(II) Utilizo parámetros Y

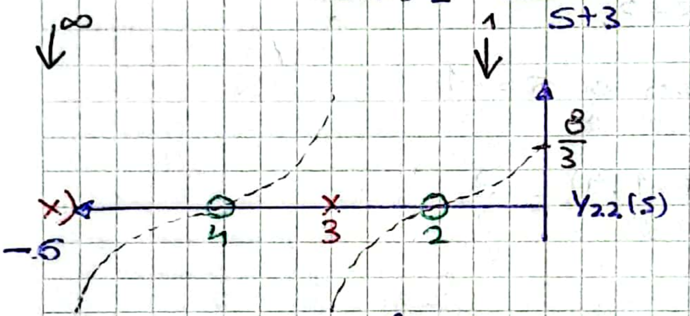
$$T(s) = \left.\frac{V_2(s)}{V_1(s)}\right|_{I_2=0} = -\frac{Y_{21}(s)}{Y_{22}(s)} = \frac{\frac{Y_{21}(s)}{A(s)}}{\frac{Y_{22}(s)}{A(s)}}$$

Elijo convenientemente a $A(s)$ para que $Y_{22}(s)$ sea FRP y cumpla con las propiedades de una $Y_{RC}(s)$.

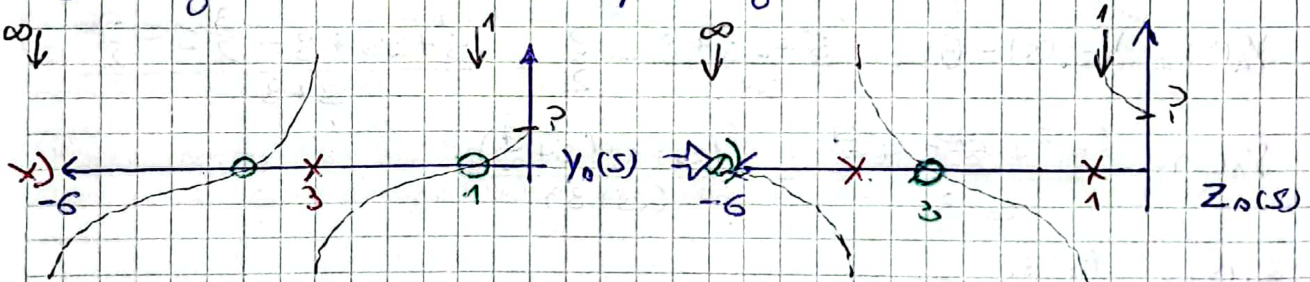
Se propone $A(s) = s+3$

Entonces

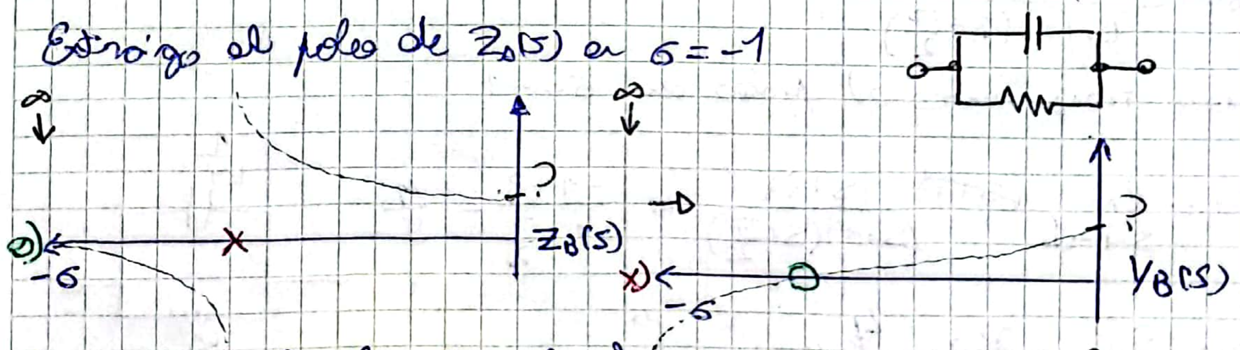
$$Y_{21}(s) = \frac{k(s+1)}{s+3} \; ; \; Y_{22}(s) = \frac{(s+2)(s+4)}{(s+3)}$$



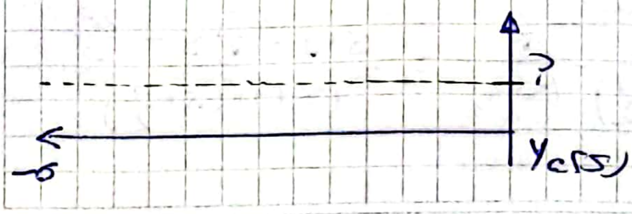
Extraigo un polo de $\sigma = 0$ para ajustar un cero en $\sigma = -1$



Extraigo el polo de $Z_0(s)$ en $\sigma = -1$



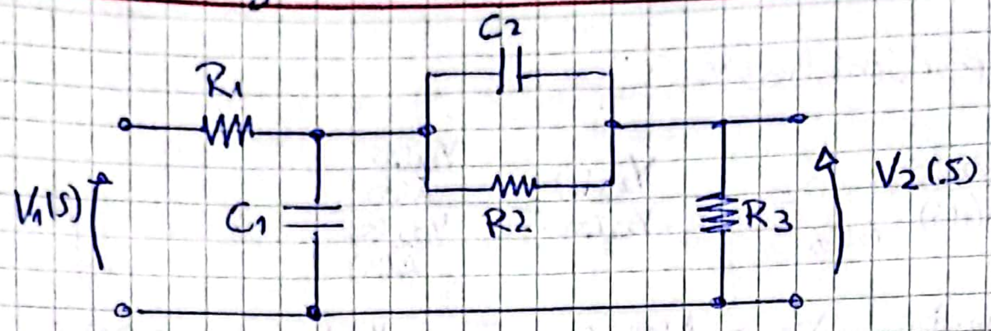
Remuevo el polo de infinito en $Y_B(s)$



→ Tengo una resistencia, pero como excitación generador de tensión ideal, la saco en serie

La topología circuital resulta

a)



b) Se realiza ahora, la síntesis analítica

$$Y_{22}(s) = \frac{(s+2)(s+4)}{(s+3)} = \frac{s^2+6s+8}{s+3}$$

Extraigo R3 para fijar un cero en $\sigma = -1$

$$G_3 = Y_{22}(s=-1) = \frac{(-1+2)(-1+4)}{(-1+3)} = \frac{3}{2}$$

$$R_3 = \frac{2}{3} //$$

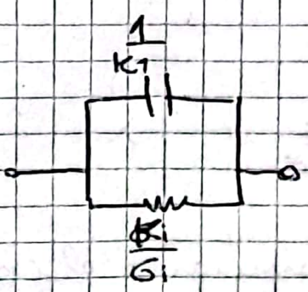
$$Y_A(s) = Y_{22}(s) - G_3 = \frac{s^2+6s+8}{s+3} - \frac{3}{2} = \frac{s^2+6s+8-\frac{3}{2}s-\frac{9}{2}}{s+3}$$

$$Y_A(s) = \frac{s^2+\frac{9}{2}s+\frac{7}{2}}{s+3} = \frac{(s+1)(s+\frac{7}{2})}{(s+3)}$$

$$Z_A(s) = \frac{(s+3)}{(s+1)(s+\frac{7}{2})}$$

Ahora remuevo el polo en $\sigma = -1$

$$K_1 = \lim_{s \to -1} \cancel{(s+1)} \frac{(s+3)}{\cancel{(s+1)}(s+\frac{7}{2})} = \frac{-1+3}{-1+\frac{7}{2}} = \frac{4}{5}$$



$$C_2 = \frac{5}{4} // ; \quad R_2 = \frac{4}{5} //$$

$$Z_B(s) = Z_A(s) - \frac{K_1}{s+1} = \frac{s+3}{(s+1)(s+\frac{7}{2})} - \frac{\frac{4}{5}}{(s+1)} = \frac{s+3-\frac{4}{5}s-\frac{28}{10}}{(s+1)(s+\frac{7}{2})}$$

$$Z_B(s) = \frac{\frac{1}{5}(s+1)}{(s+1)\left(s+\frac{7}{2}\right)} = \frac{1}{5\left(s+\frac{7}{2}\right)} \Rightarrow Y_B(s) = 5s + \frac{35}{2}$$

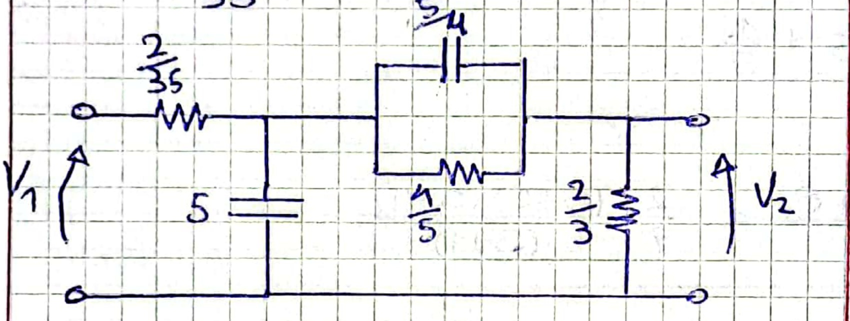
Removemos el polo en infinito de $Y_B(s)$

$$K_\infty = \lim_{s\to\infty} \frac{Y_B(s)}{s} = 5$$

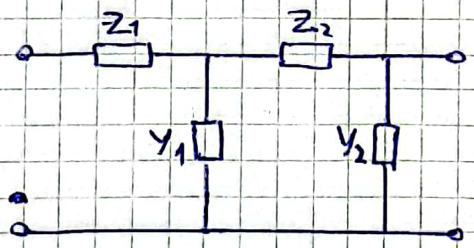
Entonces $C_1 = 5$

$$Y_C(s) = Y_B(s) - 5s = \frac{35}{2} \Rightarrow Z_C(s) = \frac{2}{35}$$

$R_1 = \frac{2}{35}$



Para verificar la transferencia se puede pensar al circuito como 2 cuadripolos L en cascada



$$T_T = T_1 \cdot T_2 = \begin{pmatrix} 1+Z_1Y_1 & Z_1 \\ Y_1 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1+Z_2Y_2 & Z_2 \\ Y_2 & 1 \end{pmatrix}$$

Para calcular la transferencia de tensiones nos interesa A.

$$A_T = (1 + Z_1 Y_1)(1 + Z_2 Y_2) + Z_1 Y_2$$

$$A_T = \left(1 + \frac{2}{35} 5S\right)\left(1 + \frac{1}{S\frac{5}{4} + \frac{5}{4}} \cdot \frac{3}{2}\right) + \frac{2}{35} \cdot \frac{3}{2}$$

$$A_T = \left(1 + \frac{2}{7} S\right)\left(\frac{(S+1) + \frac{6}{5}}{S+1}\right) + \frac{3}{35}$$

$$A_T = \frac{\left(1 + \frac{2}{7} s\right)\left(s + \frac{11}{5}\right)}{S+1} + \frac{3}{35}$$

$$A_T = \frac{S + \frac{11}{5} + \frac{2}{7} s^2 + \frac{22}{35} S + \frac{3}{35} S + \frac{3}{35}}{S+1}$$

$$A_T = \frac{\frac{2}{7} S^2 + \frac{12}{7} S + \frac{16}{7}}{S+1}$$

$$A_T = \frac{2}{7} \frac{S^2 + 6S + 8}{S+1} = \frac{2}{7} \frac{(S+2)(S+4)}{(S+1)}$$

$$\boxed{T(S) = \frac{V_2(S)}{V_1(S)} = \frac{1}{A_T} = \frac{7}{2} \frac{(S+1)}{(S+2)(S+4)}}$$