Práctica parcial TC II

T5 ♀

1)

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

Método de Foster

Tengo que remover 3 polos

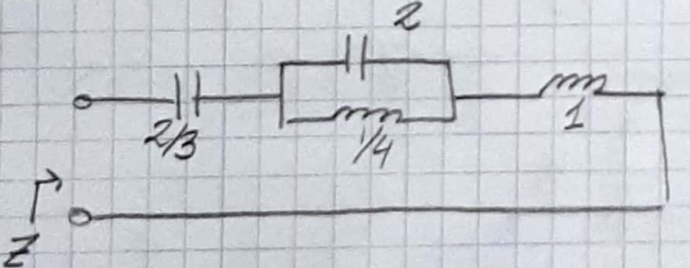
Serie

$$Z(s) = \frac{k_0}{s} + \frac{2k_1 s}{s^2+\omega_1^2} + k_\infty s$$

$$k_0 = \lim_{s\to 0} Z(s)\, s = \frac{(0+3)(0+1)}{(0+2)} = \frac{3}{2}$$

$$k_\infty = \lim_{s\to\infty} \frac{Z(s)}{s} = \frac{(s^2+3)(s^2+1)}{s^2(s^2+2)} = 1$$

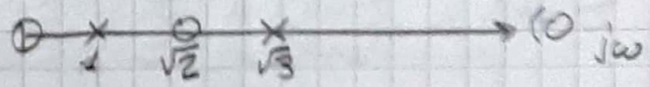
$$2k_1 = \lim_{s^2\to -2} Z(s)\,\frac{(s^2+2)}{s} = \frac{(s^2+3)(s^2+1)}{s^2} = \frac{1}{2}$$



$$Z_1 = \frac{2k_1 s}{s^2+\omega_1^2} = \frac{1}{s\frac{1}{2k_1} + \frac{1}{s\frac{2k_1}{\omega_1^2}}}$$

Paralelo

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

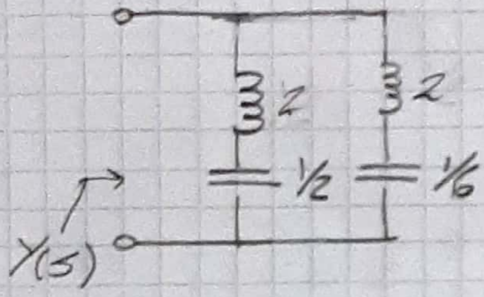


$$Y(s) = \frac{2k_1 s}{s^2+1} + \frac{2k_2 s}{s^2+3} \quad ; \quad Y = \frac{1}{s\frac{1}{2k} + \frac{1}{s\frac{2k}{\omega^2}}}$$

$$2k_1 = \lim_{s^2\to -1} Y(s)\cdot\frac{(s^2+1)}{s} = \frac{(s^2+2)}{(s^2+3)} = \frac{1}{2}$$

$$2k_2 = \lim_{s^2\to -3} Y(s)\cdot\frac{(s^2+3)}{s} = \frac{(s^2+2)}{(s^2+1)} = \frac{1}{2}$$

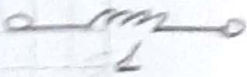
NOTA $L_1 = 1/2k_1 = 2 \quad C_1 = \frac{2k_1}{1} = 1/2 \;;\; L_2 = 1/2k_2 = 2 \quad C_2 = \frac{2k_2}{3} = 1/6$



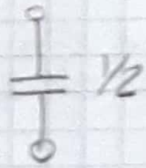
b) Cauer ∞

$$Z(s) = \frac{(s^2+3)(s^2+1)}{s(s^2+2)} = \frac{s^4+4s^2+3}{s^3+2s}$$

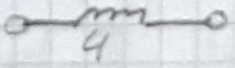
$$\begin{array}{l|l} s^4+4s^2+3 & s^3+2s \\ -\,s^4+2s^2+0 & s \\ \hline \end{array}$$



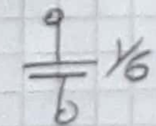
$$\begin{array}{l|l} s^3+2s & 2s^2+3 \\ -\,s^3+\frac{3}{2}s & \frac{1}{2}s \\ \hline \end{array}$$

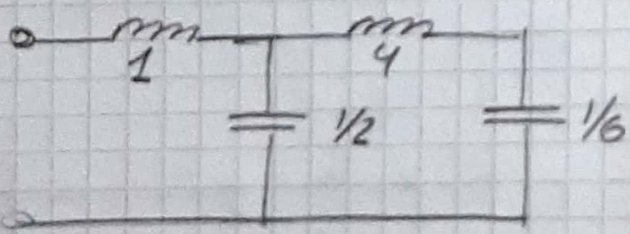


$$\begin{array}{l|l} 2s^2+3 & 1/2\,s \\ -\,2s^2 & 4s \\ \hline \end{array}$$



$$\begin{array}{l|l} 1/2\,s & 3 \\ & 1/6\,s \end{array}$$

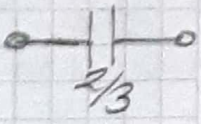




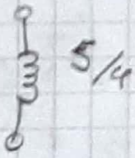
Cauer ①

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

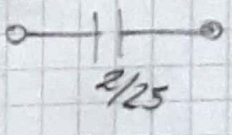
$$\begin{array}{r|l} 3+4s^2+s^4 & 2s+s^3 \\ -\left(3+\frac{3}{2}s^2\right) & \frac{3}{2}\frac{1}{s} \end{array}$$



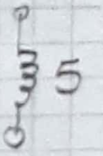
$$\begin{array}{r|l} 2s+s^3 & \frac{5}{2}s^2+s^4 \\ -\left(2s+\frac{4}{5}s^3\right) & \frac{4}{5}\frac{1}{s} \end{array}$$

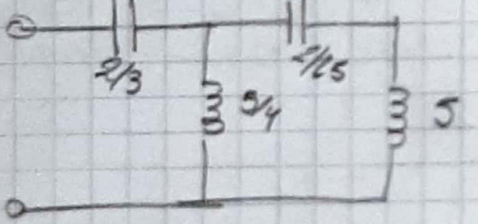


$$\begin{array}{r|l} \frac{5}{2}s^2+s^4 & \frac{1}{5}s^3 \\ -\left(\frac{5}{2}s^2+0\right) & \frac{25}{2}\frac{1}{s} \end{array}$$



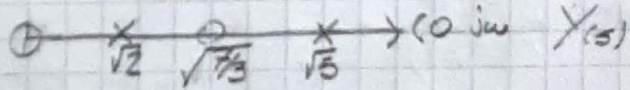
$$\begin{array}{r|l} \frac{1}{5}s^3 & s^4 \\ & \frac{1}{5}\frac{1}{s} \end{array}$$

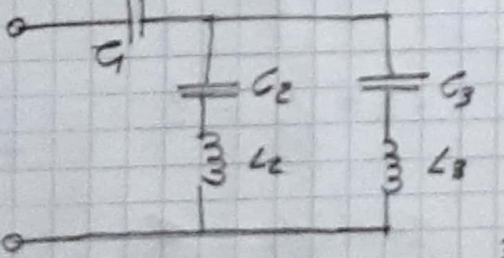




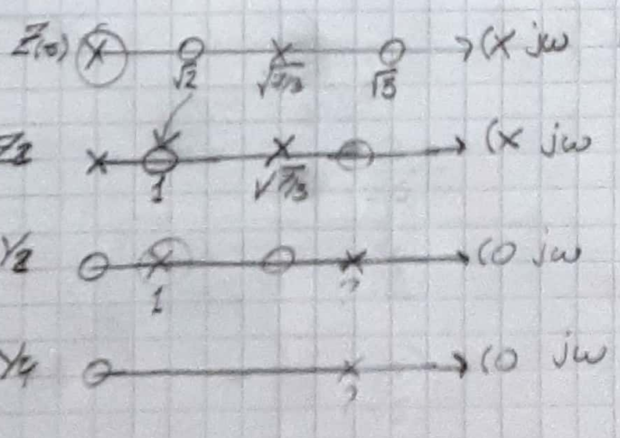
2)

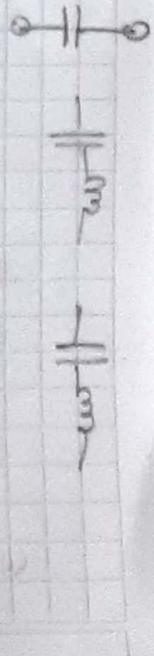
$$Y(s) = \frac{3s(s^2+7/3)}{(s^2+2)(s^2+5)}$$





L2 y C2 resuenan a 1 rad/s





$$Z(s) = \frac{(s^2+2)(s^2+5)}{3s(s^2+7/3)}$$

$$Z_2(s)\Big|_{s=j1} = Z(s) - \frac{K_0}{s} = 0$$

$$K_0 = Z(s)\Big|_{s=j1} \cdot s \Rightarrow K_0 = \frac{(-1+2)(-1+5)}{3(-1+7/3)} = 1$$

NOTA +4h

$$Z_2 = \frac{s^4+7s^2+10 - 3(s^2+7/3)}{3s(s^2+7/3)}$$

$$Z_2 = \frac{s^4+7s^2+10-3s^2-7}{3s(s^2+7/3)} = \frac{s^4+4s^2+3}{3s(s^2+7/3)}$$

$$Z_2 = \frac{(s^2+1)(s^2+3)}{3s(s^2+7/3)} \longrightarrow Y_2 = \frac{3s(s^2+7/3)}{(s^2+1)(s^2+3)}$$

$$2k_1 = \lim_{s^2\to -1} Y_2(s) \cdot \frac{(s^2+1)}{s} = \frac{3(s^2+7/3)}{(s^2+3)} = 2$$

$$\Rightarrow Y_4 = Y_2 - \frac{2k_1 s}{(s^2+1)}$$

$$Y_4 = \frac{3s(s^2+7/3)}{(s^2+1)(s^2+3)} - \frac{2s}{(s^2+1)} = \frac{3s(s^2+7/3)-2s(s^2+3)}{(s^2+1)(s^2+3)}$$

$$Y_4 = \frac{3s^3+7s-2s^3-6s}{(s^2+1)(s^2+3)} = \frac{s^3+s}{(s^2+1)(s^2+3)} = \frac{s\cancel{(s^2+1)}}{\cancel{(s^2+1)}(s^2+3)}$$

$$\Rightarrow Y_4 = \frac{s}{(s^2+3)} \Rightarrow 2k_2 = 1$$

- $k_0 = 1 \Rightarrow C_1 = 1$

$$L_2 = \frac{1}{2k_1} = \frac{1}{2}$$

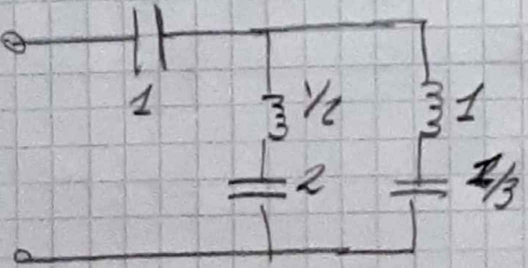
- $$\frac{2k_1 s}{(s^2+1)} = \frac{1}{\underbrace{s\frac{1}{2k_1} + \frac{1}{s\frac{2k_1}{1}}}_{Z_3}} = Y_3$$

$$C_2 = \frac{2k_1}{1} = 2$$

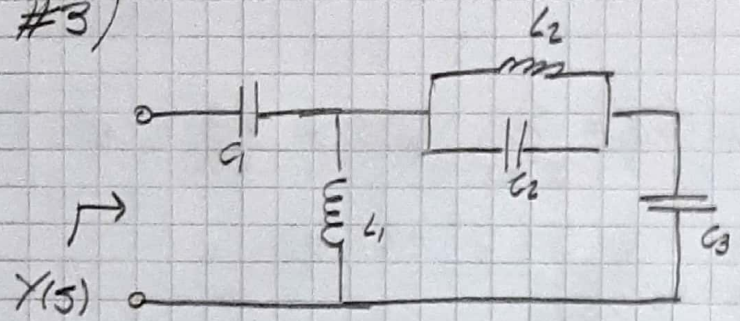
$$L_3 = \frac{1}{2k_1} = 1$$

- $$\frac{2k_2 s}{s^2+3} = \frac{1}{s\frac{1}{2k_2} + \frac{1}{s\frac{2k_2}{3}}} = Y_6$$

$$C_3 = \frac{2k_2}{3} = \frac{1}{3}$$

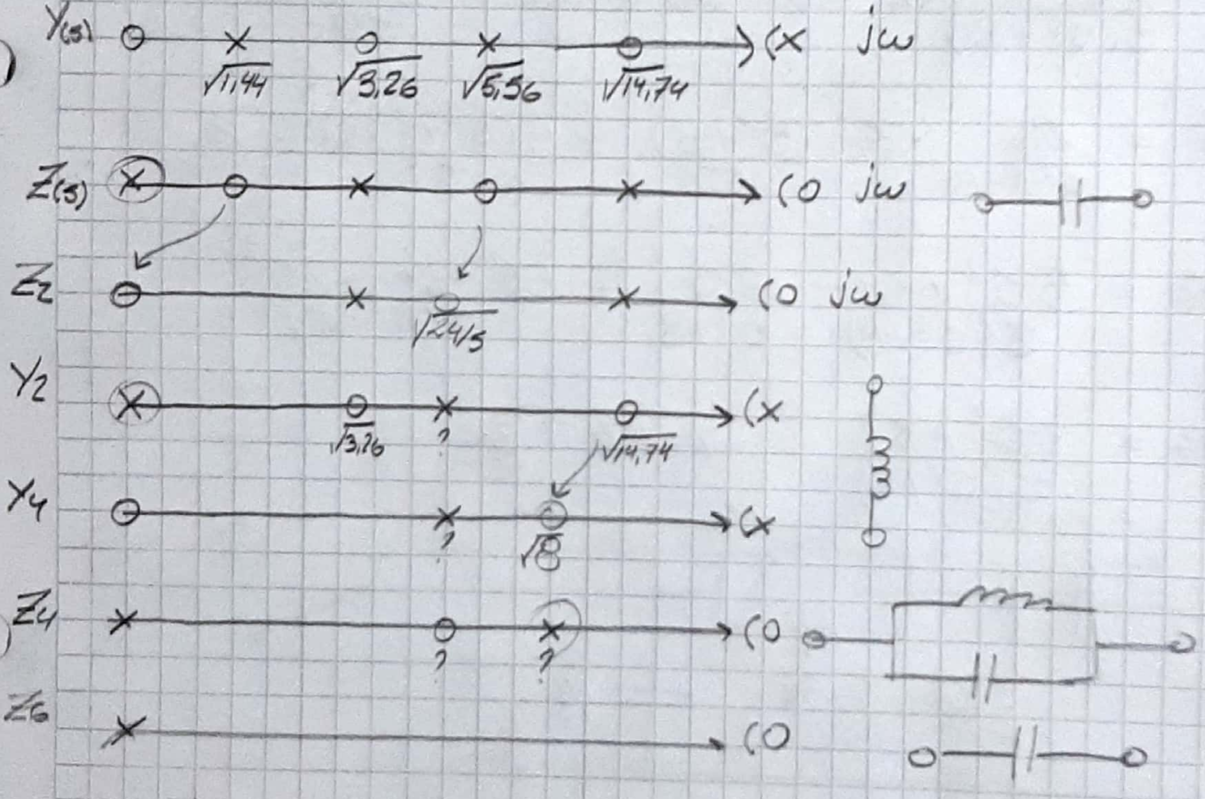


#3)



$$Y(s) = \frac{s^5+18s^3+48s}{6s^4+42s^2+48}$$

$$Y(s) = \frac{s(s^2+3,26)(s^2+14,74)}{6(s^2+5,56)(s^2+1,44)}$$



$$Z(s) = \frac{6s^4+42s^2+48}{s^5+18s^3+48s} = \frac{6(s^2+5,56)(s^2+1,44)}{s(s^2+3,26)(s^2+14,74)}$$

$$Z_2 = Z - \frac{k_0}{s} \Rightarrow k_0 = \lim_{s^2\to 0} Z(s)\cdot s = \frac{(5,56 \cdot 1,44)6}{3,26 \cdot 14,74}$$

$$k_0 = 1$$

$$Z_2 = \frac{6s^4+42s^2+48 - (s^4+18s^2+48)}{s(s^4+18s^2+48)}$$

$$Z_2 = \frac{5s^4+24s^2}{s(s^2+3,26)(s^2+14,74)} = \frac{5s^{\cancel{2}}(s^2+24/5)}{\cancel{s}(s^2+3,26)(s^2+14,74)}$$

NOTA 12:30

$$Y_2 = \frac{s^4+18s^2+48}{5s(s^2+24/5)}$$

$$Y_4 = Y_2 - \frac{k_{0L}}{s} \Rightarrow k_{0L} = \lim_{s^2\to 0} Y_2 s = \frac{48}{24} = 2$$

$$Y_4 = \frac{s^4+18s^2+48 - 2.5(s^2+24/5)}{5s(s^2+24/5)}$$

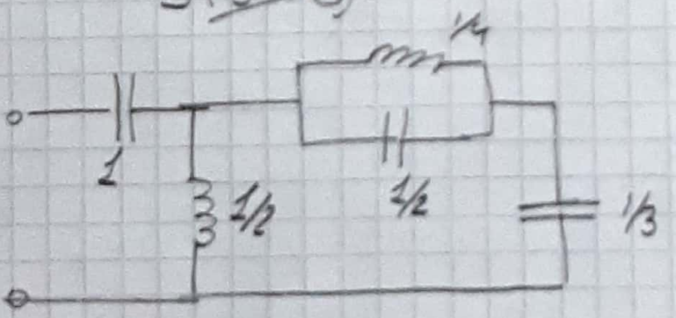
$$Y_4 = \frac{s^4+8s^2}{5s(s^2+24/5)} = \frac{s^{\cancel{4}}(s^2+8)}{5\cancel{s}(s^2+24/5)}$$

$$Z_4 = \frac{5(s^2+24/5)}{s(s^2+8)} \Rightarrow Z_6 = Z_4 - \frac{2K_1 s}{s^2+8}$$

$$2K_1 = \lim_{s^2\to -8} Z_4 \frac{(s^2+8)}{s} = \frac{5(s^2+24/5)}{s^2} = 2$$

$$\Rightarrow Z_6 = \frac{5s^2+24}{s(s^2+8)} - \frac{2s}{s^2+8} = \frac{5s^2+24-2s^2}{s(s^2+8)}$$

$$Z_6 = \frac{3\cancel{(s^2+8)}}{s\cancel{(s^2+8)}} \Rightarrow Z_6 = \frac{3}{s}$$



$$Z_3 = \frac{2K_1 s}{s^2+\omega_1^2} = \frac{1}{\underbrace{s\frac{1}{2K_1} + \frac{1}{s\frac{2K_1}{\omega_1^2}}}_{Y_3}}$$

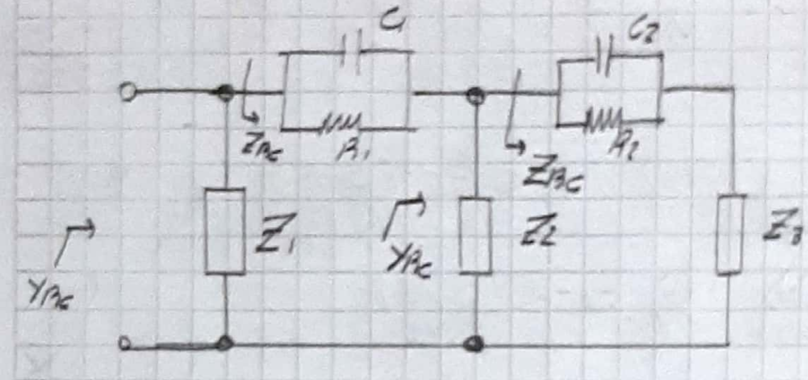
$$C_2 = \frac{1}{2K_1} = \frac{1}{2}$$

$$L_2 = \frac{2K_1}{\omega_1^2} = \frac{2}{8} = \frac{1}{4}$$

EJ 8.

$G R_1 = 1$

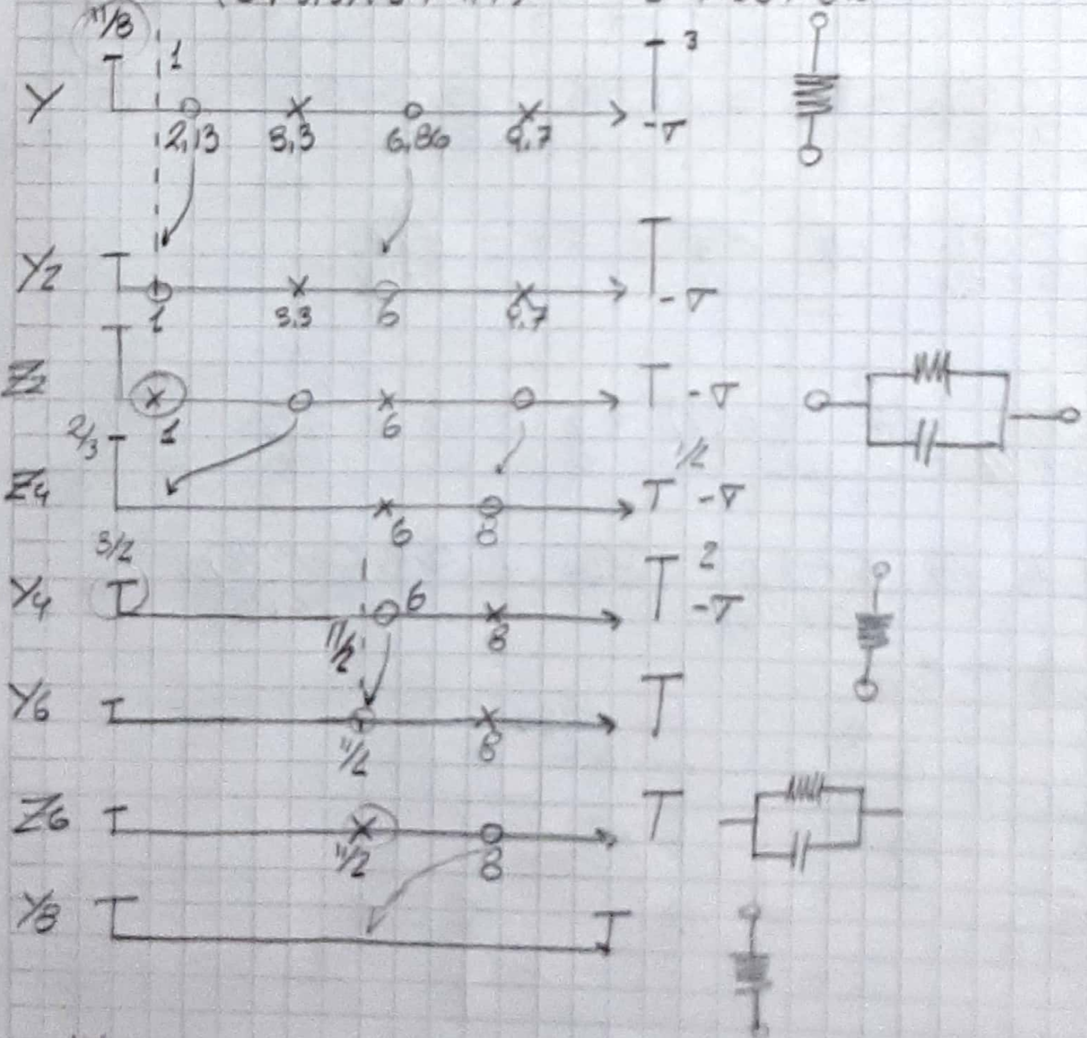
$$Z(s) = \frac{s^2+13s+32}{3s^2+27s+44} = \frac{(s+3{,}3)(s+9{,}7)}{3(s+2{,}13)(s+6{,}86)}$$



YRC

↳ $Y_{RC}(0) < Y_{RC}(\infty)$

$$Y = \frac{3(s+2{,}13)(s+6{,}86)}{(s+3{,}3)(s+9{,}7)} = \frac{3s^2+27s+44}{s^2+13s+32}$$



$$Y_2\big|_{s=-1} = Y - Y_1 = 0 \Rightarrow Y_1 = 3\frac{(-1+2{,}13)(-1+6{,}86)}{(-1+3{,}3)(-1+9{,}7)} \cdot 1$$

$$Y_2 = \frac{3s^2+27s+44}{s^2+13s+32} - 1 = \frac{3s^2+27s+44 - (s^2+13s+32)}{s^2+13s+32}$$

$$Y_2 = \frac{2s^2+14s+12}{s^2+13s+32} \Rightarrow Z_2 = \frac{s^2+13s+32}{2(s^2+7s+6)} = \frac{(s+3,3)(s+9,7)}{2(s+1)(s+6)}$$

$$Z_4 = Z_2 - \frac{k_1}{(s+1)} \Rightarrow k_1 = \lim_{s\to -1} Z_2\,(s+1) = \frac{s^2+13s+32}{2(s+6)} = 2$$

$$Z_4 = \frac{s^2+13s+32 - 2.2(s+6)}{2(s+1)(s+6)} = \frac{s^2+9s+8}{2(s+1)(s+6)} = \frac{\cancel{(s+1)}(s+8)}{2\cancel{(s+1)}(s+6)}$$

$$\Rightarrow Z_4 = \frac{(s+8)}{2(s+6)} \Rightarrow Y_4 = \frac{2(s+6)}{s+8}$$

$$Y_6\Big|_{s=-5} \frac{2(s+6)}{s+8} - Y_5 = 0 \Rightarrow Y_5 = \lim_{s\to -11/2} \frac{2(-11/2+6)}{-11/2+8} = 2/5$$

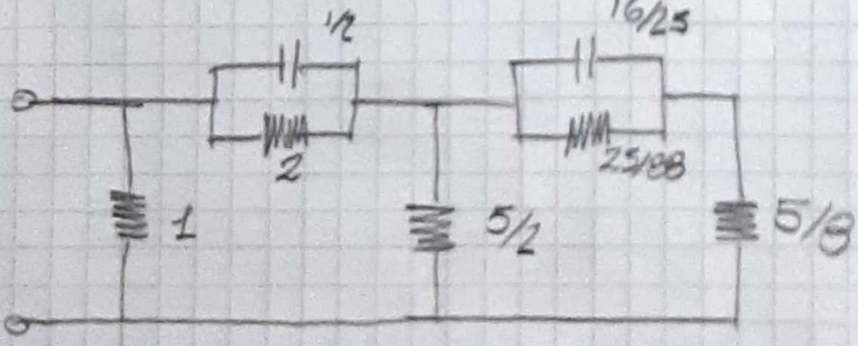
$$Y_6 = \frac{2(s+6)}{s+8} - 2/5 = \frac{2(s+6) - 2/5\,(s+8)}{(s+8)} = \frac{8/5\,(s+11/2)}{(s+8)}$$

$$Z_6 = \frac{5}{8}\frac{(s+8)}{(s+11/2)} \Rightarrow Z_8 = Z_6 - \frac{k_2}{s+11/2}$$

$$k_2 = \lim_{s\to -11/2} Z_6\,.\,(s+11/2) = \frac{5}{8}(s+8) = \frac{25}{16}$$

$$\Rightarrow Z_8 = \frac{5/8(s+8) - 25/16}{(s+11/2)} = 5/8\,\frac{\cancel{(s+11/2)}}{\cancel{(s+11/2)}}$$

$$\Rightarrow Z_8 = 5/8$$



Tanque 1 : $Z = \dfrac{2}{s+1} = \dfrac{1}{\frac{s}{2}+\frac{1}{2}}$ $\quad R_1 = 2$, $C_1 = 1/2$

" 2 : $Z = \dfrac{25/16}{s+11/2} = \dfrac{1}{s\frac{16}{25}+\frac{88}{25}}$ $\Rightarrow R_2 = 25/88$, $C_2 = 16/25$

1b)

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

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

$$Z_{21} = \left.\frac{V_2}{I_1}\right|_{I_2=0} \quad y \quad Z_{22} = \left.\frac{V_2}{I_2}\right|_{I_1=0}$$

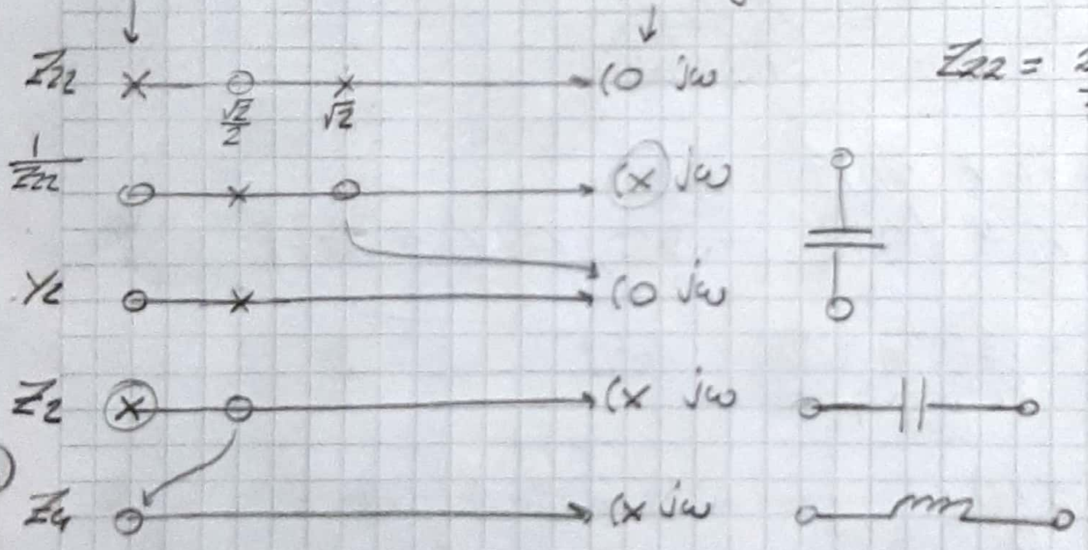
$$T = \left.\frac{I_2}{I_1}\right|_{V_2=0} = \frac{Z_{21}}{Z_{22}}$$

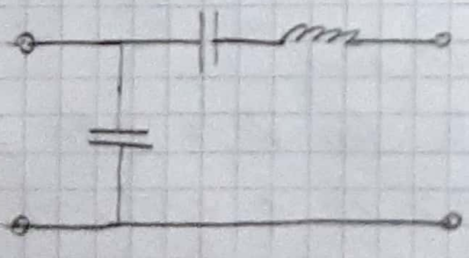
1°) se excita con I_1 ∴ 1° componente en derivación

2°) $V_2 = 0$ ∴ Último componente en serie.

Z_{21} impone polos en 0 y en ∞

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





$$\frac{1}{Z_{22}} = \frac{s(s^2+2)}{2(s^2+1/2)} \Rightarrow Y_2 = \frac{1}{Z_{22}} - k_\infty s$$

$$k_\infty = \lim_{s\to\infty} \frac{1}{Z_{22}}\frac{1}{s} = \lim_{s\to\infty} \frac{(s^2+2)}{2(s^2+1/2)} = \frac{1}{2} \quad ∴ \; C_1 = 1/2$$

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

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

$$Z_2 = \frac{2(s^2+1/2)}{3/2\, s} \Rightarrow Z_4 = Z_2 - \frac{K_0}{s}$$

$$K_0 = \lim_{s\to 0} Z_2 \cdot s = \frac{2(0+1/2)}{3/2} = 2/3$$

$$\Rightarrow Z_4 = \frac{4(s^2+1/2)}{3s} - \frac{2}{3s} = \frac{4s^2 \cancel{+2} \cancel{-2}}{3s} = \frac{4}{3} s$$

TS 11-2

$$T(s) = \left.\frac{V_2}{V_1}\right|_{I_2=0} = \frac{K(s+1)}{(s+2)(s+4)}$$

$$I_1 = Y_{11} V_1 + Y_{21} V_2$$
$$I_2 = Y_{21} V_1 + Y_{22} V_2 \xrightarrow{I_2=0} -Y_{21} V_1 = Y_{22} V_2$$

$$\Rightarrow T(s) = \left.\frac{V_2}{V_1}\right|_{I_2=0} = \frac{-Y_{21}}{Y_{22}}$$

$$Y_{21} = \frac{(s+1)}{D} \quad y \quad Y_{22} = \frac{(s+2)(s+4)}{D}$$

D
↳ tiene que establecer: - Alternancia

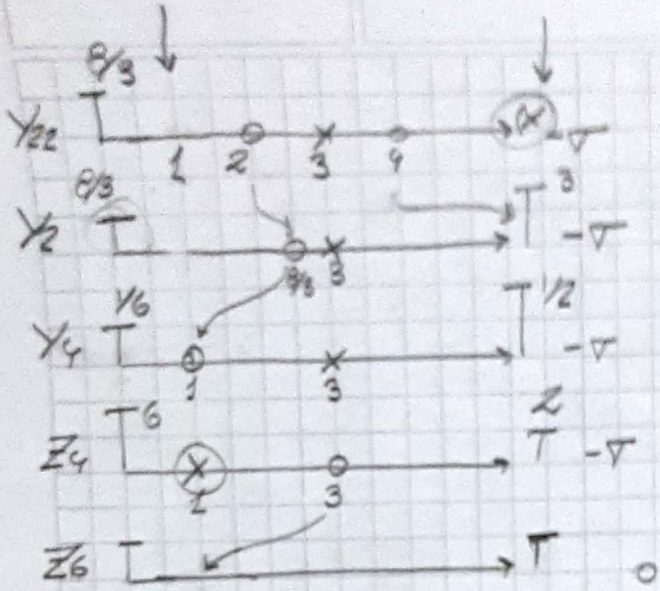
propongo $D = (s+3)$ — ± 1 orden V = orden que N

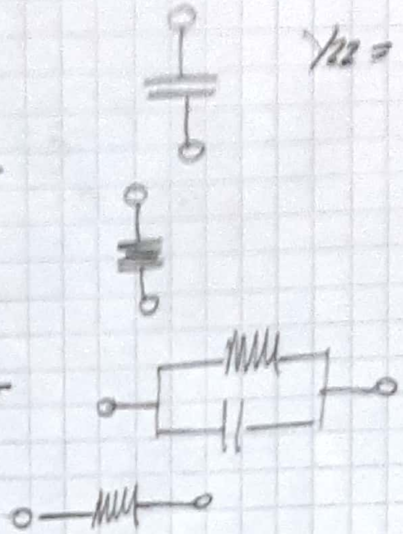
— $Y_{RC}(0) < Y_{RC}(\infty)$

$$\Rightarrow Y_{21} = \frac{(s+1)}{(s+3)}$$ ↳ tengo que hacer remociones en -1

- Excito con V_1 ∴ 1° comp en serie
- $I_2 = 0$ ∴ último comp en derivación

NOTA





$$Y_{22} = \frac{(s+2)(s+4)}{(s+3)}$$

$$Y_2 = Y_{22} - k_\infty s \quad \Rightarrow \quad k_\infty = \lim_{s \to \infty} \frac{Y_{22}}{s} = 1$$

$$Y_2 = \frac{s^2+6s+8}{s+3} - s = \frac{s^2+6s+8 - s(s+3)}{s+3}$$

$$Y_2 = \frac{3s+8}{s+3} = \frac{3(s+8/3)}{s+3}$$

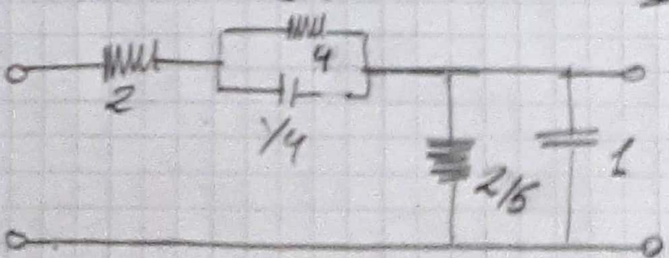
$$Y_4\Big|_{s=-1} = Y_2 - G_1 = 0 \quad \Rightarrow \quad Y_2\Big|_{s=-1} = G_1 = 3\frac{(-1+8/3)}{-1+3} = 5/2$$

$$Y_4 = \frac{3s+8}{s+3} - 5/2 = \frac{3s+8 - 5/2(s+3)}{s+3} = \frac{1/2(s+1)}{(s+3)}$$

$$Z_4 = 2\frac{(s+3)}{s+1} \quad \Rightarrow Z_6 = Z_4 - \frac{k_1}{s+1}$$

$$k_1 = \lim_{s \to -1} Z_4(s+1) = 2(-1+3) = 4$$

$$\Rightarrow Z_6 = \frac{2s+6}{s+1} - \frac{4}{s+1} = \frac{2(s+1)}{s+1} \quad \Rightarrow Z_6 = 2$$



$$Z_s = \frac{k_1}{s+1} = \frac{1}{s\frac{1}{k} + \frac{1}{k}}$$