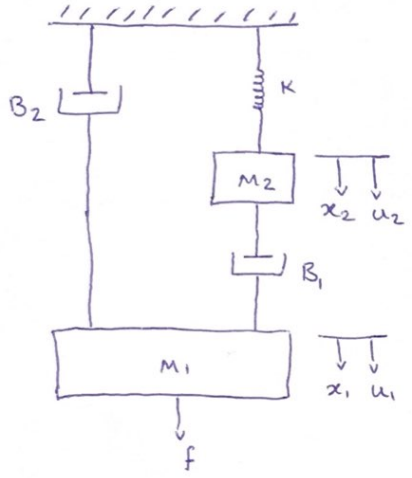
یا لطیف

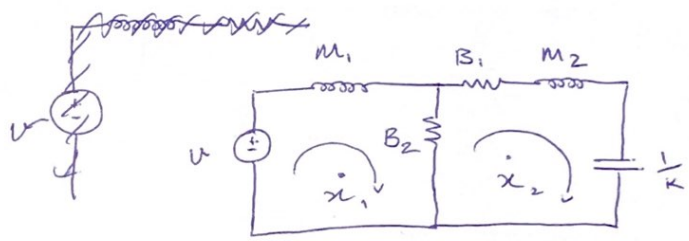
رضا ادیب پور
۹۸۱۴۳۵۳
تمرین سری ۲ - کنترل خطی

#1

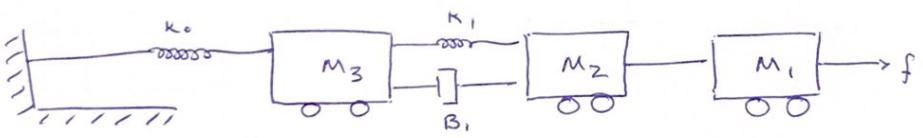


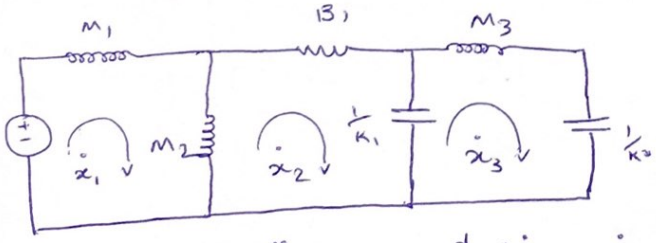
$$u_2 = m_2 \ddot{x}_2 + B_1(\dot{x}_2 - \dot{x}_1) + K x_2$$

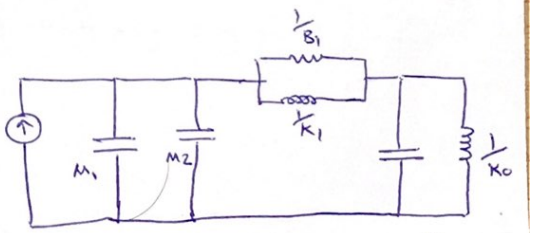
$$u_1 = m_1 \ddot{x}_1 + B_1(\dot{x}_1 - \dot{x}_2) + B_2 x$$



#2







KVL 1: $-U + M_1 \ddot{x}_1(t) + M_2 \frac{d}{dt}(\dot{x}_1(t) - \dot{x}_2(t)) = 0 \Rightarrow U(t) = \ddot{x}_1(t)(M_1 + M_2) - \ddot{x}_2(t)$ (I)

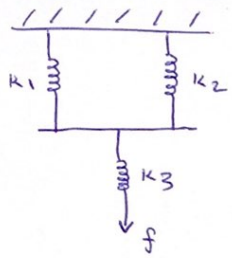
KVL 2: $M_2 \frac{d}{dt}(\dot{x}_2(t) - \dot{x}_1(t)) + B_1 \dot{x} + K_1 \int (\dot{x}_2(t) - \dot{x}_3(t))\,dt$

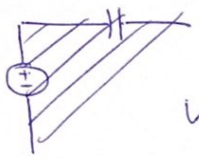
$\Rightarrow M_2 \ddot{x}_2(t) - M_2 \ddot{x}_1(t) + B_1 \dot{x}(t) + K_1 x_2(t) - K_1 x_3(t) = 0$ (II)

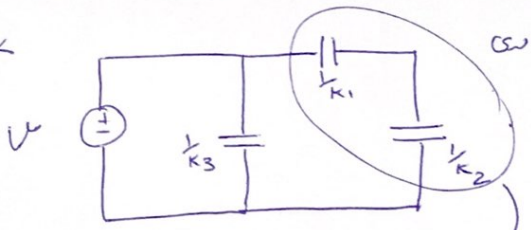
KVL in 3: $M_3 \ddot{x}_3(t) + K_0 \int \dot{x}_3(t)\,dt + K_1 \int (\dot{x}_3(t) - \dot{x}_2(t)) = 0$

$\Rightarrow M_3 \ddot{x}_3(t) + K_0 x_3(t) + K_1 x_3(t) - K_1 x_2(t) = 0$ (III)

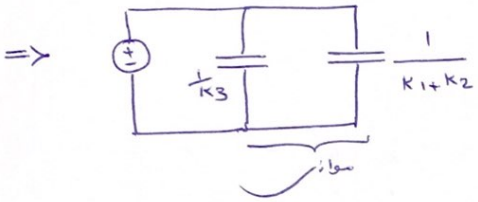
#3

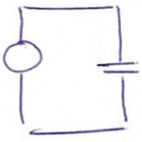






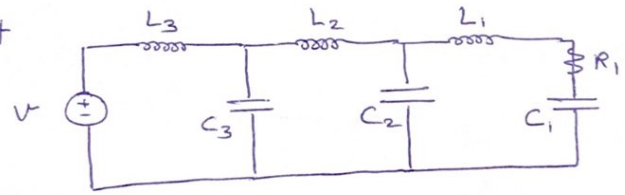
$$K_{1,2} = \frac{\frac{1}{K_1} \times \frac{1}{K_2}}{\frac{1}{K_1} + \frac{1}{K_2}}$$

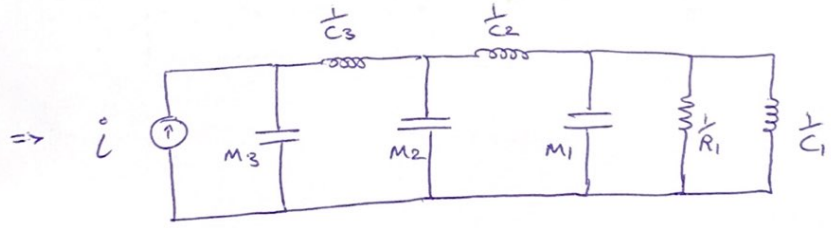




$$K_T = \frac{1}{K_1+K_2} + \frac{1}{K_3} = \frac{K_1+K_2+K_3}{K_3(K_1+K_2)}$$

#4

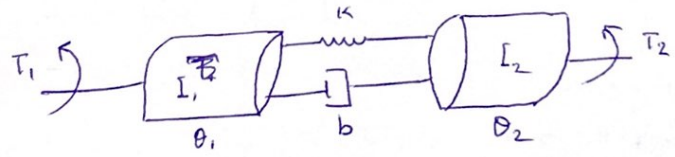




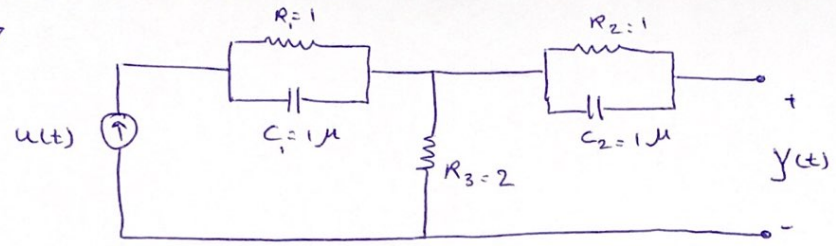
#5

به دلیل دارای تبدیل ~~تبدیل~~ مدل الکتریکی برای مهندسان برق، ترجیح می‌دهیم که مدل یک سیستم مکانیکی را ابتدا به مدل الکتریکی آن تبدیل نموده و سپس سیستم را تحلیل کنیم

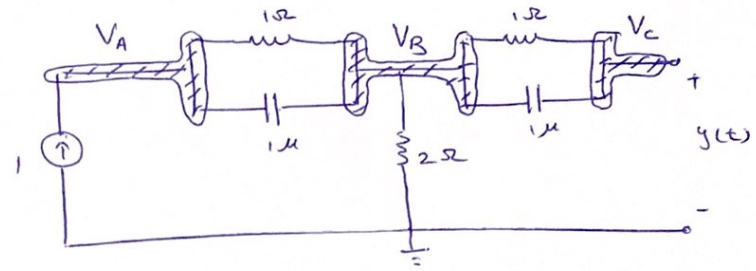
#6



#7



$u(t): \begin{cases} 1 & t > 0 \\ 0 & t \le 0 \end{cases} \Rightarrow$



KCL @ V_A: $-1 + \frac{V_A - V_B}{1} + 1^{\mu} \frac{d}{dt}(V_A - V_B) = 0 \Rightarrow \frac{dV_A}{dt} - \frac{dV_B}{dt} + V_A - V_B = 1$ (I)

KCL @ V_B: $\frac{V_B - V_A}{1} + \frac{d}{dt}(V_B - V_A) + \frac{V_B - V_C}{1} + \frac{d}{dt}(V_B - V_C) = 0$

$\Rightarrow 2\frac{dV_B}{dt} + 2V_B - \frac{dV_A}{dt} - V_A - \frac{dV_C}{dt} - V_C = 0$ (II)

KCL @ V_C: $\frac{V_C - V_B}{1} + \frac{d}{dt}(V_C - V_B) = 0 \Rightarrow \frac{dV_C}{dt} + V_C = \frac{dV_B}{dt} + V_B$ (III)

(I) in (II) $\Rightarrow$ $2\frac{dV_B}{dt} + 2V_B - \frac{dV_B}{dt} - V_B - 1 - \frac{dV_C}{dt} - V_C = 0 \Rightarrow \frac{dV_B}{dt} + V_B - \frac{dV_C}{dt} - V_C = 1$ (IV)

(III) in (IV) $\Rightarrow$ $\frac{dV_C}{dt} + V_C - \frac{dV_C}{dt} - V_C = 1$???