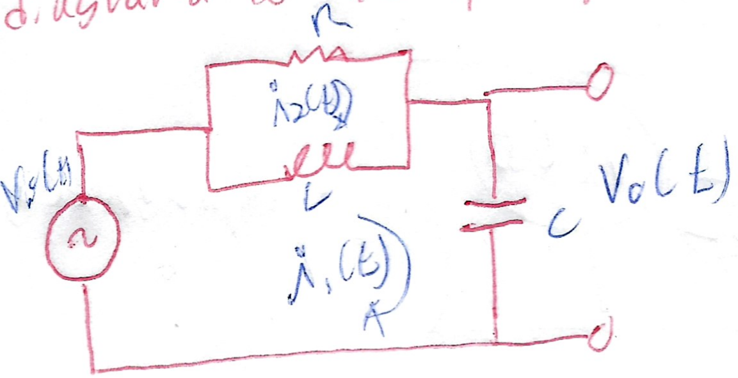
Problema

determinar la función de transferencia por el metodo de diagrama de bloques para el siguiente sistema



1) Determinamos las ecuaciones

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

$$0 = L\frac{di_2(t)}{dt} - L\frac{di_1(t)}{dt} + R i_2(t) \quad \ldots (2)$$

$$V_o(t) = \frac{1}{C}\int i_1(t)dt \quad \ldots (3)$$

2) Transformar ecuaciones

$$V_i(s) = sL I_1(s) - sL I_2(t) + \frac{1}{sC} I_1(s) \quad \ldots (4)$$

$$0 = sL I_2(s) - sL I_1(s) + R I_2(s) \quad \ldots (5)$$

F.T

$$\boxed{V_o(s) = \frac{1}{sC} I_1(s) \quad \ldots (6)}$$ ..... dependiente (6)

variable de entrada

variable salida

3) Determinar variables dependientes (corrientes y salidas)

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

$$\boxed{I_1(s) = I_2(s)\left(\frac{sL+R}{sL}\right)}$$ ..... dependiente (7)

F.T

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

$$I_2(s) = \frac{I_1(s)\left(\frac{s^2CL+1}{sC}\right) - V_i(s)}{sL}$$

$$\boxed{I_2(s) = I_1(s)\left(\frac{s^2CL+1}{s^2CL}\right) - \frac{1}{sL}\,V_i(s)}$$ --- dependientes

$I_2(s)$ → Variable de salida

$I_1(s)$ → Variable de entrada

$\frac{s^2CL+1}{s^2CL}$ → F.T

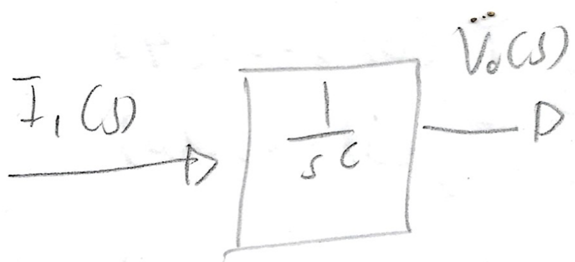
$\frac{1}{sL}$ → F.T

$V_i(s)$ → Variable de entrada

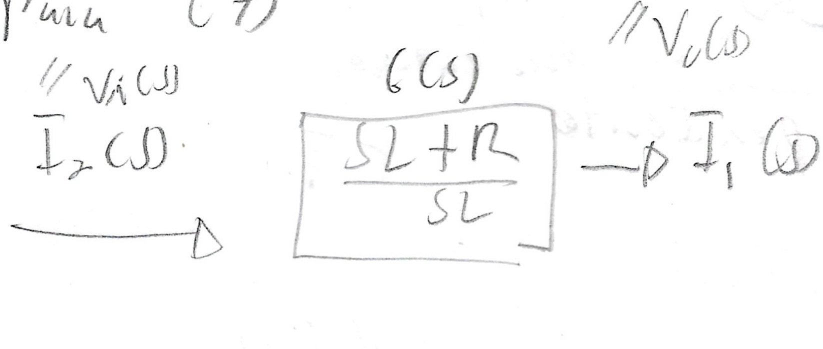
Elegimos las variables de salida y las funciones de transferencia ~~del sistema~~

(4) Generamos un diagrama de bloques particular para cada ecuación

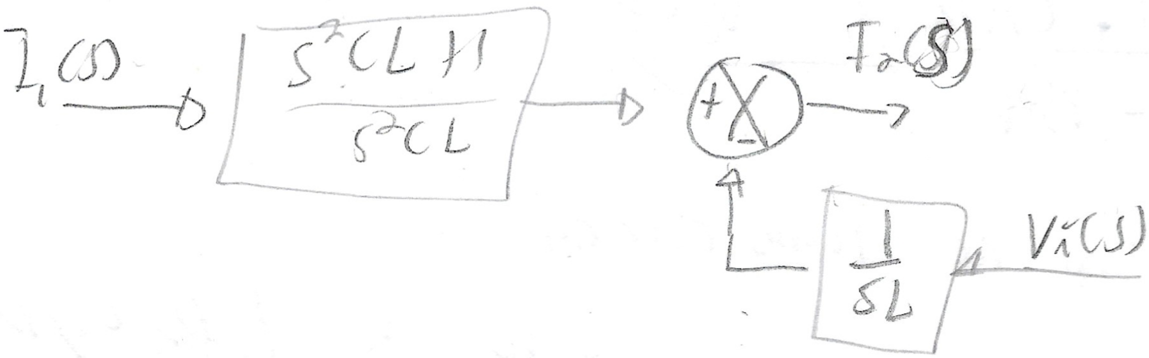
Para (6)



Para (7)



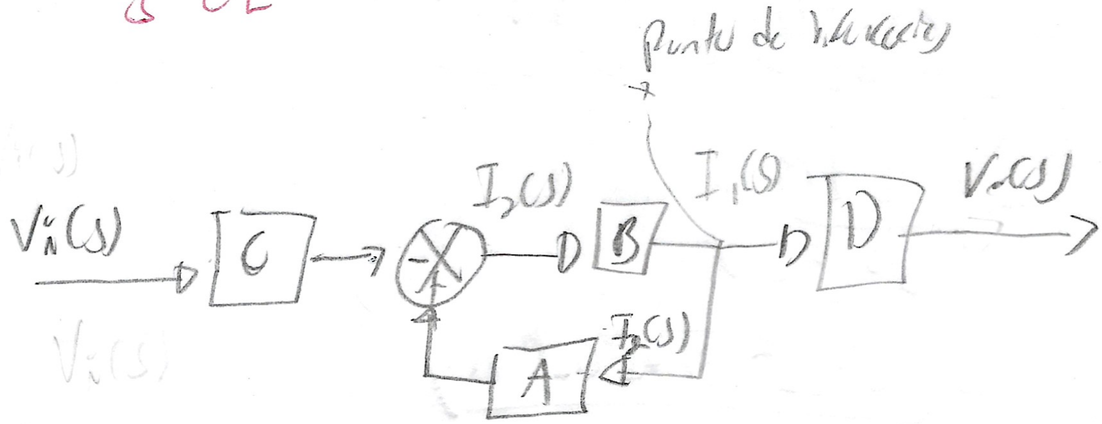
Para (8)



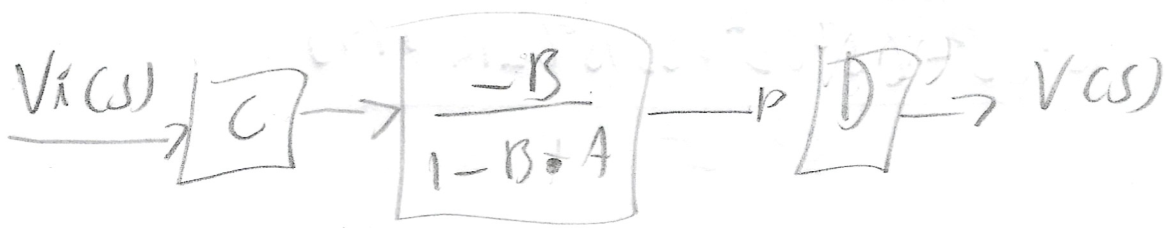
5) Reducir los diagramas de bloques

Asignamos

$A = \frac{s^2CL+1}{s^2CL}$ $\quad B = \frac{sL+R}{sL}$ $\quad C = \frac{1}{sL}$ $\quad D = \frac{1}{sC}$



del acuerdo con signo (-,+) $\quad \frac{C(s)}{R(s)} = \frac{-G(s)}{1-G(s)H(s)}$



6) Aplicar el álgebra de bloques

~~Aplicam~~

Aplicando la Regla 4 de la tabla

$$V_i(s) \longrightarrow \boxed{\frac{-B\cdot CAD}{1-B\cdot A}} \longrightarrow V_o(s)$$

Función de transferencia

Ahora sustituyendo los valores de A, B, C y D

$$\frac{-B\cdot CAD}{1-B\cdot A} = \frac{-\left(\frac{sL+R}{sL}\right)\cdot\frac{1}{sL}\cdot\frac{1}{sC}}{1-\left[\left(\frac{sL+R}{sL}\right)\left(\frac{s^2CL+1}{s^2CL}\right)\right]}$$

$$= \frac{-\left(\frac{sL+R}{s^3L^2C}\right)}{1-\left(\frac{s^3CL^2+sL+s^2CLR+R}{s^3CL^2}\right)}$$

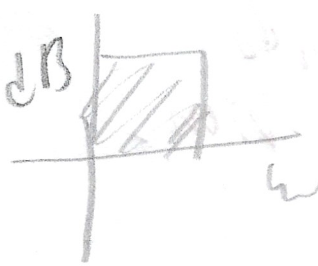
$$= -\frac{\frac{sL+R}{s^3L^2C}}{\frac{s^3CL^2-(s^3CL^2+sL+s^2CLR+R)}{s^3CL^2}}$$

$$\frac{V_o(s)}{V_i(s)} = \frac{sL+R}{s^2CLR+sL+R} \quad F.T$$

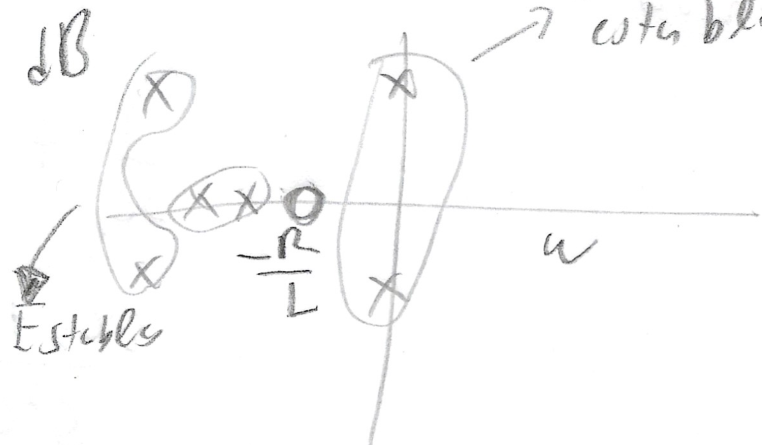
7) Analizamos la función de transferencia

$$K = \lim_{s \to 0} G(s) \approx 1$$

$$K = \lim_{s \to \infty} G(s) \approx 0$$



pasa bajas



orden = segundo

exactitud = dos

No polos = dos

No ceros = Uno

$$S_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Si $sL + R = 0 \Rightarrow s = -\frac{R}{L}$