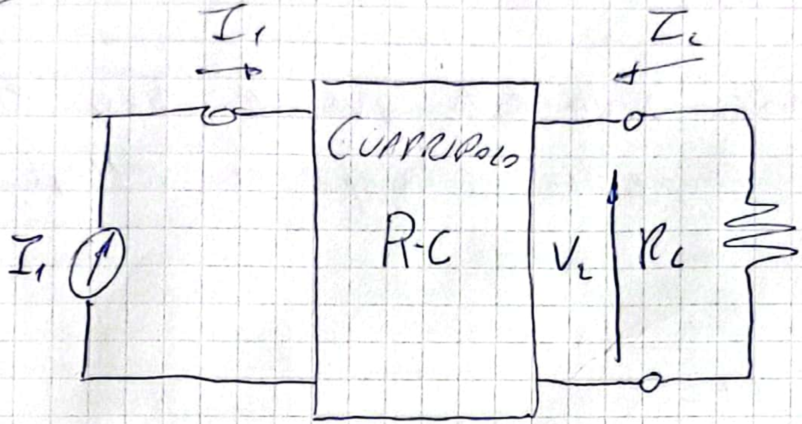
Síntesis de redes cargadas

TS 13

1



$$\frac{(-I_2)}{I_1} = H \frac{s^2+5s+4}{s^2+8s+12}$$

$$z_{21} = 6.H$$

La relación entre V_2 e I_2 está dada por R_L

$$V_2 = (-I_2) R_L$$

Debe comenzar en derivación, si comenzara todo en serie no participaría en la transferencia. (I_1).

$$\left.\frac{(-I_2)}{I_1}\right|_{V_2=(-I_2)R_L} = H \frac{s^2+5s+4}{s^2+8s+12}$$

$$V_2 = z_{21} I_1 + z_{22} I_2$$

$$(-I_2) R = z_{21} I_1 + z_{22} I_2$$

$$(-I_2)(R+Z_{22}) = I_1 Z_{21}$$

$$\frac{(-I_2)}{I_1} = \frac{Z_{21}}{R+Z_{22}}$$

Función de transferencia

Función de excitación

- Normalizamos asumiendo que no hay escalamiento a nivel de impedancia. Luego se refleja en la cte.

$$\frac{(-I_2)}{I_1} = \frac{Z_{21}}{1+Z_{22}}$$

- Reemplazando por los datos

$$(1+Z_{22})\underbrace{\left(\frac{-I_2}{I_1}\right)}_{T(s)} = Z_{21}$$

$$Z_{22} = Z_{21} \cdot \frac{1}{T(s)} - 1$$

$$Z_{22} = \frac{6\cancel{H}}{\cancel{H}} \frac{s^2+8s+12}{s^2+5s+4} - 1$$

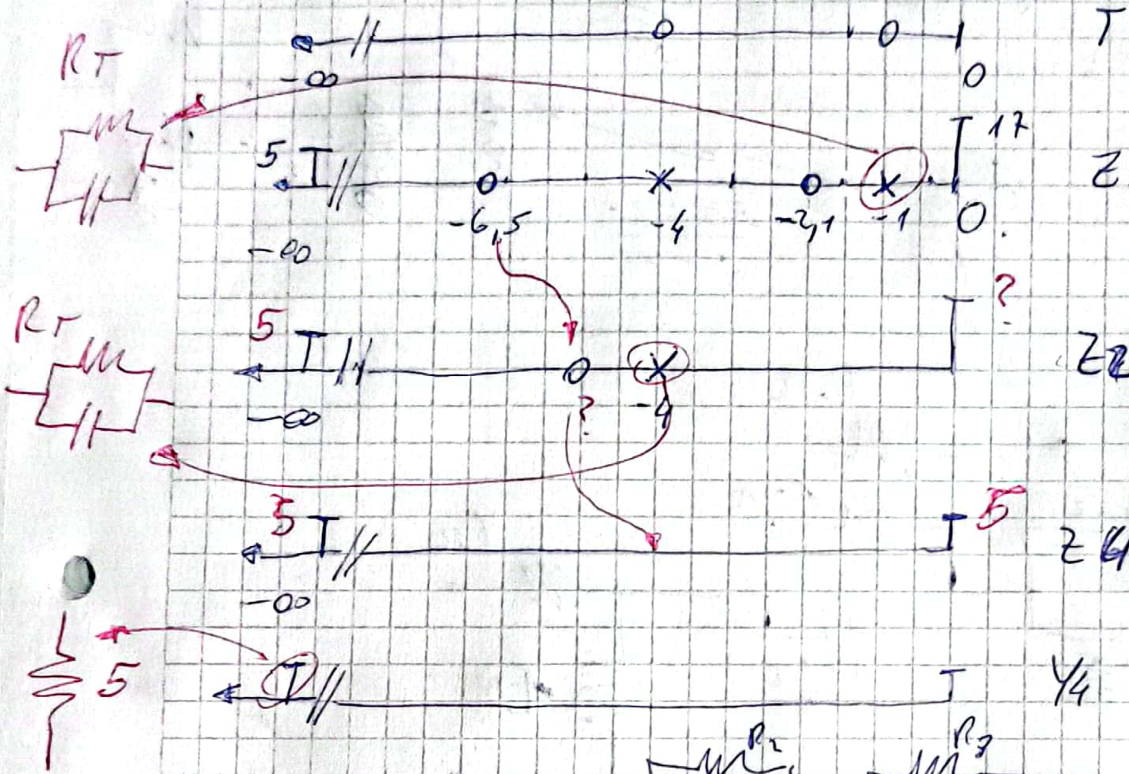
$$Z_{22} = \frac{5s^2+43s+68}{s^2+5s+4} =$$

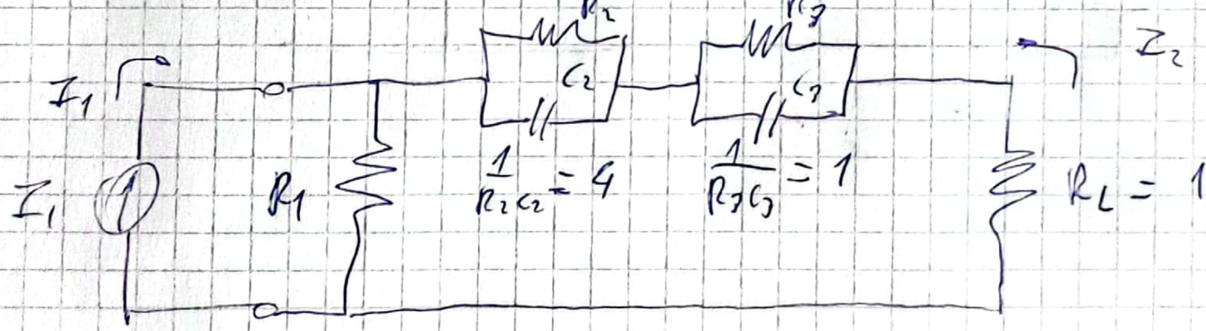
- La topología no puede ser serie sino $I_2 = I_1$ la transferencia es unitaria y no cumple con consigna

Remoción desde la salida hacia la entrada:

$T(s) = (s+1)(s+4)$

$Z_{22} = \frac{5s^2+43s+68}{s^2+5s+4}$





Parte ANALÍTICA

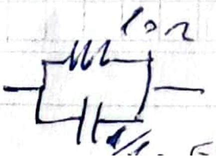
1era Remoción Total:

$$Z_2 = Z_{22} - \frac{K_1}{s+1}$$

$$K_1 = \lim_{s\to -1} Z_{22}(s+1) = \lim_{s\to -1} \frac{5s^2+43s+68}{\cancel{(s+1)}(s+4)}\cancel{(s+1)} = 10$$

∴

$$Z_2 = \frac{5s^2+43s+68}{(s+1)(s+4)} - \frac{10}{(s+1)} = \frac{5s^2+33s+28}{(s+1)(s+4)}$$

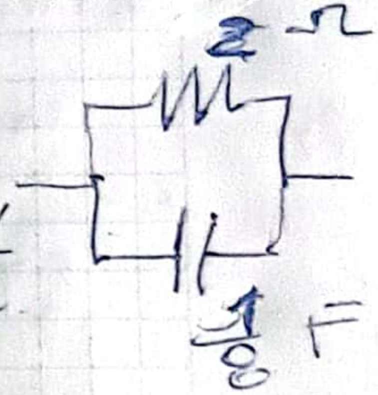
$\frac{10}{s+1} \Rightarrow$ 

$Z_2 = \frac{5\cancel{(s+1)}(s+\frac{28}{5})}{\cancel{(s+1)}(s+4)} = 5\frac{s+\frac{28}{5}}{s+4}$

2da Remoción Total

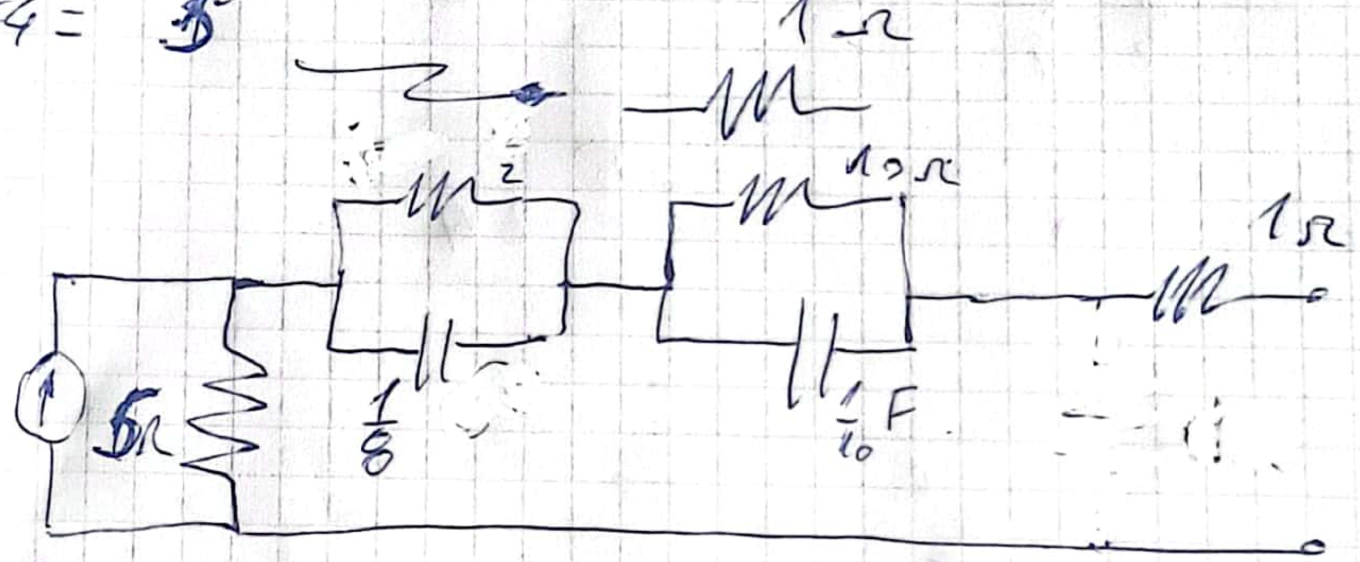
$$K_2 = \lim_{s \to -4} s\left(\frac{s + \frac{28}{s}}{\cancel{(s+4)}}\right)\cancel{(s+4)} = 8$$

$$\frac{1}{\frac{1}{8}s + \frac{\cancel{4}}{\cancel{8}}\frac{1}{2}}$$



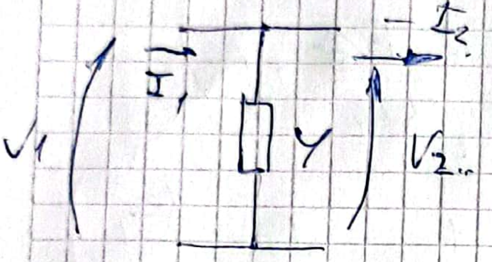
$$Z_4 = \frac{s^2 + 28}{s+4} - \frac{8}{s+4} = \frac{s^2+20}{s+4}$$

$$Z_4 = 5$$



TS 13

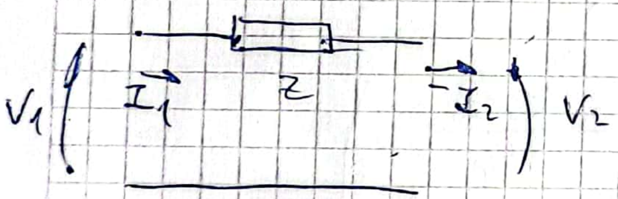
Verificación



$$\begin{cases} V_1 = A V_2 + B(-I_2) \\ I_1 = C V_2 + D(-I_2) \end{cases}$$

$A = \dfrac{V_1}{V_2}\Big|_{-I_2=0} = 1$ $\qquad C = \dfrac{I_1}{V_2}\Big|_{-I_2=0} = Y$

$B = \dfrac{V_1}{-I_2}\Big|_{V_2=0} = 0$ $\qquad D = \dfrac{I_1}{-I_2}\Big|_{V_2=0} = 1$



$A = \dfrac{V_1}{V_2}\Big|_{-I_2=0} = 1$ $\qquad C = \dfrac{I_1}{V_2}\Big|_{-I_2=0} = 0$

$B = \dfrac{V_1}{-I_2}\Big|_{V_2=0} = Z$ $\qquad D = \dfrac{I_1}{-I_2}\Big|_{V_2=0} = 1$

$$T_1 = \begin{pmatrix} 1 & 0 \\ \frac{1}{s} & 1 \end{pmatrix} \qquad T_2 = \begin{pmatrix} 1 & \frac{8}{s+4} \\ 0 & 1 \end{pmatrix}$$

$$T_3 = \begin{pmatrix} 1 & \frac{10}{s+1} \\ 0 & 1 \end{pmatrix} \qquad T_4 = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$$

$$T_T = T_1 \cdot T_2 \cdot T_3 \cdot T_4$$

$$T_{12} = \begin{pmatrix} 1 & 0 \\ \frac{1}{s} & 1 \end{pmatrix} \begin{pmatrix} 1 & \frac{8}{s+4} \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & \frac{8}{s+4} \\ \frac{1}{s} & \frac{8/s}{s+4} + 1 \end{pmatrix}$$

$$T_{34} = \begin{pmatrix} 1 & \frac{10}{s+1} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 1 + \frac{10}{s+1} \\ 0 & 1 \end{pmatrix}$$

$$T_T = T_{12} \cdot T_{34} = \begin{pmatrix} 1 & \frac{8}{s+4} \\ \frac{1}{s} & \frac{8/s}{s+4} + 1 \end{pmatrix} \begin{pmatrix} 1 & 1 + \frac{10}{s+1} \\ 0 & 1 \end{pmatrix}$$

$$T_T = \begin{pmatrix} 1 & 1 + \frac{10}{s+1} + \frac{8}{s+4} \\ \frac{1}{s} & \frac{1}{s}\left(1 + \frac{10}{s+1}\right) + \frac{8/s}{s+4} + 1 \end{pmatrix}$$

$$\frac{I_1}{-I_2} = D = \frac{1}{s} + \frac{2}{s+1} + \frac{8/5}{s+4} + 1$$

$$\frac{I_1}{-I_2} = \frac{(s+1)(s+4) + 10(s+4) + 8(s+1) + 5(s+1)(s+4)}{5(s+1)(s+4)}$$

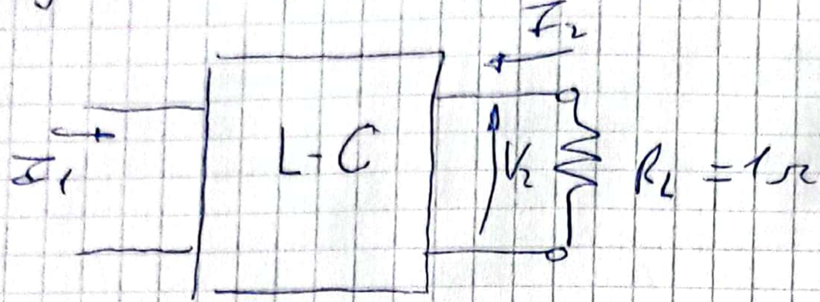
$$\frac{I_1}{-I_2} = \frac{1}{5} \cdot \frac{s^2 + 5s + 4 + 10s + 40 + 8s + 8 + 5s^2 + 25s + 20}{(s+1)(s+4)}$$

$$\frac{I_1}{-I_2} = \frac{1}{5} \frac{6s^2 + 48s + 72}{(s+1)(s+4)}$$

$$\frac{I_1}{-I_2} = \frac{6}{5} \frac{s^2 + 8s + 12}{s^2 + 5s + 4}$$

$$T(s) = \frac{I_2}{I_1} = \frac{5}{6} \frac{s^2 + 5s + 4}{s^2 + 8s + 12}$$

* Ejercicio 2



$$T(s) = \frac{V_2}{I_1} = K \frac{s}{s^3 + 2s^2 + 2s + 1}$$

- Elegir función a sintetizar para llegar a Ob

$$\frac{F_T}{1 + F_E}$$

Relacionar V_2 e I_1 para obtener los parámetros Z o Y

$$\boxed{\frac{V_2}{(-I_2)} = R_L}$$

Condición impuesta

Parámetros Z

$$\begin{cases} V_1 = I_1 \cdot z_{11} + I_2 \cdot z_{12} \\ V_2 = I_1 \cdot z_{21} + I_2 \cdot z_{22} \end{cases}$$

$$V_2 = I_1 \, z_{21} + \frac{V_2}{R_L} z_{22}$$

$$\left(V_2 + \frac{V_2}{R_L} z_{22} \right) = I_1 \, z_{21}$$

$$V_2\left(1+\frac{z_{22}}{R_L}\right)=I_1 z_{21}$$

$$\frac{V_2}{I_1}=\frac{z_{21}}{1+\frac{z_{22}}{R_L}}$$

$$\boxed{\frac{V_2}{I_1}=\frac{z_{21}}{1+z_{22}}}$$

$$\frac{z_{21}}{1+z_{22}}=K\,\frac{s}{s^3+2s^2+2s+1}$$

FC. parte par

$$\frac{V_2}{I_1}=K\,\frac{s}{(2s^2+1)\left(1+\frac{s^3+2s}{2s^2+1}\right)}$$

$$\frac{V_2}{I_1}=K\,\underbrace{\frac{s}{2s^2+1}}_{z_{21}}\;\frac{1}{1+\underbrace{\frac{s^3+2s}{2s^2+1}}_{z_{22}}}$$

1) $\underline{I_1}$: gen I:

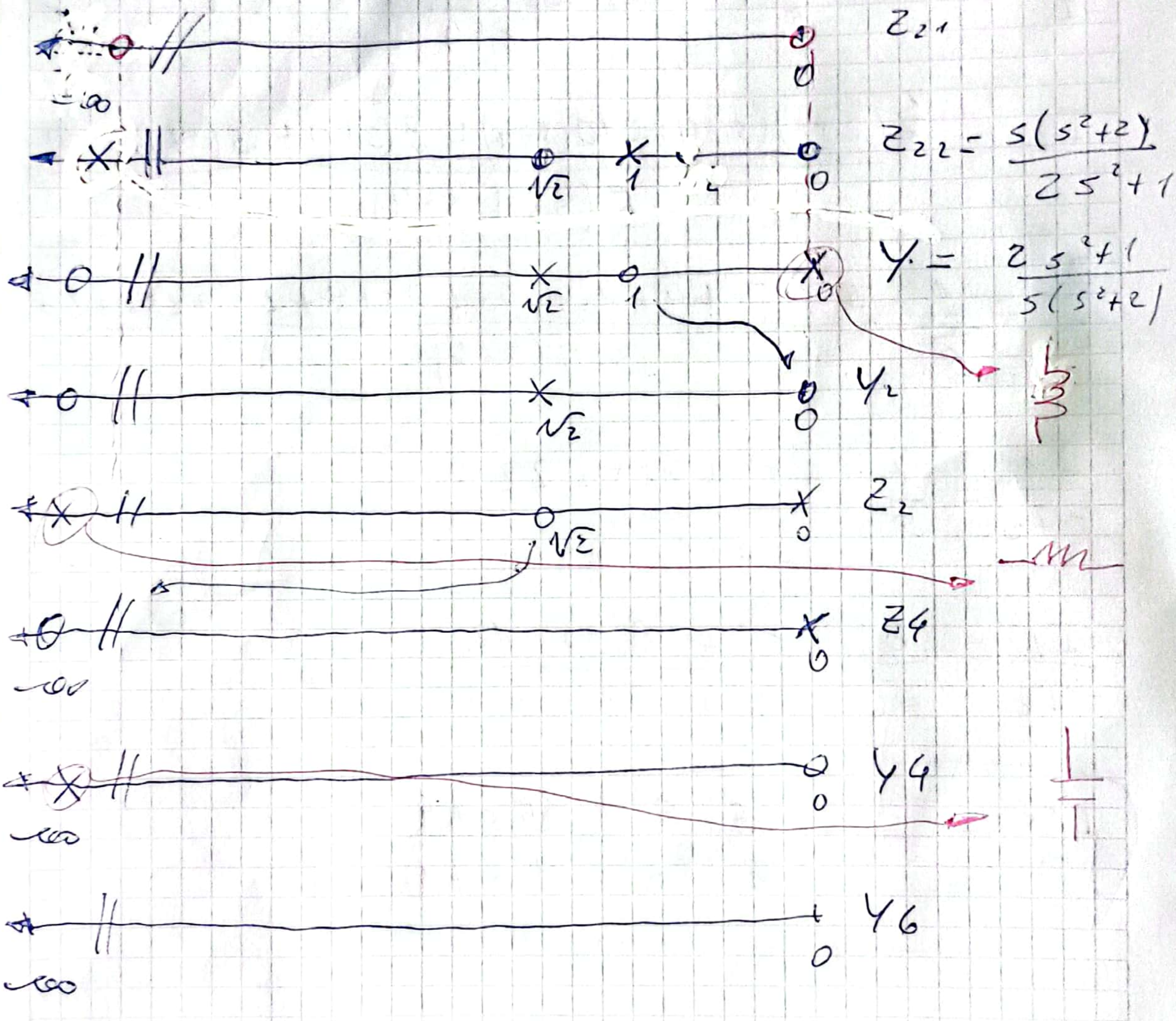
1° elemento: Derivación

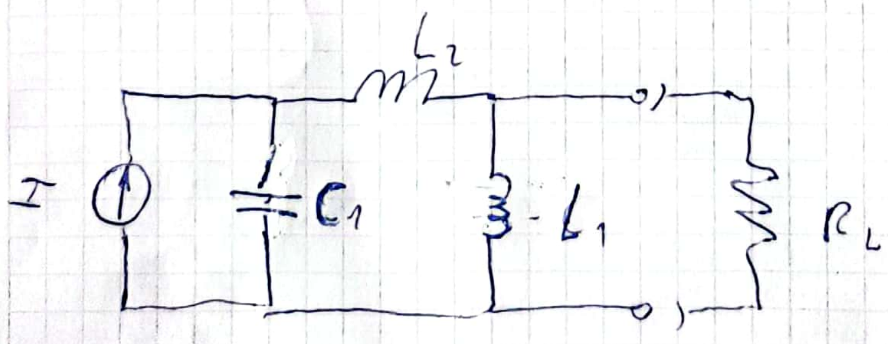
Último [illegible]

$$T(s)=\left.\frac{V_2}{I_1}\right|_{I_2=0}=\frac{1}{C}$$

Último elemento es derivación

Método gráfico





Analítico

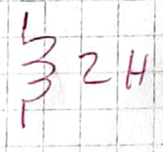
1era remoción total en 0 (Y)

$$Y_2 = Y - \frac{K_1}{s} \Rightarrow \lim_{s\to 0} Y_2 = 0$$

$$K_1 = \lim_{s\to 0} Ys = \lim_{s\to 0} \frac{2s^2+1}{s^2+2} = 1/2$$

$$\frac{2s^2+1}{s(s^2+2)} - \frac{\frac{1}{2}}{s} = \frac{2s^2+\cancel{1}-\frac{s^2}{2}-\cancel{1}}{s(s^2+2)} = \frac{3}{2}\frac{s^{\cancel{2}}}{\cancel{s}(s^2+2)}$$

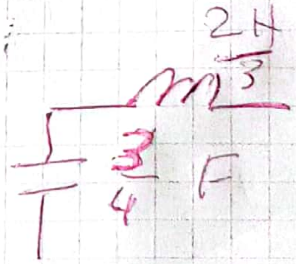
$$Y_2 = \frac{3}{2}\frac{s}{(s^2+2)}$$

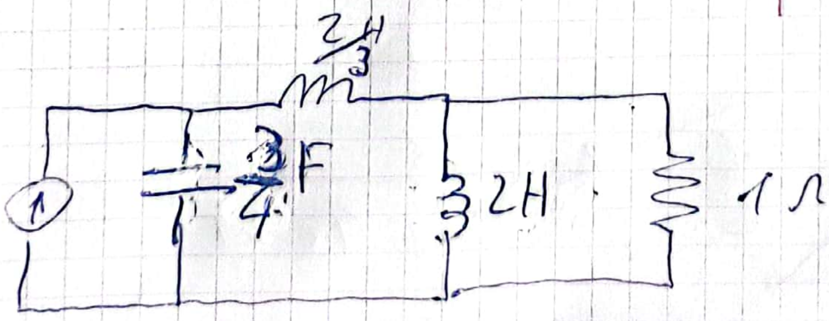


2da remoción total en infinito (Z)

$$Z_2 = \frac{2}{3}\frac{s^2+2}{s}$$

$$Z_2 = \frac{2}{3}s + \frac{4}{3s}$$





Normalizado a nivel de impedancia

b) Verificación

Parámetros T (ABCD)

$$T(s) = \frac{V_2}{I_1}\bigg|_{-I_2=0} = \frac{1}{C}$$

$$T_{12} = \begin{pmatrix} 1 & 0 \\ \frac{3s}{4} & 1 \end{pmatrix}\begin{pmatrix} 1 & \frac{2s}{3} \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & \frac{2s}{3} \\ \frac{3s}{4} & \left(\frac{s^2}{2}+1\right) \end{pmatrix}$$

$$T_{34} = \begin{pmatrix} 1 & 0 \\ \frac{1}{2s} & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \frac{1}{2s}+1 & 1 \end{pmatrix}$$

$$T_T = T_{12} \cdot T_{34} = \begin{pmatrix} 1 & \frac{2s}{3} \\ \frac{3s}{4} & \left(\frac{s^2}{2}+1\right) \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \frac{1}{2s}+1 & 1 \end{pmatrix} = \begin{pmatrix} \cdots & \cdots \\ \cdots & \cdots \end{pmatrix}$$

$$\frac{3s}{4} + \left(\frac{s^2}{2}+1\right)\left(\frac{1}{2s}+1\right)$$

HOJA Nº

FECHA

$$C = \frac{3s}{4} + \left(\frac{s^2}{2} + 1\right)\left(\frac{1}{2s} + 1\right)$$

$$C = \frac{3s}{4} + \frac{s}{4} + \frac{s^2}{2} + \frac{1}{2s} + 1 = s + \frac{s^2}{2} + \frac{1}{2s} + 1$$

$$C = \frac{2s^2 + s^3 + 1 + 2s}{2s}$$

$$T(s) = \frac{V_2}{I_1}\Big|_{I_2=0} = \frac{1}{C} = \boxed{\frac{2s}{s^3 + 2s^2 + 2s + 1}}$$

$$\boxed{K = 2}$$