TS12

domingo, 9 de octubre de 2022 7:32 p. m.

1) Ej. 6 TP Síntesis de Cuadripolos)

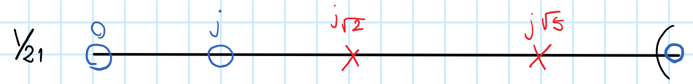
Sintetizar un cuadripolo que cumpla con los siguientes parámetros:

* Ultimo elemento en serie

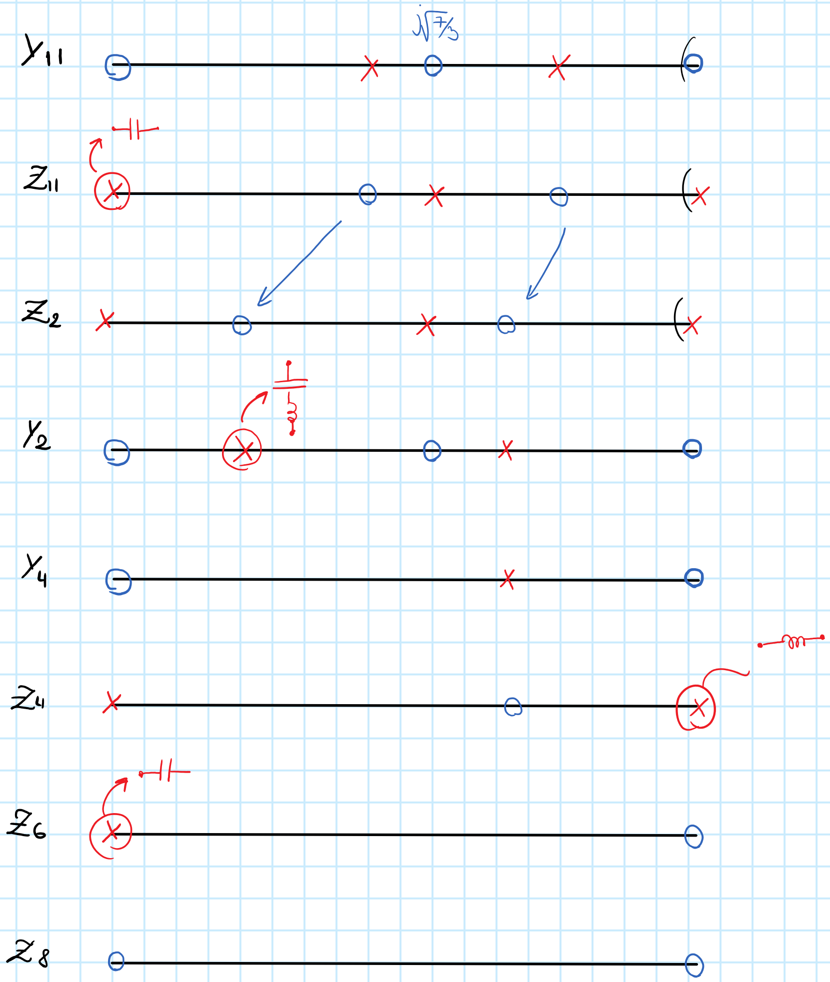
$$Y_{11} = \frac{I1}{V1}\bigg|_{V_2=0} = \frac{3s.(s^2+7/3)}{(s^2+2)(s^2+5)} \qquad Y_{21} = \frac{I2}{V1}\bigg|_{V_2=0} = \frac{s.(s^2+1)}{(s^2+2)(s^2+5)}$$

a) Obtener la topología mediante la **síntesis gráfica**, es decir la red sin valores.
b) Calcular el valor de los componentes, es decir la **síntesis analítica.**

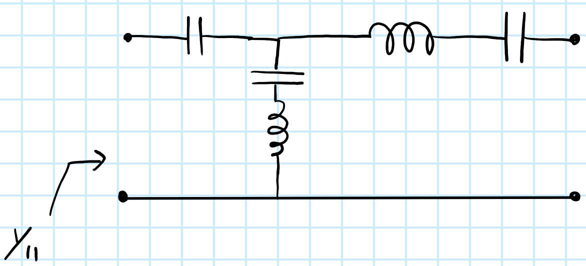
a)



Tenemos que sintetizar Y_{11}, de tal manera que cumpla los ceros de Y_{21}



Red



$$Z_2 = Z_{11} - \frac{K_0}{s} = 0 \to K_0' = \lim_{s^2 \to -1} Z_{11} \cdot s = \lim_{s \to -1} \frac{(s^2+2)(s^2+5)}{3\cancel{s}(s^2+7/3)} \cdot \cancel{s} = \frac{(-1+2)(-1+5)}{3(-1+7/3)}$$

$$K_0' = 1$$

$$Z_2 = \frac{(s^2+2)(s^2+5)}{3s(s^2+7/3)} - \frac{1}{s} = \frac{(s^2+2)(s^2+5) - 3(s^2+7/3)}{3s(s^2+7/3)} = \frac{s^4+5s^2+2s^2+10-3s^2-7}{3s(s^2+7/3)}$$

$$Z_2 = \frac{s^4+4s^2+3}{3s(s^2+7/3)} \overset{C.A}{\Rightarrow} \frac{(s^2+1)(s^2+3)}{3s(s^2+7/3)}$$

C.A

$z = s^2$

$s^4+4s^2+3 \Rightarrow z^2+4z+3 \Rightarrow$

$\Rightarrow (z+1)(z+3) \wedge z = s^2$

$\therefore (s^2+1)(s^2+3)$

$$Y_4(s) = Y_2(s) - \frac{2K_i s}{s^2+1} = 0 \Rightarrow 2K_i = \lim_{s^2 \to -1} Y_2(s)\frac{(s^2+1)}{s}$$

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

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

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

$$Z_6 = Z_4(s) - sK_\infty = 0 \to K_\infty = \lim_{s^2 \to \infty} \frac{Z_4(s)}{s} = \lim_{s^2 \to \infty} \frac{s^2+3}{s \cdot s} \to K_\infty = 1$$

$$Z_6 = \frac{s^2+3}{s} - s = \frac{\cancel{s^2}+3-\cancel{s^2}}{s} \to Z_6 = \frac{3}{s}$$

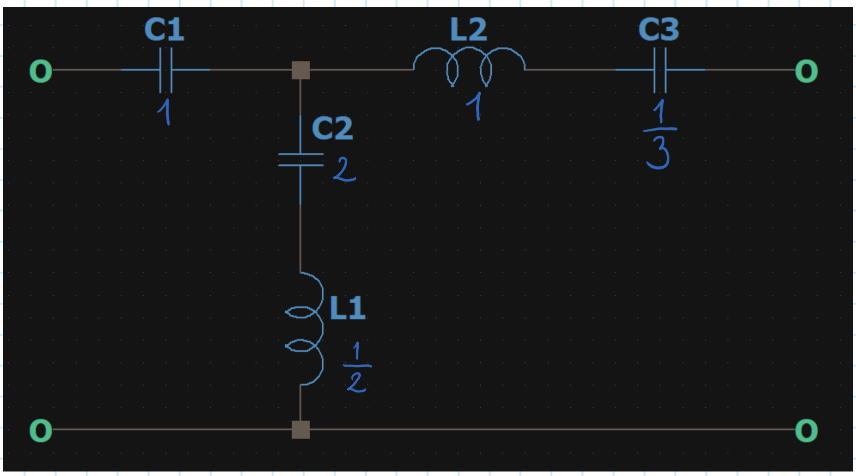
$$Z_8 = Z_6 - \frac{K_0}{s} = 0 \Rightarrow \frac{3}{s} - \frac{K_0}{s} = 0 \quad \therefore K_0 = 3$$

$\frac{K_0'}{s} \to C = \frac{1}{K_0'}$ $\qquad$ $L = \frac{1}{2K_i}$ $\qquad$ $C = \frac{2K_i}{\omega_i^2}$

Capacitores $K_0' = 1$ $\quad K_0 = 3$ $\qquad$ Inductores $K_\infty = 1$ $\qquad$ Tanques $\to \omega_i = 1 \wedge 2K_i = 2$

$C_1 = 1$ $\quad C_3 = \frac{1}{3}$ $\qquad L_2 = 1$ $\qquad L_1 = \frac{1}{2}$ $\quad C_2 = 2$

SINTESIS



2) Dada la siguiente transferencia:

$$T(s) = \left.\frac{V2}{V1}\right|_{I_2=0} = \frac{k.(s+1)}{(s+2)(s+4)}$$

DISIPATIVA

a) Obtener la topología circuital que respeta la transferencia solicitada, utilizando parámetros Z e Y.

b) Calcular el valor de los componentes y el parámetro k.

$$T(s)\Big|_{I_2=0} = \frac{K(s+1)}{(s+2)(s+4)} = K\,\frac{\frac{P}{D}}{\underbrace{\frac{Q}{D}}_{\text{Tiene que ser FRP}}}$$

* Como $I_2=0$, el último elemento del cuadripolo tiene que estar en derivación

Como es un transferencia de TENSIÓN $\frac{Q}{D}$ — Z_{11} / Y_{22}

$$\therefore\quad Z_{11} = \frac{(s+2)(s+4)}{D} = \frac{P'}{Q'} \qquad \vee \qquad Y_{22} = \frac{(s+2)(s+4)}{D} = \frac{P'}{Q'}$$

Elijo D
- Z_{11} sea Z_{RC}
- $Z_{RC}(0) > Z_{RC}(\infty)$
- $Gr\{P'\} \leq Gr\{Q'\}$

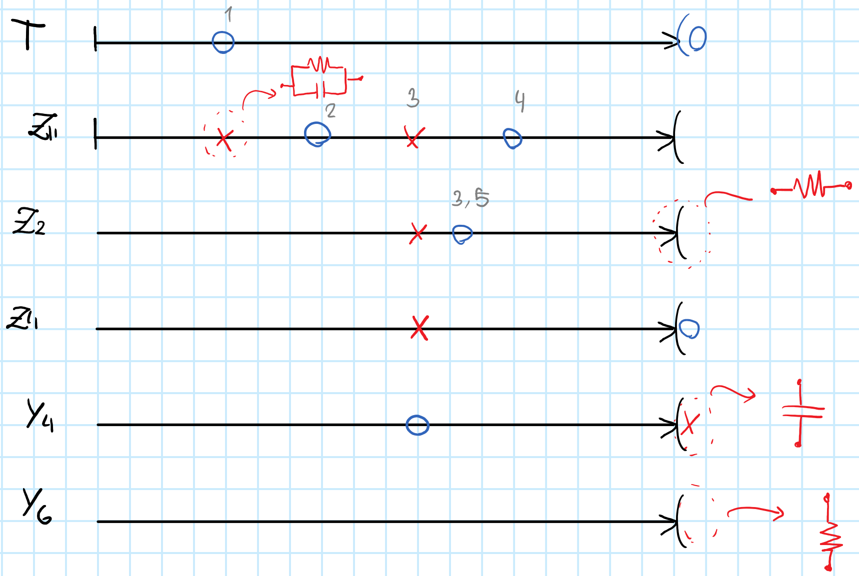
Elijo D
- Y_{22} sea Y_{RC}
- $Y_{RC}(0) < Y_{RC}(\infty)$
- $Gr\{P'\} \geq Gr\{Q'\}$

- AMBOS TIENEN QUE TENER ALTERNANCIA
- TIENEN QUE RESPETAR LOS CEROS DE LA TRANSFERENCIA

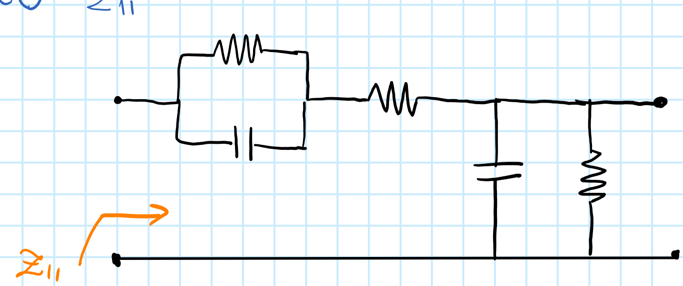
a)

CASO Z_{11}: Elijo $D = (s+1)(s+3)$

$$Z_{11} = \frac{(s+2)(s+4)}{(s+1)(s+3)}$$



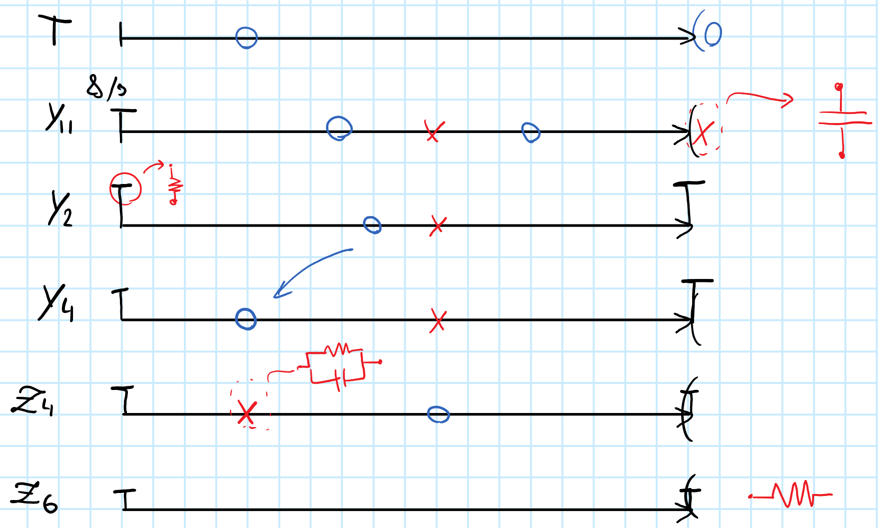
Circuito Z_{11}



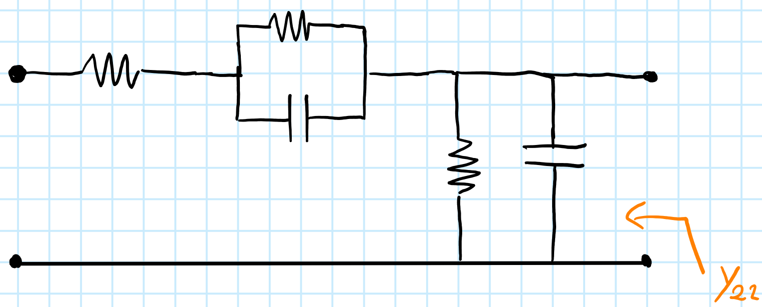
Caso Y_{22}: $D = (s+3)$

$$Y_{22}\Big|_{V_1=0} = \frac{(s+2)(s+4)}{(s+3)}$$

ULTIMO ELEMENTO RETIRADO EN SERIE



Circuito Y_{22}



b) Valores Z

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

$$Z_2 = \frac{(s+2)(s+4)}{(s+1)(s+3)} - \frac{3/2}{(s+1)} = \frac{(s+2)(s+4) - 3/2\,(s+3)}{(s+1)(s+3)} = \frac{s^2+6s+8-3/2\,s - 9/2}{(s+1)(s+4)}$$

$$Z_2 = \frac{\cancel{(s+1)}(s+7/2)}{\cancel{(s+1)}(s+3)} \rightarrow Z_2 = \frac{(s+7/2)}{(s+3)}$$

$$Z_4 = Z_2 - K_\infty = 0 \rightarrow K_\infty = \lim_{s\to\infty} \frac{(s+7/2)}{(s+3)} \Rightarrow \boxed{K_\infty = 1}$$

$$Z_4 = \frac{(s+7/2)}{(s+3)} - 1 = \frac{(\cancel{s}+7/2-\cancel{s}-3)}{(s+3)} \rightarrow Z_4 = \frac{1/2}{s+3}$$

$Y_6 = Y_4 - sK'_\infty = 0 \rightarrow K'_\infty = \lim_{s\to\infty} \frac{(s+3)}{1/2}\cdot\frac{1}{s} \Rightarrow \boxed{K'_\infty = 2}$

$Y_6 = 2(s+3) - 2s = \boxed{6}$

$sC = sK_\infty \rightarrow C = K_\infty$

$\frac{K_i}{s+\sigma} = \frac{1}{\frac{s}{K_i}+\frac{\sigma}{K_i}} \} Y \rightarrow C = \frac{1}{K_i} \qquad R = \frac{K_i}{\sigma}$

Valores Componentes

Tanque

$R_1 = \frac{K_i}{\sigma} = \frac{3}{2}$

$C_1 = \frac{1}{K_i} = \frac{2}{3}$

R_∞

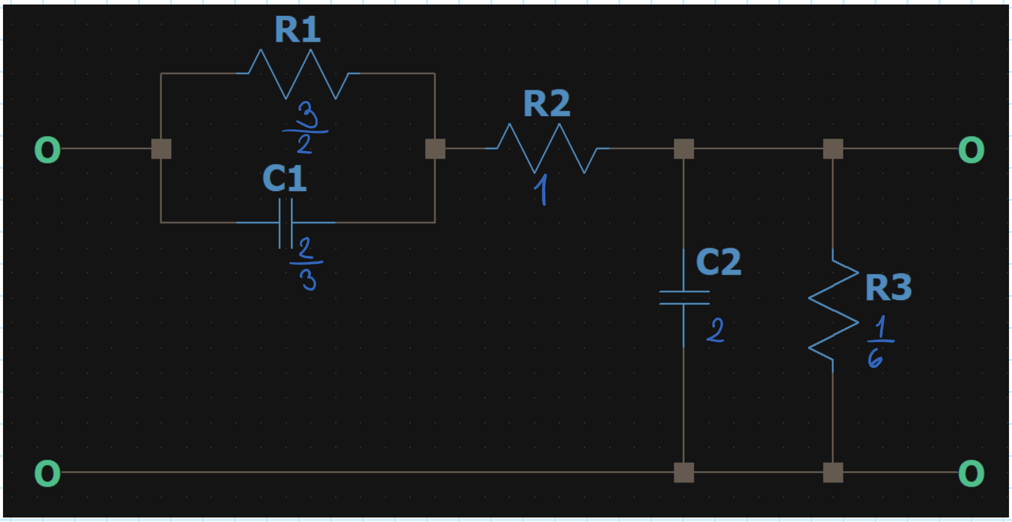
$R_2 = K_\infty = 1$

C_∞

$C_3 = K'_\infty = 2$

R Final

$R_3 = \frac{1}{6}$



Valores Y

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

$Y_2 = \frac{(s+2)(s+4)}{(s+3)} - s = \frac{\cancel{s^2}+6s+8-\cancel{s^2}-3s}{(s+3)} = \frac{3s+8}{(s+3)}$

$Y_4 = Y_2 - G_0 = 0 \rightarrow G_0 = \lim_{s\to -1}\frac{3s+8}{s+3} = \frac{-3+8}{-1+3} \Rightarrow \frac{5}{2}$

$Y_4 = \frac{3s+8}{s+3} - 5/2 = \frac{3s+8-5/2\, s - 15/2}{s+3} \quad \frac{1/2\, s + 1/2}{s+3} \Rightarrow Y_4 = \frac{(s+1)}{2(s+3)}$

$Z_6 = Z_4 - \frac{K_i}{s+1} = 0 \rightarrow K_i = \lim_{s\to-1}\frac{2(s+3)}{\cancel{(s+1)}}\cdot\cancel{(s+1)} \Rightarrow K_i = 4$

$Z_6 = \frac{2(s+3)}{(s+1)} - \frac{4}{(s+1)} = \frac{2\cancel{(s+1)}}{\cancel{s+1}} \rightarrow Z_6 = 2$

Valores Componentes

Cap. Inf — R parcial — Tanque — R final

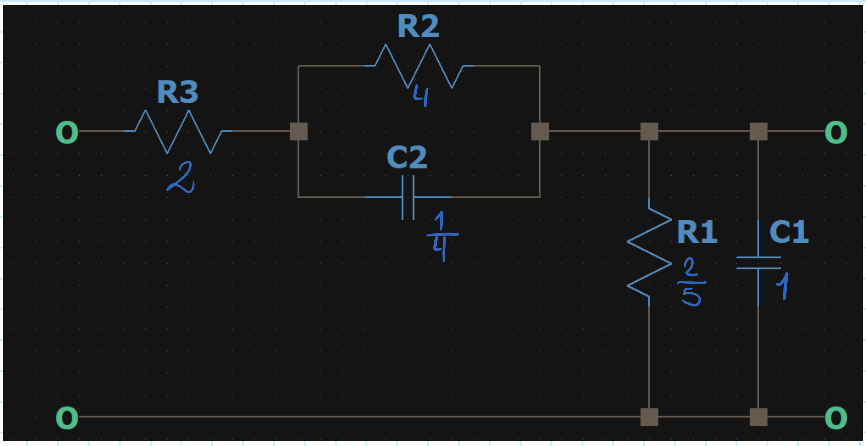
$s K_\infty = s C \to C_1 = K_\infty$

$C_1 = 1$

$G_0 = \frac{1}{R_1} \to R_1 = \frac{1}{G_1} = \frac{2}{5}$

$R_2 = \frac{K_i}{\sigma} = 4$ $\quad C_2 = \frac{1}{K_i} = \frac{1}{4}$

$R_3 = 2$

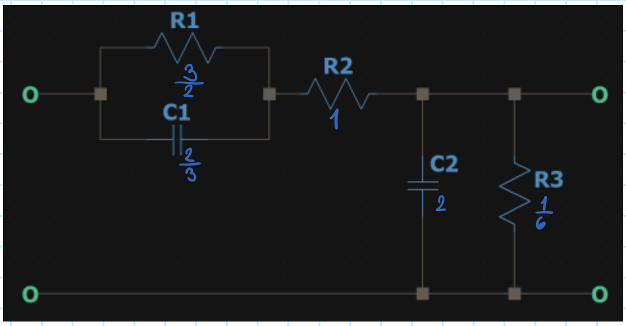


b) Calcular el valor de los componentes y el parámetro k.

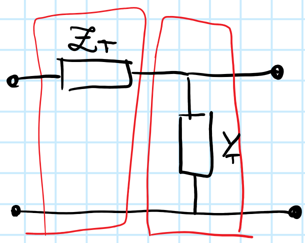
$$T(s) = \left.\frac{V2}{V1}\right|_{I_2=0} = \frac{k.(s+1)}{(s+2)(s+4)}$$

CALCULO LA TRANSFERENCIA DE LA RED CON SU MATRIZ T

RED Z



$\Rightarrow$



SOLO NOS INTERESA EL PARAMETRO A

$$T = \begin{pmatrix} 1 & Z_T \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ Y_T & 1 \end{pmatrix}$$

$$Z_T = 1 + \frac{\frac{3}{2} \cdot \frac{3}{2s}}{\frac{3}{2} + \frac{3}{2s}} = 1 + \frac{\frac{9}{4s}}{\frac{3s+3}{2s}}$$

$$Z_T = 1 + \frac{\cancel{9}^{3}}{\cancel{6}_{2}(s+1)} = \frac{2(s+1)+3}{2(s+1)} = \frac{2s+5}{2(s+1)}$$

$$Y_T = 6 + 2s$$

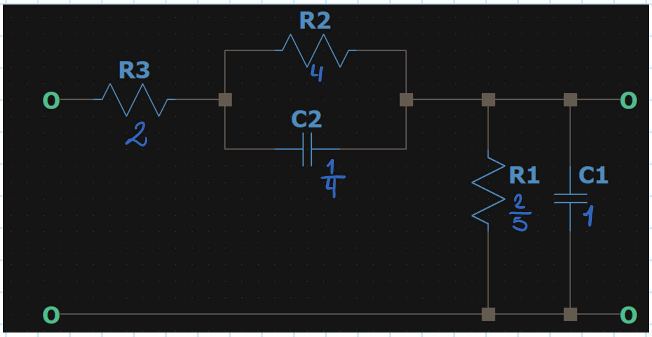
$$A = 1 + Z_T Y_T$$

$$A = 1 + \frac{\cancel{2}(s+3)(2s+5)}{\cancel{2}(s+1)}$$

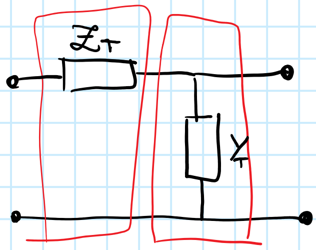
$$A = \frac{s+1+2s^2+11s+15}{(s+1)} = \frac{2s^2+12s+16}{s+1} = \frac{2(s+2)(s+4)}{(s+1)}$$

$$\boxed{T = \frac{1}{A} = \frac{1}{2} \cdot \frac{(s+1)}{(s+2)(s+4)} \quad \text{con} \quad K = \frac{1}{2}}$$

RED Y   MISMO PROCEDIMIENTO QUE ANTES



$\Rightarrow$



$$Z_P = \frac{4 \cdot \frac{4}{s}}{4 + \frac{4}{s}} = \frac{\frac{16}{\cancel{s}}}{\frac{4(s+1)}{\cancel{s}}} = \frac{4}{(s+1)}$$

$$Z_T = 2 + \frac{4}{s+1} = \frac{2(s+1) + 4}{s+1} = \frac{2s+6}{s+1}$$

$$Y_T = \frac{5}{2} + s = \frac{5+2s}{2}$$

$$T = \begin{pmatrix} 1 & Z_T \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ Y_T & 1 \end{pmatrix}$$

$$A = 1 + Z_T Y_T$$

$$= 1 + \frac{\cancel{2}(s+3)}{(s+1)} \cdot \frac{(2s+5)}{\cancel{2}}$$

$$\frac{s+1 + 2s^2 + 11s + 15}{(s+1)} = \frac{2s^2 + 12s + 16}{s+1} = \frac{2(s+2)(s+4)}{(s+1)}$$

$$\boxed{T = \frac{1}{A} = \frac{1}{2} \cdot \frac{(s+1)}{(s+2)(s+4)} \quad \text{con} \quad K = \frac{1}{2}}$$