HOJA Nº 11

FECHA

Recu 3/12/22

1) Filtro pasivo no disipativo

$$\frac{I_2}{I_1} = \frac{k\,s^2}{s^3+2s^2+2s+1}$$

$$T = \begin{bmatrix} 0 & 1/50 \\ 0 & 1/50 \end{bmatrix} \qquad T \begin{cases} V_1' = V_1 A + I_1 B \\ I_g = V_1 C + I_1 D \end{cases}$$

$$B = \left.\frac{V_1'}{I_1}\right|_{V_1=0} = \frac{1}{50}$$

$$D = \left.\frac{I_g}{I_1}\right|_{V_1=0} = \frac{1}{50}$$

a) $\frac{I_1}{V_g}$? $\qquad I_g = \frac{V_g - V_1'}{R_g}$

$$D \cdot I_1 = \frac{V_g - B I_1}{R_g} \longrightarrow D I_1 R_g = V_g - B I_1$$

$$R_g = 25\,\Omega$$

$$I_1 (D R_g + B) = V_g \longrightarrow \frac{I_1}{V_g} = \frac{1}{D R_g + B} = \frac{1}{\frac{1}{50}+\frac{1}{50}} = 25$$

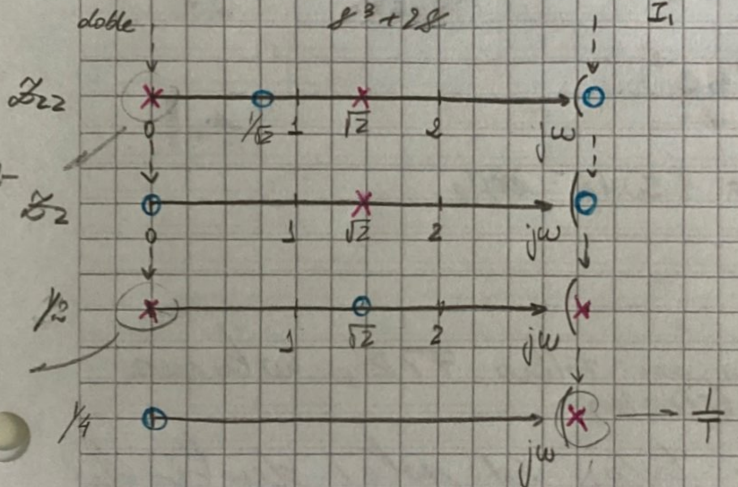
b) $$\frac{I_2}{I_1} = k \frac{\frac{s^2}{s^3+2s}}{1 + \frac{2s^2+1}{s^3+2s}}$$

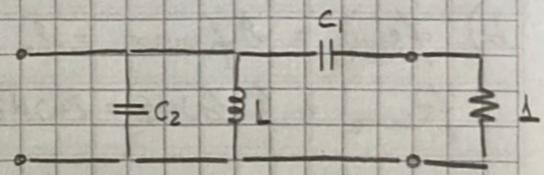
$$V_2 = z_{21} I_1 + z_{22} I_2 \qquad V_2 = -I_2 R_L$$

$$\frac{I_2}{I_1} = \frac{z_{21}}{1 + z_{22}}$$

normalizado por $R_g = R_L$

$$z_{21} = \frac{s^2}{s^3+2s} \qquad z_{22} = \frac{2(s^2+1/2)}{s(s^2+2)}$$





c) $$z_2 = z_{22} - \frac{k_0}{s}$$

$$\lim_{s \to 0} s \cdot \frac{2s^2+1}{s^3+2s} = \frac{1}{2} \Longrightarrow C_1 = 2$$

$$z_2 = \frac{2s^2+1 - \frac{1}{2}s^2 - 1}{s^3+2s} = \frac{3}{2}\,\frac{s}{s^2+2}$$

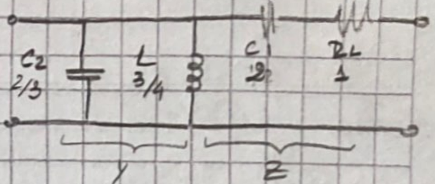
$$y_4 = \frac{1}{z_2} - \frac{k_0'}{s} \qquad \lim_{s\to 0} s\,\frac{2}{3}\,\frac{s^2+2}{s} = \frac{4}{3} \longrightarrow L = \frac{3}{4}$$

$$y_4 = \frac{2}{3}\,\frac{s^2+2}{s} - \frac{4}{3s} = \frac{2}{3}s \longrightarrow C_2 = \frac{2}{3}$$

d) Para verificar con parámetros T, tengo que poner la resistencia en serie (por la cond de medición)

NOTA

$$T = \begin{bmatrix} 1 & 0 \\ sC_2 + \frac{1}{sL_1} & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & R_L + \frac{1}{sC_1} \\ 0 & 1 \end{bmatrix}$$

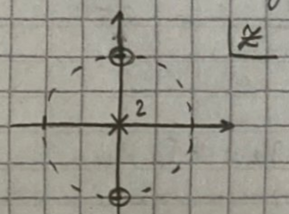


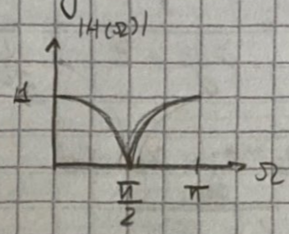
$$D = \frac{s^2 L_1 C_2 + 1}{sL_1} \cdot \frac{sC_1 R_L + 1}{sC_1} + 1 = \frac{s^3 L_1 C_1 C_2 R_L + s^2 L_1 (C_2 + C_1) + sC_1 R_L + 1}{s^2 C_1 L_1}$$

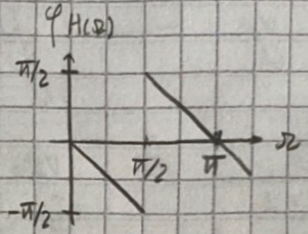
$$D = \frac{1}{C_2} \frac{s^2}{s^3 + s^2 \frac{C_1 + C_2}{C_1 C_2} + \frac{s}{C_2 L} + \frac{1}{C_1 C_2 L}} = \frac{3}{2} \frac{s^2}{s^3 + 2s^2 + 2s + 1} \qquad k = \frac{3}{2}$$

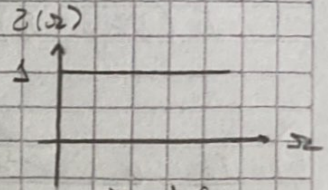
2) Eliminabanda 50 Hz

a) Propongo un FIR 2do orden con polos c.c sobre el eje $j\omega$









$$\tau = -\frac{d\varphi}{d\Omega}$$

$$H(z) = \frac{z^2 + 1}{2 \cdot z^2} \qquad H(\Omega) = \frac{1 + e^{-2j\Omega}}{2}$$

b) $fs_{50Hz} = 2 f_{max} = 2 \cdot 2 f_0 = 4 \cdot 50Hz = 200Hz$

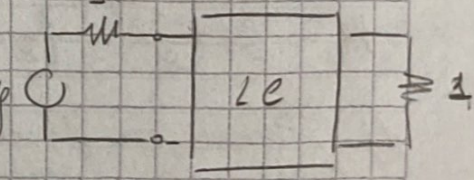
$fs_{60Hz} = 4 \cdot 60Hz = 240Hz$

c) No es recursivo ya que es un Filtro FIR, no toma muestras de salidas anteriores

II) Es estable ya que tiene todos sus polos dentro de la circunferencia unitaria. Dado que no está realimentado (FIR) nunca deja de ser estable

III) Sí, es de retardo constante ya que tiene fase lineal

3) $|S_{21}|^2 = \frac{\omega^4}{\omega^4 + 4}$ $\qquad |S_{11}|^2 = 1 - |S_{21}|^2$



$$|S_{11}|^2 = \frac{4}{\omega^4 + 4} = S_{11}(s) \cdot S_{11}(-s)$$

$$S_{11}(s) = \frac{2}{(s+1-i)(s+1+i)} = \frac{2}{s^2 + 2s + 2}$$

$$Z_1 = \frac{1 + S_{11}}{1 - S_{11}} = \frac{s^2 + 2s + 4}{s^2 + 2s}$$

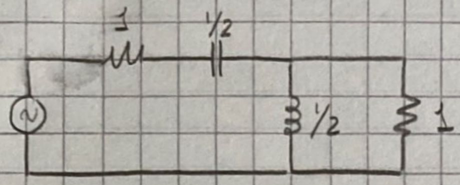
NOTA

$(1-i)(1+i) =$

HOJA Nº 12

FECHA

b) Hago Cauer con remociones en cero



$$
\begin{array}{r|l}
4+2s+s^2 & 2s+s^2 \\
-\;(4+2s) & \dfrac{2}{s} \longrightarrow 1/2 \\
\hline
2s+s^2 & s^2 \\
-\;2s & \dfrac{2}{s} \longrightarrow 1/2 \\
\hline
s^2 & s^2 \\
-\;s^2 & 1 \longrightarrow 1 \\
\hline
0 &
\end{array}
$$

la tengo que poner en derivación