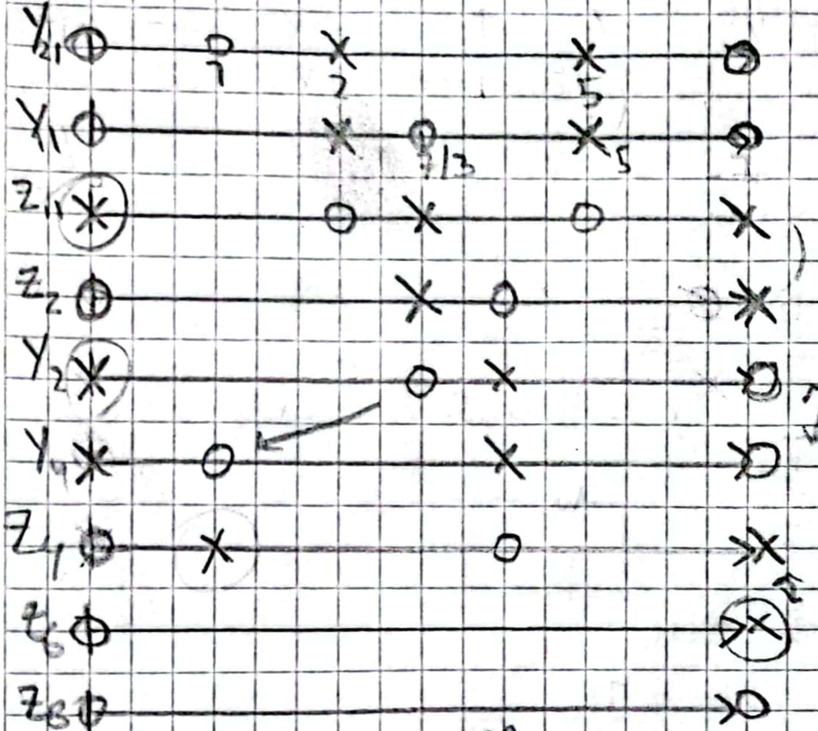
TB 12

1) $Y_{11} = \frac{I_1}{V_1}\Big|_{V_2=0} = \frac{3s(s^2+7/3)}{(s^2+2)(s^2+5)}$ $\qquad Y_{21} = \frac{I_2}{V_1}\Big|_{V_2=0} = \frac{s(s^2+1)}{(s^2+2)(s^2+5)}$



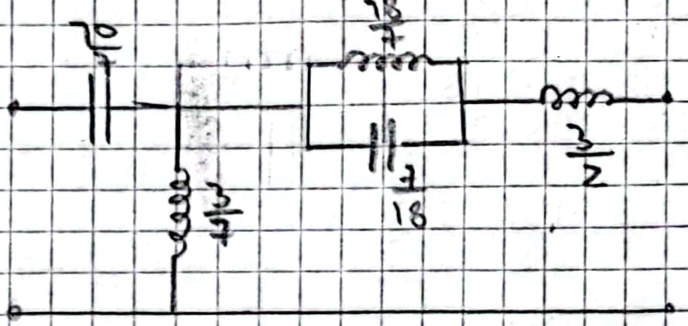
Debo cumplir los ceros de Y_{21}

Polo Z en cero

Remoción parcial en cero

Remuevo tanque

Remuevo polo Z en ∞



Después de calcular abajo

b) $Z_{11} = \frac{(s^2+2)(s^2+5)}{3s(s^2+7/3)} \rightarrow k_0 = \lim_{s\to 0}\frac{(s^2+2)(s^2+5)}{3(s^2+7/3)} = \frac{10}{7}$

$Z_2 = \frac{s^4+7s^2+10}{3s(s^2+7/3)} - \frac{10}{7s} = \frac{s^4+7s^2+10-\frac{30}{7}s^2-10}{3s(s^2+\frac{7}{3})} = \frac{s^4+\frac{19}{7}s^2}{3s(s^2+\frac{7}{3})}$

$Z_2 = \frac{s(s^2+\frac{19}{7})}{3(s^2+\frac{7}{3})} \rightarrow Y_2 = \frac{7(3s^2+7)}{s(7s^2+19)}$

$Y_4\Big|_{s^2=-1} = 0 = Y_2 - Y_3 = \frac{7(3s^2+7)}{s(7s^2+19)}\Big|_{s^2=-1} - \frac{k_1}{s}\Big|_{s^2=-1} = 0 \rightarrow k_1 = \frac{7(3s^2+7)}{7s^2+19}\Big|_{s^2=-1} = \frac{7}{3}$

$Y_1 = \frac{21s^2+49}{s(7s^2+19)} - \frac{7}{3s} = \frac{\frac{14}{3}s^2+\frac{14}{3}}{s(7s^2+19)} = \frac{14(s^2+1)}{3s(7s^2+19)}$

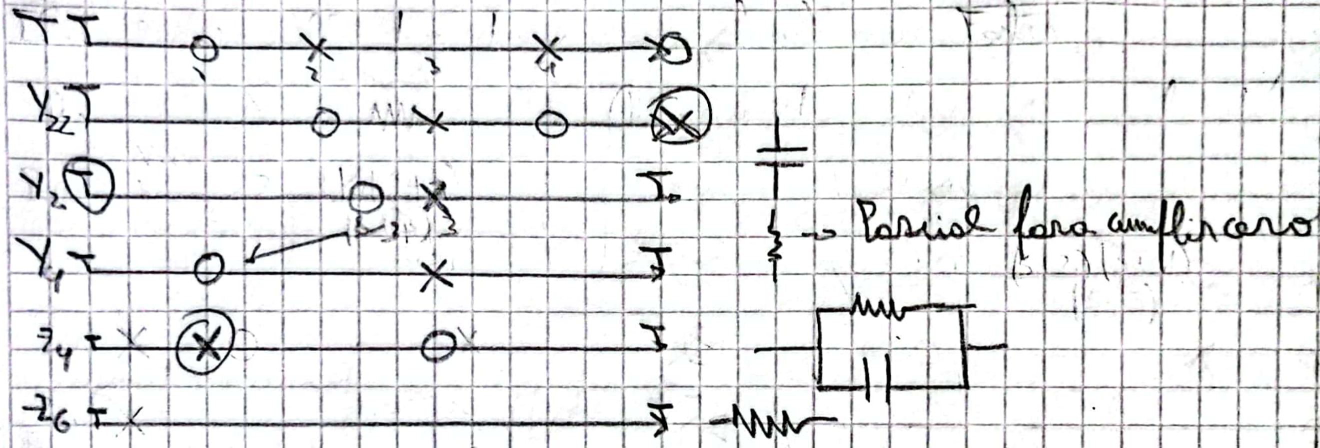
$2k_2 = \lim_{s^2\to -1}\frac{\cancel{s^2+1}}{\cancel{s}}\cdot\frac{3\cancel{s}(7s^2+19)}{14\cancel{(s^2+1)}} = \frac{18}{7}$

$Z_6 = \frac{21s^3+57s}{14(s^2+1)} - \frac{18}{7}\frac{s}{(s^2+1)}\cdot\frac{14}{14} = \frac{21s^3+21s}{14(s^2+1)} = \frac{21s\cancel{(s^2+1)}}{14\cancel{(s^2+1)}}$

$K_3 = \lim_{s\to\infty} \frac{21}{14}\frac{s}{s} = \frac{3}{2}$

2) $T(s) = \frac{V_2}{V_1}\Big|_{I_2=0} = \frac{K(s+1)}{(s+2)(s+4)} = \frac{P/D}{Q/D}$ $Gr\{P\} \leq Gr\{Q\}$

Adopto $Y_{22} = \frac{(s+2)(s+4)}{(s+3)}$ → Para cumplir los ceros
→ Para alternancia



$K_\infty = \lim_{s\to\infty} \frac{(s+2)(s+4)}{s(s+3)} = \frac{s^2+6s+8}{s^2+3s} = 1$

$Y_2 = Y_{22} - s = \frac{s^2+6s+8}{s+3} - \frac{s^2+3s}{s+3} = \frac{3s+8}{s+3}$

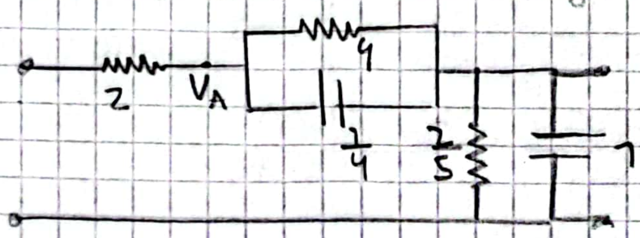
$Y_4\big|_{s=-1} = 0 = Y_2 - K_1 = 0 \to K_1 = \frac{3\cdot(-1)+8}{3-1} = \frac{5}{2}$

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

$2K_2 = \lim_{s\to -1} \frac{(s+3)2}{\cancel{s+1}}\frac{\cancel{(s+1)}}{1} = 4$

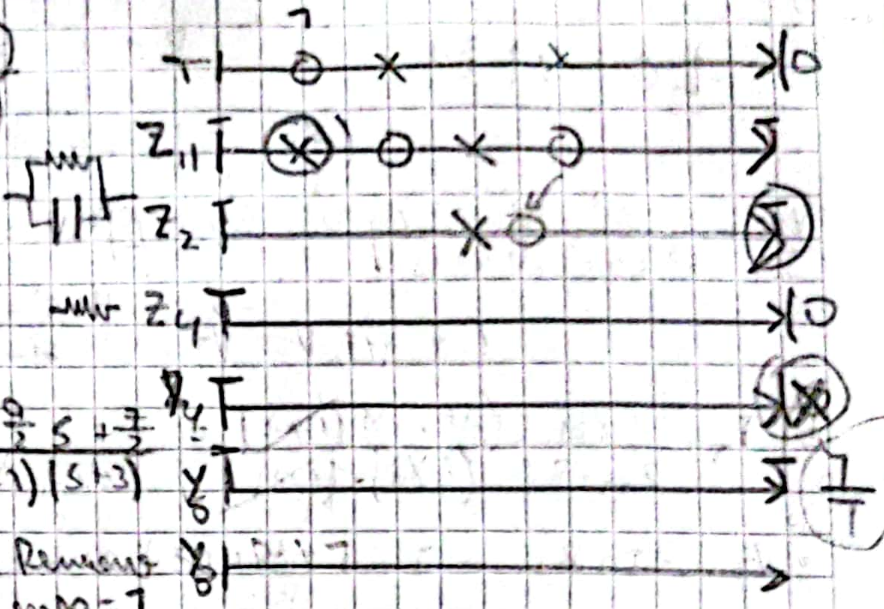
$Z_6 = \frac{2(s+3)}{s+1} - \frac{4}{s+1} = \frac{2s+2}{s+1} = 2$

Retiro Resistencia $R = 2$ $Z_8 = Z_6 - 2 = 0$



NOTA

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



$D = (s+1)(s+3)$

$Z_2 = Z_{11} - \frac{k_1}{s+1} : 0$

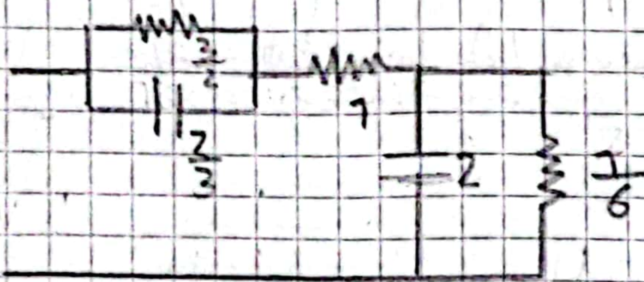
$k_1 = \lim_{s \to -1} \frac{(s+2)(s+4)}{s+3} = \frac{3}{2}$

$Z_2 = \frac{s^2+6s+8}{(s+1)(s+3)} - \frac{3}{2}\frac{1}{s+1} = \frac{s^2+\frac{9}{2}s+\frac{7}{2}}{(s+1)(s+3)}$

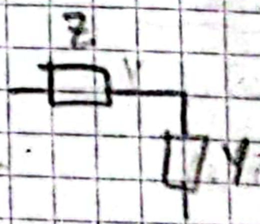
$Z_2 = \frac{s+7/2}{s+3}$ $\quad Z_2(0) = \frac{7}{6}$ $\quad Z_2(\infty) = 1$ Remuevo $R_{\infty} = 1$

$Z_4 = Z_2 - 1 = \frac{1/2}{s+3}$ $\quad k_\infty = \lim_{s \to \infty} \frac{s+3}{1/2\, s} = 2$

$Y_6 = 2(s+3) - 2s = 6$ → Remuevo $R = 6$



b) Calculo transferencia con matriz T de Z



$T_Z = \begin{pmatrix} 1 & Z \\ 0 & 1 \end{pmatrix}$ $\quad T_Y = \begin{pmatrix} 1 & 0 \\ Y & 1 \end{pmatrix}$ $\quad Y = 6 + 2s$

$Z = 1 + \frac{\frac{3}{2s}\cdot\frac{3}{2}}{\frac{3}{2s}+\frac{3}{2}} = 1 + \frac{\frac{9}{4s}}{\frac{3+3s}{2s}} = 1 + \frac{9}{6(s+1)} = \frac{2s+5}{2(s+1)}$

$A = 1 + Z_1 Y_1 = 1 + \frac{4s^2+22s+30}{2(s+1)} = \frac{4s^2+24s+32}{2(s+1)} = 2\frac{(s^2+6s+8)}{s+1}$

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