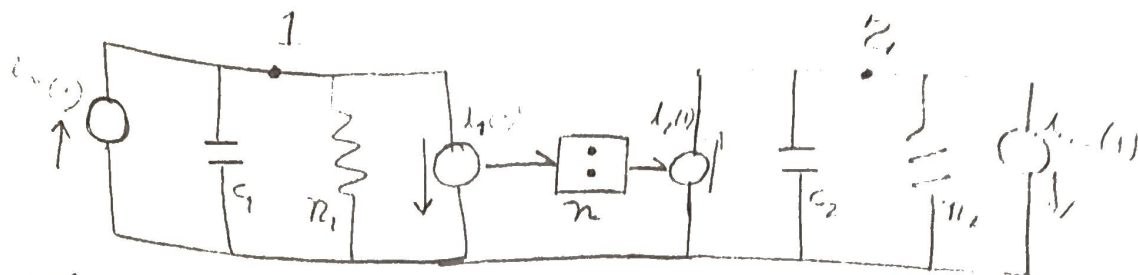


Ex 1:



• 1: $V_1(C_1 D + \frac{1}{R_1}) = \dot{i}_m - \dot{i}_1$

• 2: $V_2(C_2 D + \frac{1}{R_2}) = \dot{i}_2 - \dot{i}_c$

→ $\omega_1(J_1 D + B_1) = T_m - T_1$

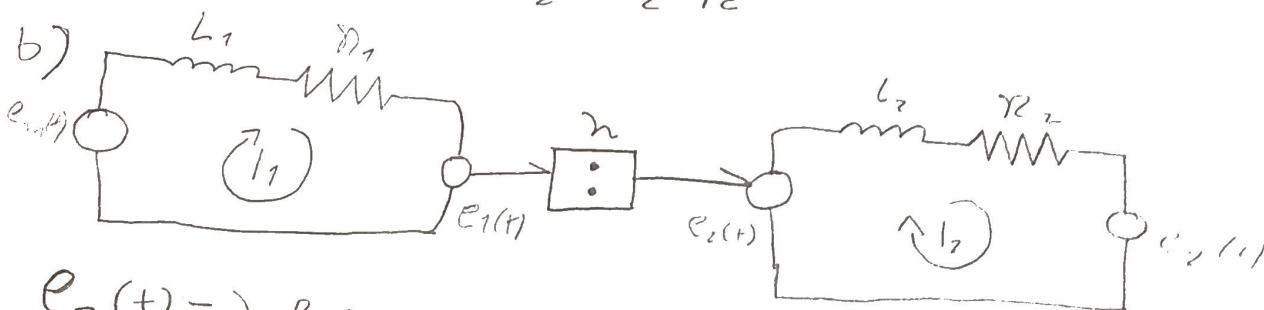
↳ $J_1 \ddot{\theta}_1 + B_1 \dot{\theta}_1 = T_m - T_1$

→ $\omega_2(J_2 D + B_2) = T_2 - T_c$

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

$T_2 = n T_1$

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



$e_2(t) = n e_1(t)$

$e_2(t) = (L_2 D + R_2) i_2 + e_c(t)$

$e_m(t) = (L_1 D + R_1) i_1 + e_1(t)$

⇓

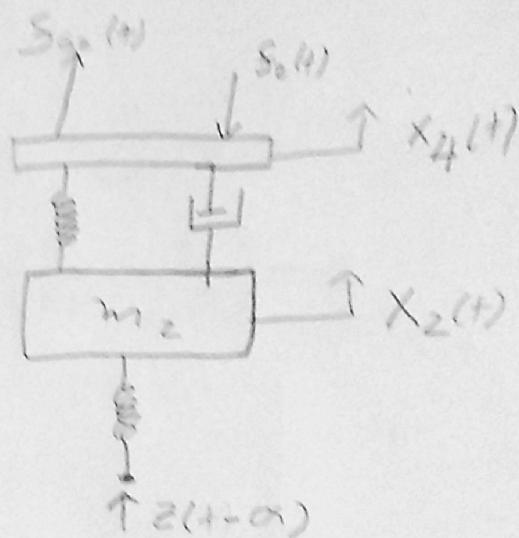
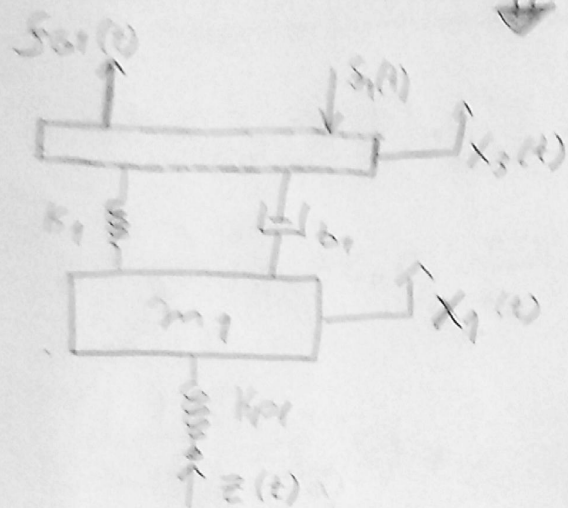
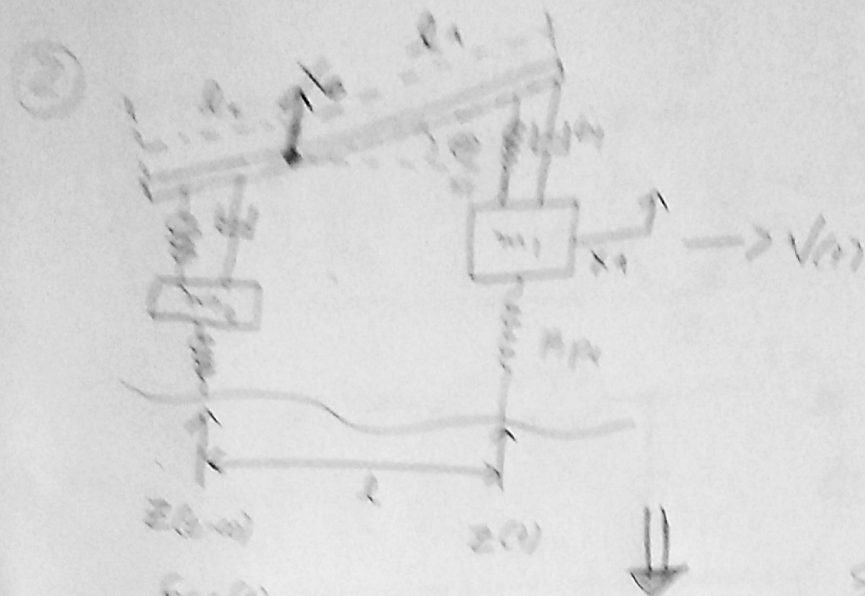
$(J_1 D + B_1) \omega_1 = T_m - T_1$

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

⇓

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

$$J_2 \ddot{\theta}_2 + \dot{\theta}_2 \dot{\theta}_2 = T_2 - T_0 \quad \dot{\theta}_2 = \frac{\dot{\theta}_1}{n}$$



$$S_1(t) = L_1 (C n_1 \dot{\theta} + b_1 \dot{\theta})$$

$$S_2(t) = L_2 (C n_2 \dot{\theta} + b_2 \dot{\theta})$$

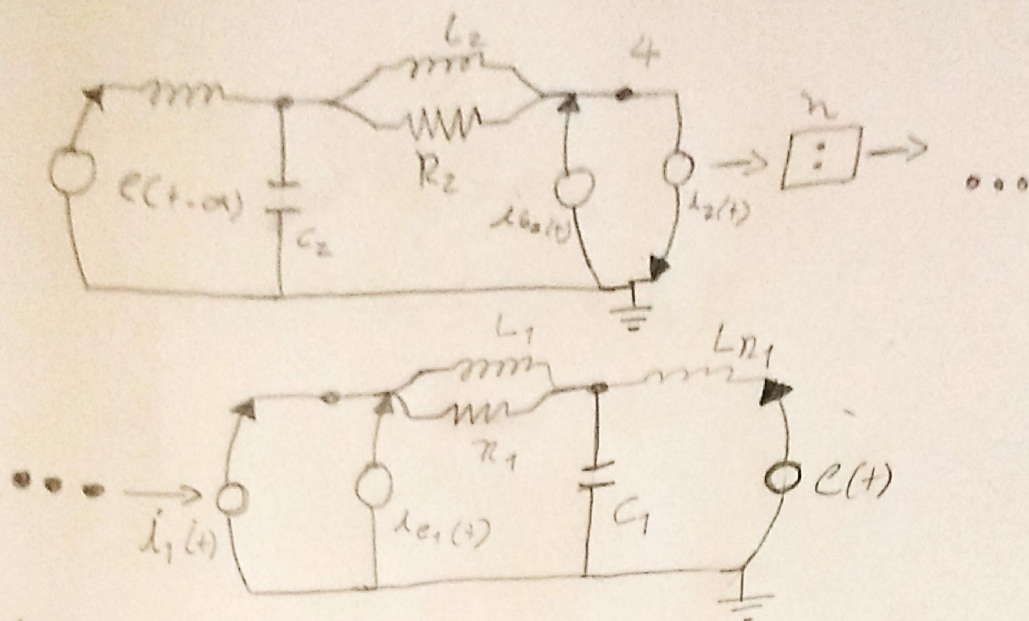


$$S_{G1}(t) = K_1 (x_G - x_1) + b_1 (\dot{x}_G - \dot{x}_1)$$

$$S_{G2}(t) = K_2 (x_G - x_2) + b_2 (\dot{x}_G - \dot{x}_2)$$

$$P_1 = P_2 \Rightarrow f_1 V_{1, \text{out}} = f_2 V_{2, \text{out}}$$

$$f_1 L_1 \dot{\theta} = f_2 L_2 \dot{\theta} \Rightarrow n = \frac{f_2}{f_1} = \frac{L_1}{L_2}$$



$$V_1 \left(\frac{1}{R_1} + \frac{1}{L_1 D} + \frac{1}{L_{n1} D} + C_1 D \right) - \frac{e(t)}{L_{n1} D} - V_3 \left(\frac{1}{R_1} + \frac{1}{L_1 D} \right) = 0$$

$$V_2 \left(\frac{1}{R_2} + \frac{1}{L_2 D} + \frac{1}{L_{p2} D} + C_2 D \right) - \frac{e(t)}{L_{p2} D} - V_4 \left(\frac{1}{R_2} + \frac{1}{L_2 D} \right) = 0$$

$$V_3 \left(\frac{1}{R_3} + \frac{1}{L_1 D} \right) = i_1(t) + i_{G1}(t)$$

$$V_4 \left(\frac{1}{R_2} + \frac{1}{L_2 D} \right) = -i_2(t) + i_{G1}(t)$$

$\Downarrow$

$$V_1 \left(\frac{1}{R_1} + \frac{1}{L_1 D} + \frac{1}{L_{p1} D} + C_1 D \right) = \frac{e(t)}{L_{p1} D} + i_1(t) + i_{G1}(t)$$

$$V_2 \left(\frac{1}{R_2} + \frac{1}{L_2 D} + \frac{1}{L_{p2} D} + C_2 D \right) = \frac{e(t-\alpha)}{L_{p2} D} - i_2(t) + i_{G2}(t)$$

$$m_1 \ddot{x}_1 + b_1 \dot{x}_1 + (k_1 + k_{p1}) x_1 = k_{p1} z(t) + f_1(t) + f_{o1}(t)$$

$$m_2 \ddot{x}_2 + b_2 \dot{x}_2 + (k_2 + k_{p2}) x_2 = k_{p2} z(t - \alpha) - f_2(t) + f_{o2}(t)$$

$\Downarrow$

$$f_1 + f_{o1} - f_2 + f_{o2} = M \ddot{x}_G$$

$$(f_1 + f_{o1}) L_1 + (f_{o2} - f_2) L_2 = J_G \ddot{\Theta}$$