Ejercicio 3

viernes, 2 de diciembre de 2022 5:48 p. m.

Conociendo la transferencia en vacío:

$$\frac{V_2}{V_1} = \frac{s^2+1}{2s^2+1}$$

a) Obtenga un circuito con 3 inductores y 1 capacitor
b) Obtenga un circuito con 3 capacitores y 1 Inductor

$$\begin{cases} I_1 = Y_{11} V_1 + Y_{12} V_2 \\ \cancel{I_2} = Y_{21} V_1 + Y_{22} V_2 \end{cases} \rightarrow -\frac{V_2}{V_1} = \frac{Y_{21}}{Y_{22}}$$

$$\left.\frac{V_2}{V_1}\right|_{I_2=0} = \frac{Z_{21}}{Z_{11}} = -\frac{Y_{21}}{Y_{22}}$$

$$\begin{cases} V_1 = Z_{11} I_1 + Z_{12} \cancel{I_2} \\ V_2 = Z_{21} I_1 + Z_{22} \cancel{I_2} \end{cases} \rightarrow \frac{V_2}{V_1} = \frac{Z_{21}}{Z_{11}}$$

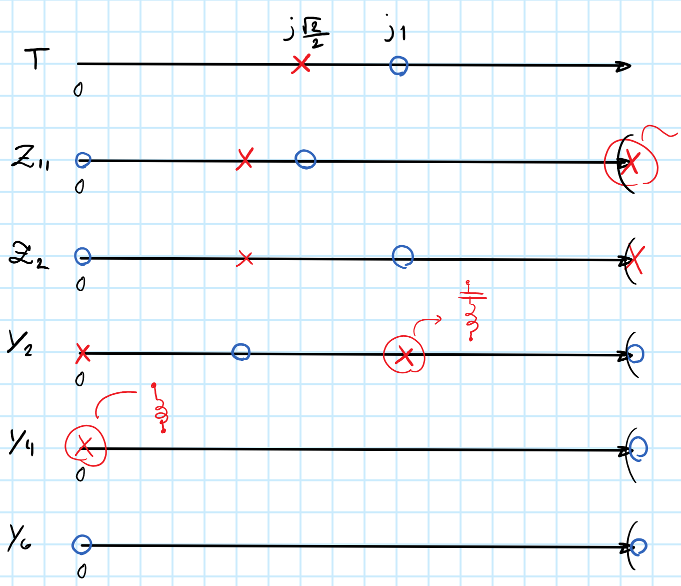
a) $Z_{11} = \dfrac{2(s^2+1/2)}{D}$

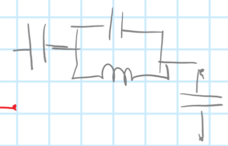
Elijo D | Halla alternancia

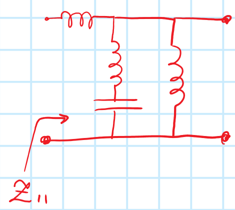
$\therefore D = \dfrac{(s^2+1/4)}{s}$

$$T = \frac{V_2}{V_1} = \frac{s^2+1}{2s^2+1}$$

$$Z_{11} = \frac{2s(s^2+1/2)}{(s^2+1/4)}$$







$$Z_2 = Z_{11} - s K_\infty = 0 \rightarrow K_\infty = \lim_{s^2\to -1} \frac{2\cancel{s}(s^2+1/2)}{\cancel{s}(s^2+1/4)} = \frac{2(-1+1/2)}{(-1+1/4)} \Rightarrow \boxed{K_\infty = \frac{4}{3}}$$

$$Z_2 = \frac{2s(s^2+1/2)}{(s^2+1/4)} - s\frac{4}{3} = \frac{6s(s^2+1/2) - 4s(s^2+1/4)}{3(s^2+1/4)} = \frac{6s^3+3s-4s^3-s}{3(s^2+1/4)} = \frac{2s(s^2+1)}{3(s^2+1/4)}$$

$$Y_4 = Y_2 - \frac{sK_i}{s^2+1} = 0 \rightarrow K_i = \lim_{s^2\to -1} \frac{3(s^2+1/4)}{2s\cancel{(s^2+1)}} \cdot \frac{\cancel{(s^2+1)}}{s} = \frac{3(-1+1/4)}{2\,(-1)} \Rightarrow \boxed{K_i = \frac{9}{8}}$$

↓

$$Y_{11} = \frac{3(s^2+1/4)}{2s(s^2+1)} - \frac{9s}{8(s^2+1)} = \frac{12s^2+3-9s^2}{8s(s^2+1)} = \frac{3\cancel{(s^2+1)}}{8s\cancel{(s^2+1)}} = \frac{3}{8s} \quad \therefore L_3 = \frac{8}{3}$$

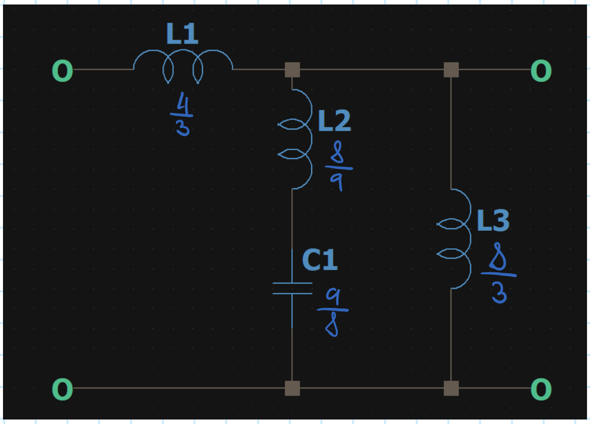
Componentes

$L_1 = K_\infty = \frac{4}{3}$; $L_2 = \frac{1}{K_i} = \frac{8}{9}$ $C_2 = \frac{K_i}{\omega^2} = \frac{9}{8}$; $L_3 = \frac{8}{3}$

C.A

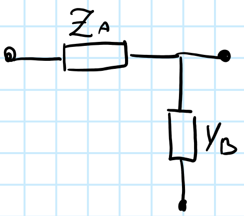
$$Y\left\{\frac{sK_i}{s^2+\omega^2} \Rightarrow \frac{1}{\frac{s}{K_i}+\frac{\omega^2}{sK_i}}\right\} Z$$

$L = \frac{1}{K_i}$ $C = \frac{K_i}{\omega^2}$



El hecho de remover en 0 y en ∞ sin respetar los ceros de la transferencia No afecta ya que se forma un : Divisor INDUCTIVO

Verificación :



$$= \begin{pmatrix} 1 + Z_A Y_B & Z_A \\ Y_B & 1 \end{pmatrix} \wedge \frac{V_2}{V_1} = \frac{1}{A}$$

$$Z_A = \frac{4}{3}s \qquad Y_B = \frac{9s}{8(s^2+1)} + \frac{3}{8s} = \frac{9s^2+3(s^2+1)}{8s(s^2+1)} = \frac{12s^2+3}{8s(s^2+1)}$$

$$A = 1 + \frac{\cancel{4}\cancel{s}}{\cancel{3}} \cdot \frac{\cancel{3}(4s^2+1)}{\cancel{8}_2\cancel{s}(s^2+1)} = \frac{2s^2+2+4s^2+1}{2(s^2+1)} = \frac{6(s^2+1/2)}{2(s^2+1)} = \frac{3(s^2+1/2)}{s^2+1}$$

$$\therefore \boxed{\frac{V_2}{V_1} = K \cdot \frac{1}{A} = \frac{2}{3}\,\frac{(s^2+1)}{(2s^2+1)}}$$

Analizando la transferencia

$$T(s=0) = \frac{2}{3} \xrightarrow{dB} 20\log\left(\frac{2}{3}\right) \cong -3,5218 \qquad T(s\to\infty) = \frac{2}{6} \xrightarrow{dB} 20\log\left(\frac{2}{6}\right) \cong -9,542425$$

Se Verifico Circuitalmente

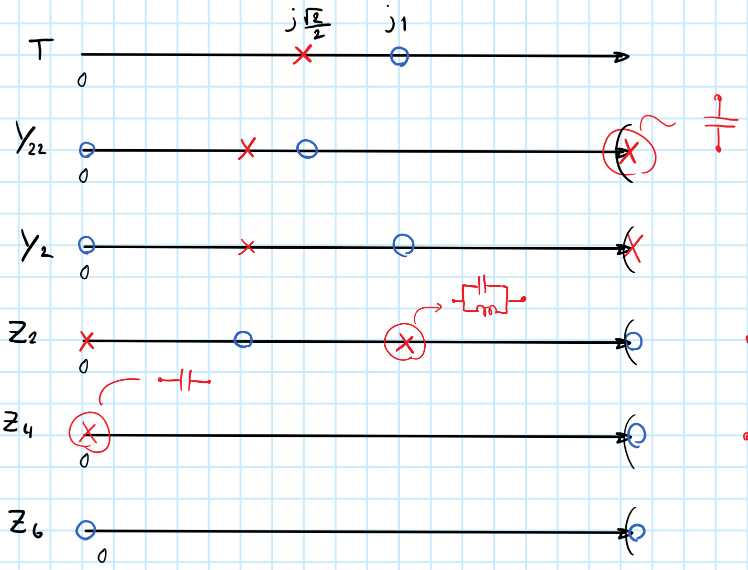
b) $Y_{22} = \frac{2(s^2+1/2)}{D}$ Elijo D | Halla alternancia

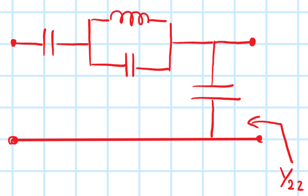
$\therefore D = \frac{(s^2+1/4)}{s}$

Voy a realizar las mismas remociones, pero desde la salida y en admitancia

$$T = \frac{V_2}{V_1} = \frac{s^2+1}{2s^2+1}$$

$$Y_{22} = \frac{2s(s^2+1/2)}{(s^2+1/4)}$$





$$Y_2 = Y_{22} - s K_\infty = 0 \rightarrow K_\infty = \lim_{s^2 \to -1} \frac{2\cancel{s}(s^2+1/2)}{\cancel{s}(s^2+1/4)} = \frac{2(-1+1/2)}{(-1+1/4)} \Rightarrow \boxed{K_\infty = \frac{4}{3}}$$

$$Y_2 = \frac{2s(s^2+1/2)}{(s^2+1/4)} - s\frac{4}{3} = \frac{6s(s^2+1/2) - 4s(s^2+1/4)}{3(s^2+1/4)} = \frac{6s^3+3s-4s^3-s}{3(s^2+1/4)} = \frac{2s(s^2+1)}{3(s^2+1/4)}$$

$$Z_4 = Z_2 - \frac{sK_i}{s^2+1} = 0 \rightarrow K_i = \lim_{s^2 \to -1} \frac{3(s^2+1/4)}{2s\cancel{(s^2+1)}} \cdot \frac{\cancel{(s^2+1)}}{s} = \frac{3(-1+1/4)}{2\ (-1)} \Rightarrow \boxed{K_i = \frac{9}{8}}$$

$$Z_4 = \frac{3(s^2+1/4)}{2s(s^2+1)} - \frac{9\ s}{8(s^2+1)} = \frac{12s^2+3-9s^2}{8s(s^2+1)} = \frac{3\cancel{(s^2+1)}}{8s\cancel{(s^2+1)}} = \frac{3}{8s} \quad \therefore C_1 = \frac{8}{3}$$

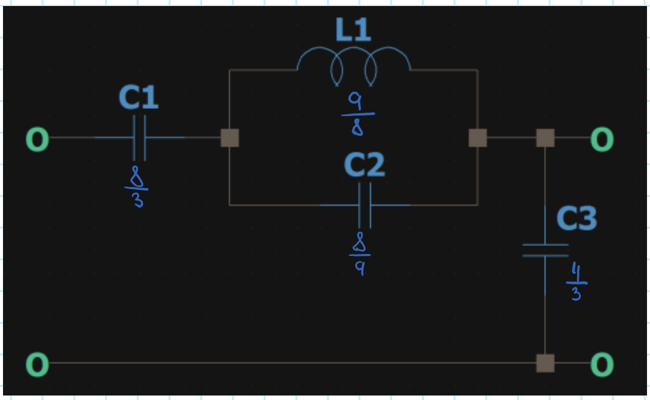
Componentes

$C_3 = K_\infty = \frac{4}{3}$; $C_2 = \frac{1}{K_i} = \frac{8}{9}$ $L_1 = \frac{K_i}{\omega^2} = \frac{9}{8}$; $C_1 = \frac{8}{3}$

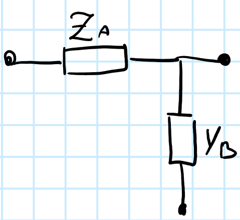
C.A

$$Z\left\{\frac{sK_i}{s^2+\omega^2} \Rightarrow \frac{1}{\frac{s}{K_i} + \frac{\omega^2}{sK_i}}\right\} Y$$

$C = \frac{1}{K_i}$ $L = \frac{K_i}{\omega^2}$



Verificación :



$$= \begin{pmatrix} 1 + Z_A Y_B & Z_A \\ Y_B & 1 \end{pmatrix} \wedge \frac{V_2}{V_1} = \frac{1}{A}$$

$$Y_B = \frac{4}{3}s \qquad Z_A = \frac{3}{8s} + \frac{9\ s}{8(s^2+1)} = \frac{9s^2+3(s^2+1)}{8s(s^2+1)} = \frac{12s^2+3}{8s(s^2+1)}$$

"A" Va a dar lo mismo que en a) $\therefore$

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$$\boxed{\frac{V_2}{V_1} = K \cdot \frac{1}{A} = \frac{2}{3}\,\frac{(\$^2+1)}{(2\$^2+1)}}$$

$K = \frac{2}{3}$

Analizando la transferencia

$T(\$=0) = \frac{2}{3} \xrightarrow{dB} 20\log\left(\frac{2}{3}\right) \cong -3,5218\ dB$

$T(\$\to\infty) = \frac{2}{6} \xrightarrow{dB} 20\log\left(\frac{2}{6}\right) \cong -9,542425\ dB$

Se Verifico Circuitalmente