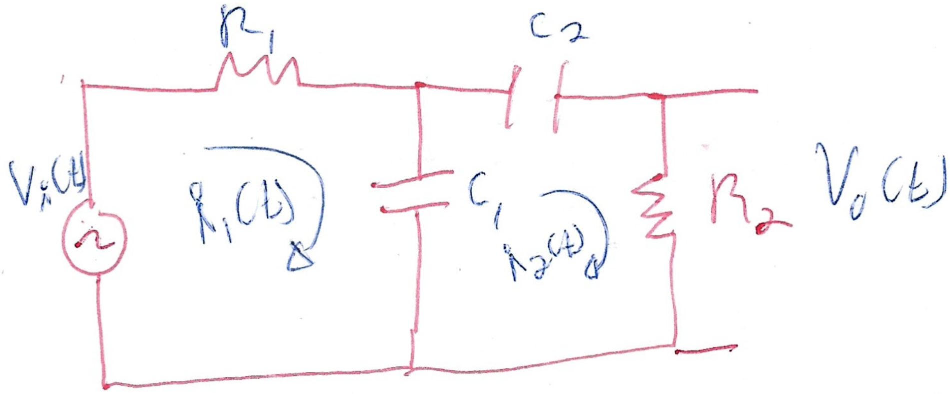


Determinamos las ecuaciones

$$V_i(t) = R_1 i_1(t) + \frac{1}{C_1}\int i_1(t)\,dt - \frac{1}{C_1}\int i_2(t)\,dt \ldots (1)$$

$$0 = R_2 i_2(t) + \frac{1}{C_2}\int i_2(t)\,dt + \frac{1}{C_1}\int i_2(t)\,dt - \frac{1}{C_1}\int i_1(t)\,dt \ldots (2)$$

$$V_o(t) = R_2 i_2(t) \ldots (3)$$

Transformamos las ecuaciones (1), (2) y (3)

$$V_i(s) = R_1 I_1(s) + \frac{1}{sC_1} I_1(s) - \frac{1}{sC_1} I_2(s) \ldots (4)$$

$$0 = R_2 I_2(s) + \frac{1}{sC_2} I_2(s) + \frac{1}{sC_1} I_2(s) - \frac{1}{sC_1} I_1(s) \ldots (5)$$

$$\underbrace{V_o(s)}_{V.S} = \underbrace{R_2}_{F.T} \underbrace{I_2(s)}_{V.E} \ldots (6)$$

Despejamos las variables dependientes

de (4)

$$V_i(s) + \frac{1}{sC_1} I_2(s) = I_1(s)\left(R_1 + \frac{1}{sC_1}\right) = I_1(s)\left(\frac{sC_1R_1+1}{sC_1}\right)$$

$$\underbrace{V_i(s)}_{V.E}\underbrace{\left(\frac{sC_1}{sC_1R_1+1}\right)}_{F.T} + \underbrace{I_2(s)}_{V.E}\underbrace{\left(\frac{1}{sC_1R_1+1}\right)}_{F.T} = \underbrace{I_1(s)}_{V.S} \ldots (7)$$

de (5)

$$\frac{1}{sC_1} I_1(s) = R_2 I_2(s) + \frac{1}{sC_2} I_2(s) + \frac{1}{sC_1} I_2(s)$$

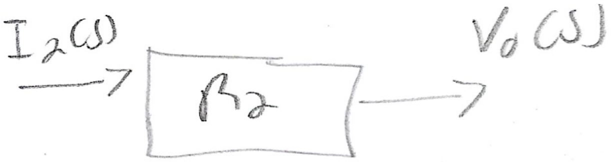
$$\frac{1}{sC_1} I_1(s) = I_2(s)\left(R_2 + \frac{1}{sC_2} + \frac{1}{sC_1} \right)$$

$$\frac{1}{sC_1} I_1(s) = I_2(s)\left(\frac{s^2 C_1 C_2 R_2 + sC_1 + sC_2}{s^2 C_1 C_2} \right)$$

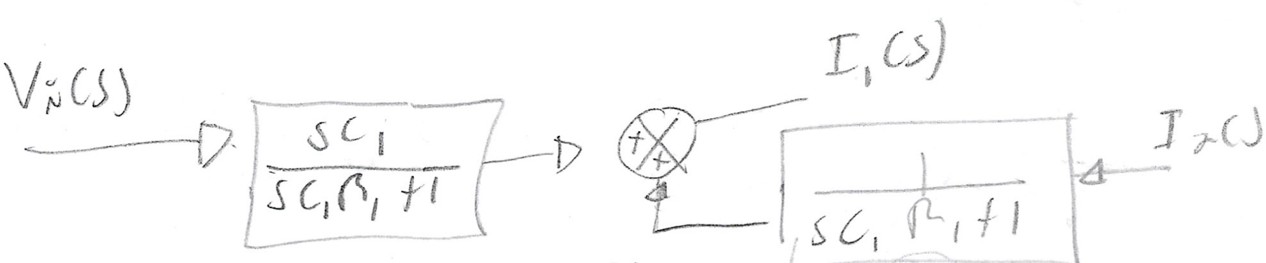
$$\underbrace{\left(\frac{sC_2}{s^2 C_1 C_2 R_2 + sC_1 + sC_2} \right)}_{F.T} \underbrace{I_1(s)}_{V.E} = \underbrace{I_2(s)}_{V.S} \ldots (8)$$

Generamos un diagrama de bloques particular para cada ecuación

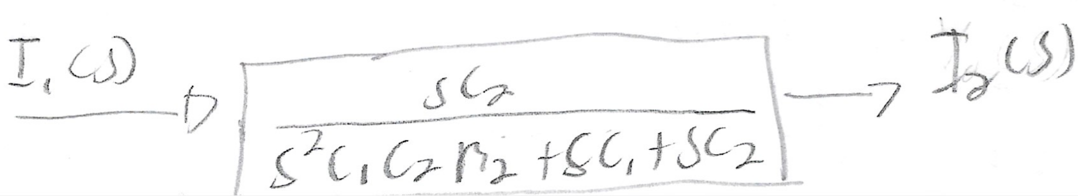
Para la ecuacion (6)



para la ecuacion (7)



Para la ecuacion (8)

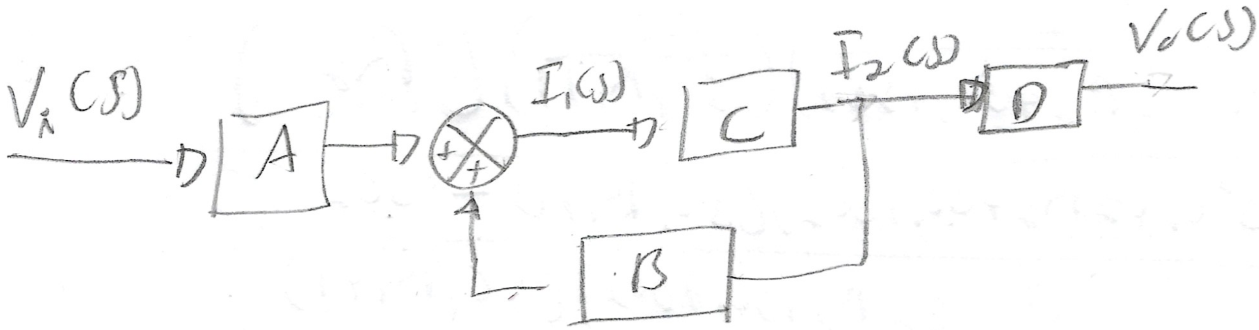


Relacionamos los diagramas de bloques

Asignamos

$$A = \frac{SC_1}{SC_1R_1+1}, \quad B = \frac{1}{SC_1R_1+1}, \quad C = \frac{SC_2}{S^2C_1C_2R_2+SC_1+SC_2}$$

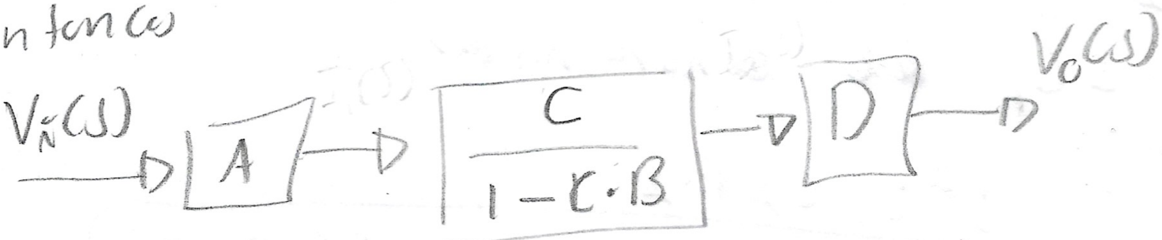
$$D = R_2$$



Como

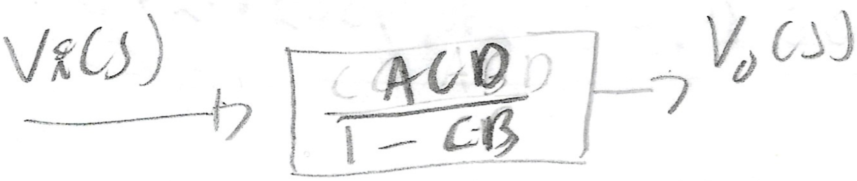
$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 - H(s)G(s)}$$

Entonces



Aplicamos algebra de Bloque

Aplicando la Regla: 4 de la tabla



Sustituyendo A, B, C y D en $\frac{ACD}{1-CB}$

$$\frac{ACD}{1-CB} = \frac{\left(\frac{sC_2}{s^2C_1C_2R_2+sC_1+sC_2}\right)\left(\frac{sC_1}{sC_1R_1+1}\right)(R_2)}{1-\left(\frac{sC_2}{s^2C_1C_2R_2+sC_1+sC_2}\right)\left(\frac{1}{sC_1R_1+1}\right)}$$

$$= \frac{\left(\frac{sC_2}{s^2C_1C_2R_2+sC_1+sC_2}\right)\left(\frac{sC_1}{sC_1R_1+1}\right)(R_2)}{\frac{(s^2C_1C_2R_2+sC_1+sC_2)(sC_1R_1+1)-sC_2}{(s^2C_1C_2R_2+sC_1+sC_2)(sC_1R_1+1)}}$$

$$= \frac{s^2C_1C_2R_2}{s^3C_1^2C_2R_1R_2+s^2C_1^2R_1+s^2C_1C_2R_1+s^2C_1C_2R_2+sC_1+sC_2-sC_2}$$

Factorizando sC_1 del denominador

$$= \frac{s^2C_1C_2R_2}{sC_1(s^2C_1C_2R_1R_2+sC_1R_1+sC_2R_1+sC_2R_2+1)}$$

$$\frac{V_o(s)}{V_{in}(s)} = \frac{sC_2R_2}{s^2C_1C_2R_1R_2+sC_1R_1+sC_2R_1+sC_2R_2+1}$$

Función de transferencia