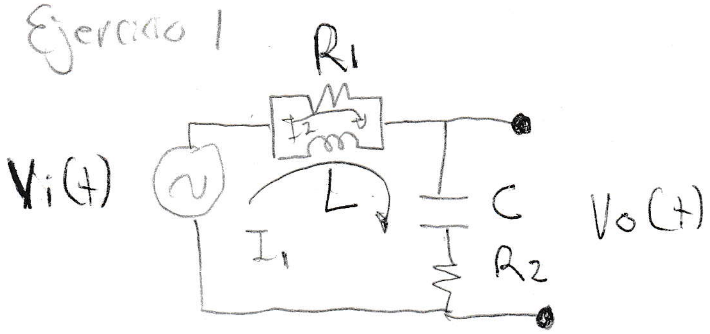
Ejercicio 1

$V_i(s) = I_1(s)\left[sL + \frac{1}{sC} + R_2\right] - sL I_2(s)$




Ecuaciones (t):

$$V_i(t) = L\frac{di_1(t)}{dt} - L\frac{di_2(t)}{dt} + \frac{1}{C}\int i_1(t)\,dt + R_2 i_1(t)$$

$$0 = R_1 i_2(t) + L\frac{di_2(t)}{dt} - L\frac{i_1(t)}{dt}$$

$$V_o(t) = \frac{1}{C}\int i_1(t) + R_2 i_1(t)$$

Transformadas:

$$V_i(S) = sL I_1(s) - sL I_2(s) + \frac{1}{sC} I_1(s) + R_2 I_1(s)$$

$$0 = R_1 I_2(s) + sL I_2(s) - sL I_1(s)$$

$$V_o(s) = \frac{1}{sC} I_1(s) + R_2 I_1(s)$$

$$I_1(s) = \frac{sC V_i(s) + s^2 LC I_2(s)}{s^2 LC + 1 + sCR_2} \quad (1) \qquad I_2(s) = \frac{sL\, I_1(s)}{R_1 + sL} \quad (2)$$

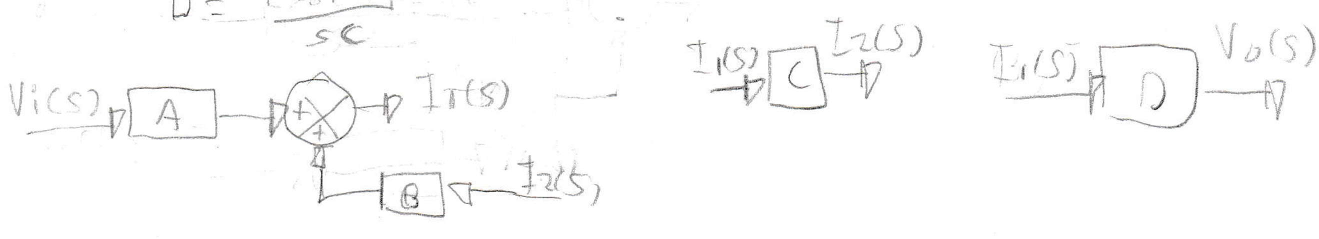
$$V_o(s) = I_1(s)\left[\frac{R_2 + sC}{sC}\right] \quad (3)$$

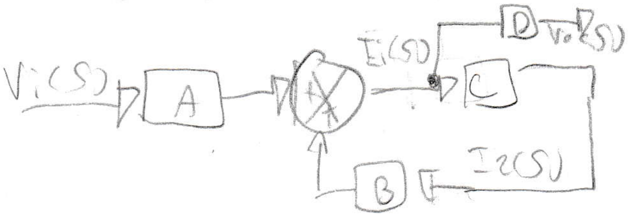
Bloques:

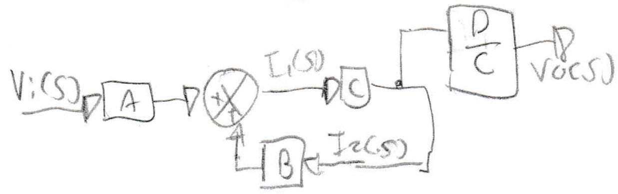
De (1): $A = \frac{sC}{s^2LC + sCR_2 + 1}$ $\quad B = \frac{s^2LC}{s^2LC + sCR_2 + 1}$ $\quad$ De (2): $C = \frac{sL}{sL + R_1}$

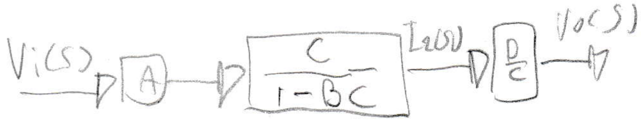
De (3):

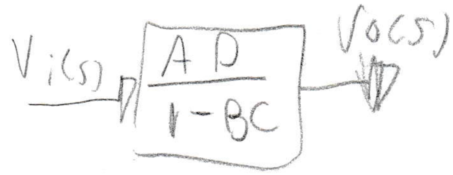
$$D = \frac{R_2 + sC}{sC}$$






$$H(s)=\frac{\left(\frac{\cancel{sC}}{s^2LC+sCR_2+1}\right)\left(\frac{R_2+sC}{\cancel{sC}}\right)}{1-\left(\frac{s^2LC}{s^2LC+sCR_2+1}\right)\left(\frac{sL}{sL+R_1}\right)}$$

$$H(s)=\frac{\frac{R_2+sC}{\cancel{s^2LC+sCR_2+1}}}{\frac{[s^2LC+sCR_2+1][sL+R_1]-[s^2LC][sL]}{\cancel{[s^2LC+sCR_2+1]}(sL+R_1)}}$$

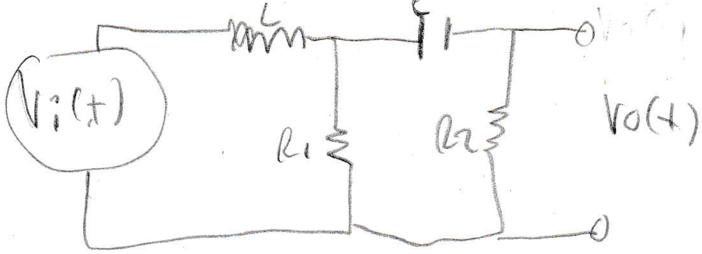
$$H(s)=\frac{\frac{R_2+sC}{1}}{\frac{\cancel{s^3L^2C}+s^2LCR_2+sL+s^2LCR_1+sCR_2R_1+R_1-\cancel{s^3L^2C}}{sL+R_1}}$$

$$H(s)=\frac{s^2L^2+s[LR_1+LR_2]+R^2R_1}{s^2[LCR_2+LCR_1]+s[L+R_2R_1]+R_1}$$

Polos: 2 Filtro: Pasa bandas

Ceros 2

# Ej 2



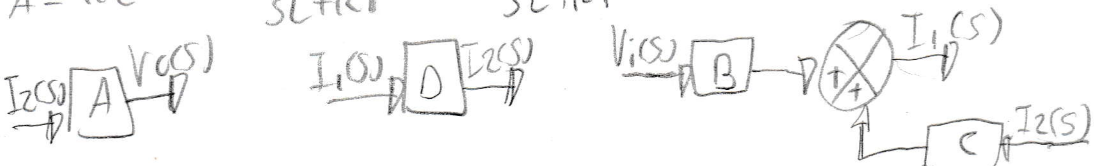

$$V_i(S) = sL\,I_1(S) + R\,I_1(S) - R_1 I_2(S) \qquad 0 = \frac{1}{sC} I_2(S) + R_2 I_2(S) + R_1 I_2(S) - R_2 I_1(S)$$

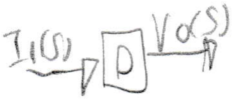
$$V_o(S) = R_2 I_2(S)$$

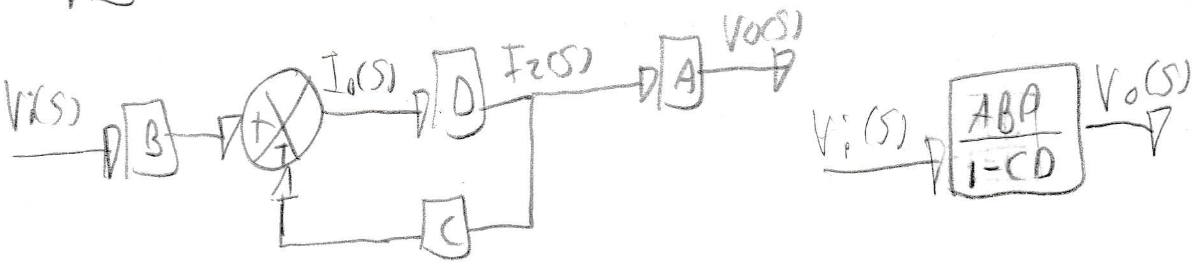
$$I_1(S) = \frac{V_i(S) + R_1 I_2(S)}{sL + R_1} \qquad I_2(S) = \frac{R_1 sC\, I_1(S)}{sC[R_2+R_1]+1}$$

Bloqus

$$A = R_2 \qquad B = \frac{1}{sL+R_1} \qquad C = \frac{R_1}{sL+R_1} \qquad D = \frac{sC R_1}{sC[R_2+R_1]+1}$$




$$H(S) = \frac{V_o(S)}{V_i(S)} = \frac{R_2\left(\frac{1}{sL+R_1}\right)\left(\frac{sCR_1}{sC[R_2+R_1]+1}\right)}{1-\left(\frac{R_1}{sL+R_1}\right)\left(\frac{sCR_1}{sC[R_2+R_1]+1}\right)} = \frac{\frac{sCR_1R_2}{\cancel{(sL+R_1)(sC[R_2+R_1]+1)}}}{\frac{(sL+R_1)(sC[R_2+R_1]+1) - sCR_1^2}{\cancel{(sL+R_1)(sC[R_2+R_1]+1)}}}$$

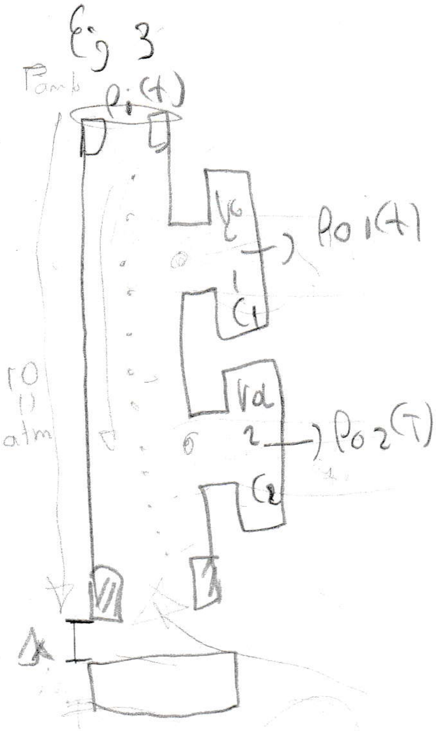
$$\frac{sCR_1R_2}{s^2(LC[R_2+R_1]) + s(L + R_1R_2) + R_1} = H(S)$$

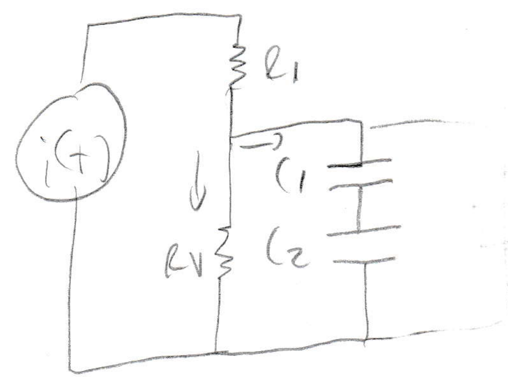
Filtro pasa bajas

1 cero 2 polos

Ej 3

$P_{o1}(t) \neq P_{o2}(t)$ $\therefore$
están en serie

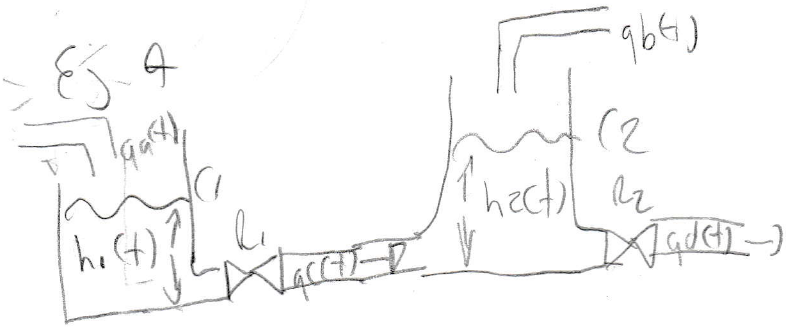



$i_{C_1} = i_{C_2}$

$i(t) = i_{R_1}$ $\qquad$ $i_{R_1} = i_{R_V} + i_{C_1}$

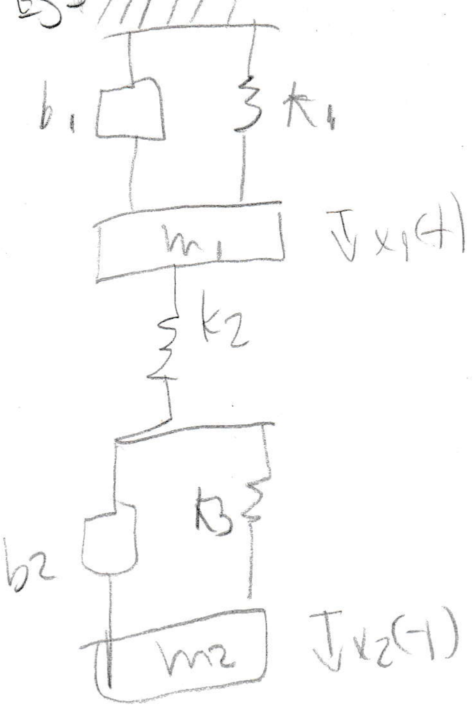
Ej 4

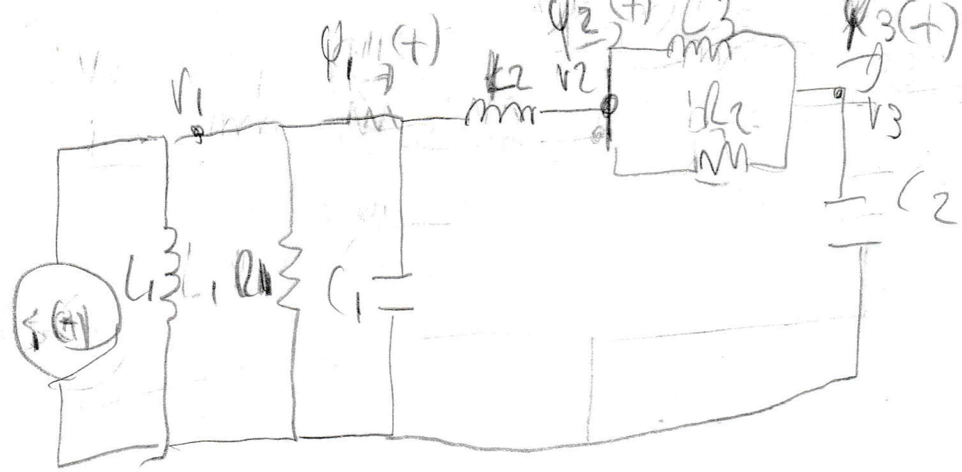



$$C_1 \frac{dh_1(t)}{dt} = q_a(t) - q_b(t) \qquad q_c(t) = \frac{h_1(t) - h_2(t)}{R_1}$$

$$C_1 \frac{dh_2(t)}{dt} = q_b(t) + q_c(t) - q_d(t) \qquad q_d(t) = \frac{h_2(t)}{R_2}$$

Ej 5




$$i(t) = i_{L_1} + i_{R_1} + i_{C_1} + i_{R_2} \qquad i_{R_2} = i_{L_3} + i_{R_2} = i_{C_2}$$

$$i(t) = \frac{1}{L_1}\int v_1(t)\,dt + \frac{v_1(t)}{R_1} + C_1\frac{d\,v_1(t)}{dt} + \frac{v_1(t)-v_2(t)}{R_2}$$

$$\frac{v_1(t)-v_2(t)}{R_2} = \frac{1}{L_3}\int v_2(t)\,dt - \frac{1}{L_3}\int v_3(t)\,dt + \frac{v_2(t)-v_3(t)}{R_2} = C_2\frac{d\,v_3(t)}{dt}$$

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$$i(t) = \frac{1}{L_1}\varphi_1(t) + \frac{1}{R_1}\cdot\frac{d\varphi_1(t)}{dt} + C_1\frac{d^2\varphi_1(t)}{dt} + \frac{1}{R_2}\frac{d\varphi_1(t)}{dt} - \frac{1}{R_2}\cdot\frac{d\varphi_2(t)}{dt}$$

$$\frac{1}{R_2}\frac{d\varphi_1(t)}{dt} - \frac{1}{R_2}\frac{d\varphi_2(t)}{dt} = \frac{1}{L_3}\varphi_2(t) - \frac{1}{L_3}\varphi_3(t) + \frac{1}{R_2}\frac{d\varphi_2(t)}{dt} - \frac{1}{R_2}\frac{d\varphi_3(t)}{dt} = C_2\frac{d^2\varphi_3(t)}{dt}$$

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$$I(s) = \frac{\varphi_1(s)}{L_1} + \frac{s\varphi_1(s)}{R_1} + C_1 s^2\varphi_1(s) + \frac{s\varphi_1(s)}{R_2} - \frac{s\varphi_2(s)}{R_2}$$

$$\frac{s\varphi_1(s)}{R_2} - \frac{s\varphi_2(s)}{R_2} = \frac{\varphi_2(s)}{L_3} - \frac{\varphi_3(s)}{L_3} + \frac{s\varphi_2(s)}{R_2} - \frac{s\varphi_3(s)}{R_2} = C_2 s^2\varphi_3(s)$$

$$I(s) = \varphi_1(s)\left[\frac{1}{L_1} + \frac{s}{R_1} + C_1 s^2 + \frac{s}{R_2}\right] - \varphi_2(s)\cdot\frac{s}{R_2}$$

$$\varphi_1(s)\left[\frac{s}{R_2}\right] = \varphi_2(s)\left[\frac{s}{R_2} + \frac{1}{L_3} + \frac{s}{R_2}\right]$$

$$\varphi_1(s)\left[\frac{s}{R_2}\right] - \varphi_2(s)\left[\frac{s}{R_2}\right] = \varphi_3(s)\, s^2 C_2$$

$$\varphi_2(s)\left[\frac{1}{L_3} + \frac{s}{R_2}\right] = \varphi_3(s)\left[s^2 C_2 + \frac{s}{R_2} + \frac{1}{L_3}\right]$$