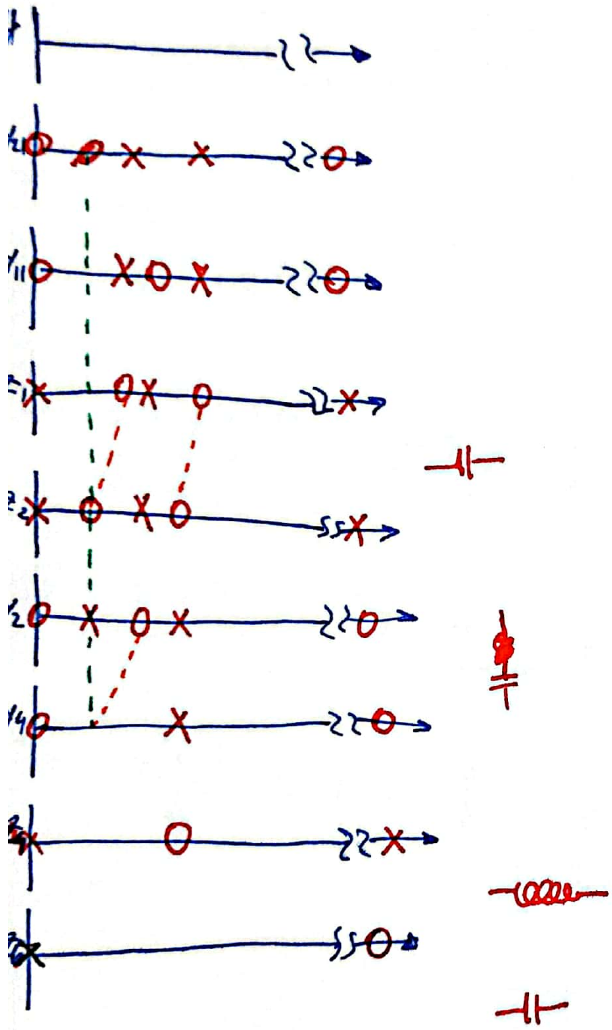
TS12 / #1 /

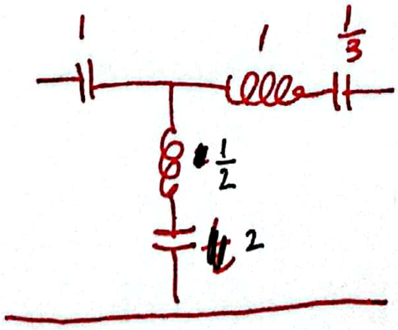
HOJA 1

$$Y_{11} = \left.\frac{I_1}{V_1}\right|_{V_2=0} = \frac{3s(s^2+7/3)}{(s^2+2)(s^2+5)}$$

$$Y_{21} = \left.\frac{I_2}{V_1}\right|_{V_2=0} = \frac{s(s^2+1)}{(s^2+2)(s^2+5)}$$

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





$$Y_{11} = \frac{3s(s^2+7/3)}{(s^2+2)(s^2+5)} = \frac{3s(s^2+7/3)}{s^4+7s^2+10}$$

$$\frac{1}{Y_{11}} = Z_1 = \frac{s^4+7s^2+10}{3s(s^2+7/3)}$$

$$K_{02} = \left.\frac{s(s^4+7s^2+10)}{3s(s^2+7/3)}\right|_{s^2=-1} = \frac{1-7+10}{-3+7} = \frac{4}{4} = 1$$

1

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

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

$$K_4 = \lim_{s^2\to -1} \frac{\cancel{(s^2+1)}}{\cancel{s}} \; \frac{3\cancel{s}(s^2+7/3)}{\cancel{(s^2+1)}(s^2+3)} = \frac{4}{2} = 2 \Rightarrow \frac{2s}{s^2+1}$$

$\frac{1}{2}$ 2

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

$$Z_4 = \frac{s^2+3}{s}$$

$$K_6 = \lim_{s\to\infty} \frac{1}{s}\,\frac{s^2+3}{s} = 1$$

1

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

$\frac{1}{3}$

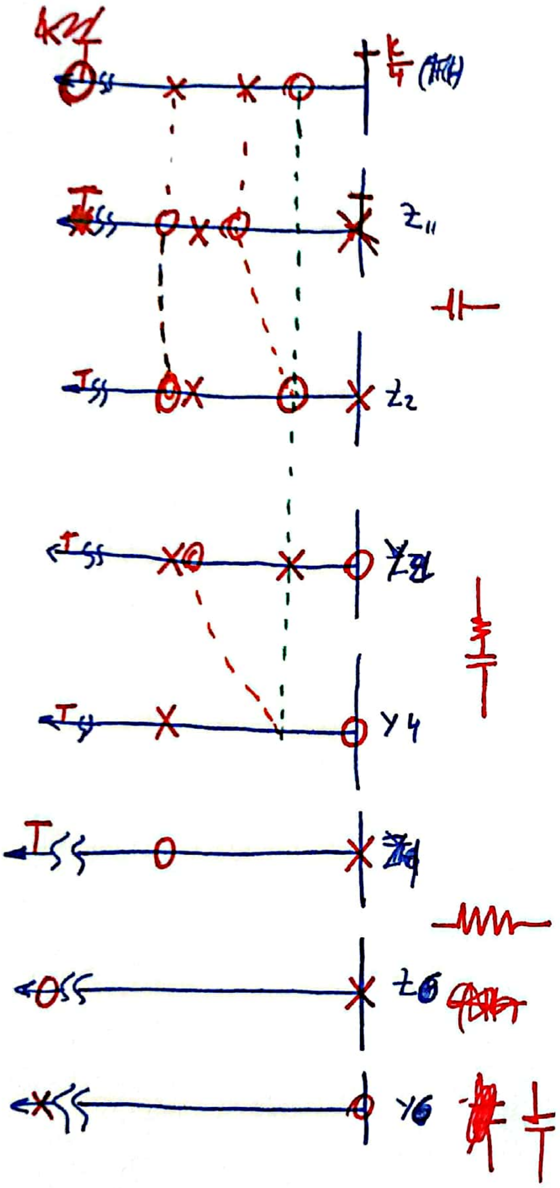
TS12 / #2 /

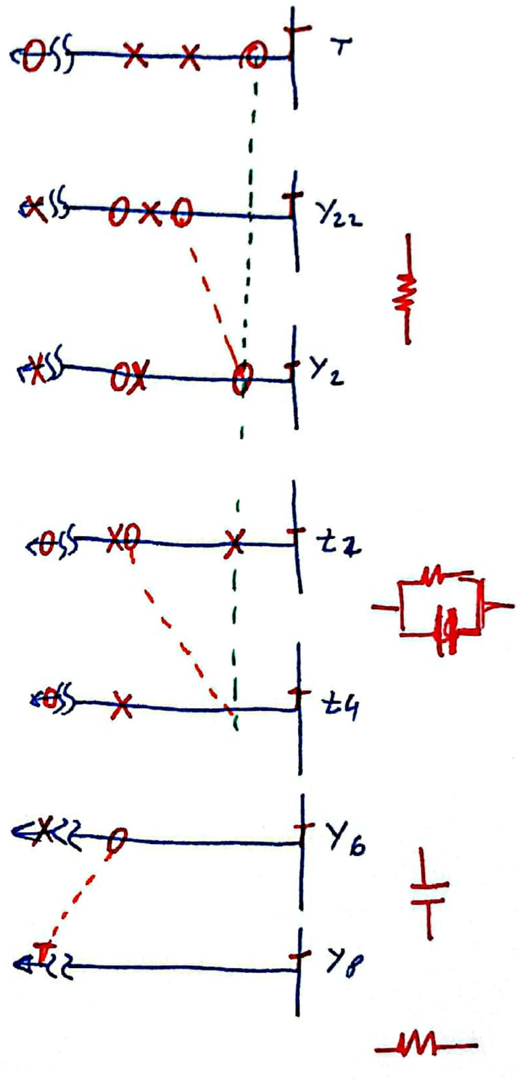
HOJA 3

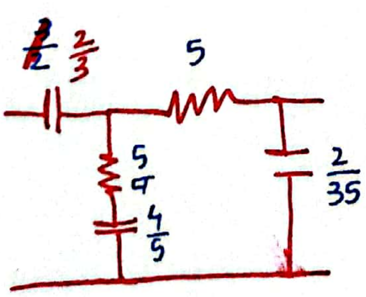
$$T(s) = \left.\frac{V_2}{V_1}\right|_{I_2=0} = \frac{K(s+1)}{(s+2)(s+4)} \qquad \frac{V_2}{V_1} = -\frac{Y_{21}}{Y_{22}} = \frac{z_{21}}{z_{11}} \qquad z_{11} = \frac{(s+2)(s+4)}{(s+3)s}$$

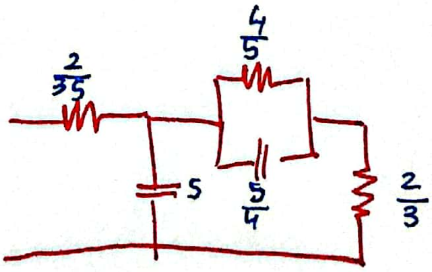
Proponemos $A = s+3$

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









HOJA 4

$$Z_{11} = \frac{(s+2)(s+4)}{(s+3)s} \qquad K_2 = \frac{(s+2)(s+4)}{s(s+3)}\, s \Big|_{s=-1} = \frac{3}{2} \qquad \frac{3}{2}$$

$$Z_2 = \frac{s^2+6s+8}{s(s+3)} - \frac{3}{2s} = \frac{2s^2+12s+16-3s-9}{s(s+3)2} = \frac{2s^2+9s+7}{s(s+3)2} = \frac{(s+1)(s+7/2)2}{s(s+3)2}$$

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

$$Y_2 = \frac{s(s+3)}{(s+1)(s+7/2)} \qquad K_4 = \frac{\cancel{(s+1)}}{s} \frac{s(s+3)}{\cancel{(s+1)}(s+7/2)}\Big|_{s=-1} = \frac{4}{5}$$

$$Y_4 = \frac{s(s+3)}{(s+1)(s+7/2)} - \frac{4s}{5(s+1)} = \frac{5s^2+15s-4s^2-14s}{(s+1)(s+7/2)5} = \frac{s\cancel{(s+1)}}{\cancel{(s+1)}(s+7/2)5} = \frac{s}{5(s+7/2)}$$

$$Z_4 = \frac{5s+\frac{35}{2}}{s} \qquad K_{\infty 6} = \frac{5s+\frac{35}{2}}{s}\Big|_{s\to\infty} = 5$$

$$Z_6 = \frac{5s+\frac{35}{2}}{s} - 5 = \frac{35}{2s}$$

$$Y_6 = \frac{2}{35}\, s$$

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

$$K_2 = \frac{(s+2)(s+4)}{s+3}\Big|_{s=-1} = \frac{3}{2} \qquad \Big\{\ Y = \frac{3}{2} \Rightarrow R = \frac{2}{3}$$

$$Y_2 = \frac{s^2+6s+8}{s+3} - \frac{3}{2} = \frac{2s^2+12s+16-3s-9}{(s+3)2} = \frac{\cancel{2}(s+1)(s+7/2)}{(s+3)\cancel{2}}$$

$$Z_2 = \frac{(s+3)}{(s+1)(s+7/2)} \qquad K_4 = \lim_{s \to -1} (s+1)\frac{(s+3)}{(s+1)(s+7/2)} = \frac{4}{5}$$

$$Z_4 = \frac{s+3}{(s+1)(s+7/2)} - \frac{4}{5(s+1)} = \frac{5s+15-4s-14}{5(s+1)(s+7/2)} = \frac{(s+1)}{5(s+1)(s+7/2)} = \frac{1}{5s+\frac{35}{2}}$$

$$Y_6 = 5s + \frac{35}{2}$$

HOJA 6

$$\begin{bmatrix} 1 & 0 \\ 5\phi & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & \frac{2}{35} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1+\frac{10\phi}{35} & \frac{2}{35} \\ 5\phi & 1 \end{bmatrix} = \begin{bmatrix} \frac{35+10\phi}{35} & \frac{2}{35} \\ 5\phi & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & \frac{4}{5\phi+5} \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} \frac{35+10\phi}{35} & \frac{2}{35} \\ 5\phi & 1 \end{bmatrix} \begin{bmatrix} \frac{35+10\phi}{35} & \frac{35+10\phi}{35}\cdot\frac{4}{5\phi+5}+\frac{2}{35} \\ 5\phi & \frac{\cancel{5}\phi 4}{\cancel{5}(\phi+1)}+1 \end{bmatrix} = \begin{bmatrix} \frac{35+10\phi}{35} & \frac{140+40\phi+10\phi+10}{35(5\phi+5)} \\ 5\phi & \frac{5\phi+1}{\phi+1} \end{bmatrix}$$

$$\begin{bmatrix} 1 & \phi \\ 3/2 & 1 \end{bmatrix}$$

$$\begin{bmatrix} \frac{35+10\phi}{35} & \frac{150+50\phi}{35(\phi+1)5} \\ 5\phi & \frac{5\phi+1}{\phi+1} \end{bmatrix} = \begin{bmatrix} \frac{35+10\phi}{35} & \frac{30+10\phi}{35(\phi+1)} \\ 5\phi & \frac{5\phi+1}{\phi+1} \end{bmatrix}$$

$$A = \frac{35+10\phi}{35} + \frac{3}{2}\,\frac{30+10\phi}{(\phi+1)35} = \frac{(2\phi+2)(35+10\phi)+90+30\phi}{70(\phi+1)}$$

$$\frac{70\phi+20\phi^2+70+20\phi+90+30\phi}{70(\phi+1)} = \frac{20\phi^2+120\phi+160}{70(\phi+1)} =$$

$$\frac{20}{70}\cdot\frac{(\phi^2+6\phi+8)}{\phi+1} = \frac{(\phi+4)(\phi+2)}{\phi+1}\,\frac{2}{7} \qquad \boxed{K = \frac{7}{2}}$$

Η ΘΠΑ 7

$$\begin{bmatrix} 1 & 0 \\ \frac{4\phi}{5(\phi+1)} & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & \frac{3}{2\phi} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \frac{5\phi+11}{5(\phi+1)} & \frac{3}{2\phi} \\ \frac{4\phi}{5(\phi+1)} & 1 \end{bmatrix}$$

$$1 + \frac{3}{\cancel{2\phi}} \frac{\overset{2}{\cancel{4\phi}}}{5(\phi+1)} = 1 + \frac{6}{5(\phi+1)} = \frac{5\phi+5+6}{5(\phi+1)} = \frac{5\phi+11}{5(\phi+1)}$$

$$\begin{bmatrix} 1 & 5 \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} \frac{5\phi+11}{5(\phi+1)} & \frac{3}{2\phi} \\ \frac{4\phi}{5(\phi+1)} & 1 \end{bmatrix} \begin{bmatrix} \frac{5\phi+11}{5(\phi+1)} & \frac{10\phi^2+25\phi+3}{2\phi(\phi+1)} \\ \frac{4\phi}{5(\phi+1)} & \frac{5\phi+1}{\phi+1} \end{bmatrix}$$

$$\frac{5\phi+11}{\cancel{5}(\phi+1)} \cancel{5} + \frac{3}{2\phi} = \frac{10\phi^2+22\phi+3\phi+3}{(\phi+1)2\phi} = \frac{10\phi^2+25\phi+3}{2\phi(\phi+1)}$$

$$\frac{4\phi}{\cancel{5}(\phi+1)} \cancel{5} + 1 = \frac{4\phi}{\phi+1} + 1 = \frac{4\phi+\phi+1}{\phi+1} = \frac{5\phi+1}{\phi+1}$$

$$\begin{bmatrix} 1 & 0 \\ \frac{2\phi}{35} & 1 \end{bmatrix}$$

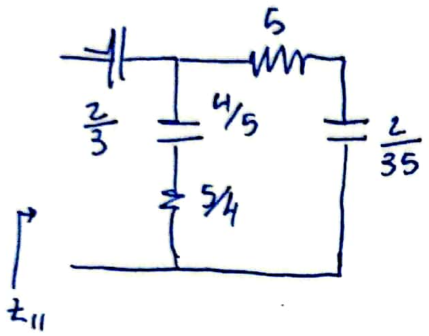
$$\begin{bmatrix} \frac{5\phi+11}{5(\phi+1)} & \frac{10\phi^2+25\phi+3}{2(\phi+1)\phi} \\ \frac{4\phi}{5(\phi+1)} & \frac{5\phi+1}{\phi+1} \end{bmatrix} \begin{bmatrix} \frac{\phi^2+6\phi+8}{7(\phi+1)} & \frac{10\phi^2+25\phi+3}{2(\phi+1)\phi} \\ & \end{bmatrix}$$

Resumiendo

$$T(s) = \frac{V_2}{V_1} = k \frac{(s+1)}{(s+2)(s+4)}$$

Sintetizando $z_{11} = \frac{(s+2)(s+4)}{s(s+3)}$

obtenemos la red

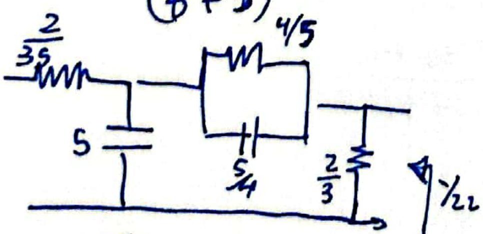


Verificamos por interconexión de cuadripolos y llegamos a:

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

$$\frac{1}{A} = \left.\frac{V_2}{V_1}\right|_{I_2=0} = 7 \frac{s+1}{(s+2)(s+4)} \qquad \boxed{k = 7}$$

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



Verificamos por interconexión

$$A = \frac{20(s^2+6s+8)}{70\ (s+1)} = \frac{2}{7} \frac{s^2+6s+8}{s+1}$$

$$\frac{1}{A} = \left.\frac{V_2}{V_1}\right|_{I_2=0} = \frac{7}{2} \frac{s+1}{s^2+6s+8}$$