TS9

1) $Z(s) = \dfrac{(s^2+3)(s^2+1)}{s(s^2+2)}$ — par 4, impar 3

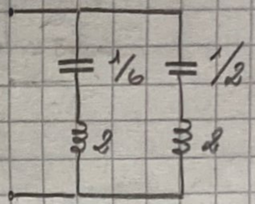
Hallar la topología circuital y valores de los componentes para:

a) Síntesis de $Z(s)$ método de Foster paralelo / derivación

$$Y(s) = \frac{s(s^2+2)}{(s^2+3)(s^2+1)} = \frac{2k_1 s}{s^2+(\sqrt{3})^2} + \frac{2k_2 s}{s^2+1^2}$$

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

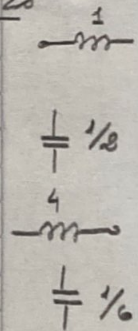
$$2k_2 = \lim_{s^2 \to -1} \frac{s^2+1}{s} \cdot Y(s) = \frac{1}{2}$$

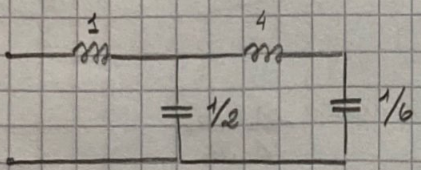


b) Cauer 1 y 2

$$Z(s) = \frac{s^4+4s^2+3}{s^3+2s}$$ para k_∞

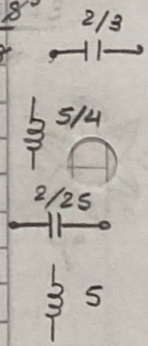
$$\begin{array}{l} s^4+4s^2+3 \;|\; s^3+2s \\ -(s^4+2s^2) \quad\; s \\ \quad s^3+2s \;|\; 2s^2+3 \\ \quad -(s^3+\tfrac{3}{2}s) \quad \tfrac{1}{2}s \\ \quad\quad 2s^2+3 \;|\; \tfrac{1}{2}s \\ \quad\quad -2s^2 \quad 4s \\ \quad\quad\quad \tfrac{1}{2}s \;|\; 3 \\ \quad\quad\quad -\tfrac{1}{2}s \quad \tfrac{1}{6}s \\ \quad\quad\quad\quad 0 \end{array}$$

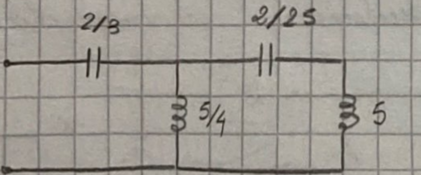




Para k_0

$$\begin{array}{l} 3+4s^2+s^4 \;|\; 2s+s^3 \\ -(3+\tfrac{3}{2}s^2) \quad \tfrac{3}{2s} \\ \quad 2s+s^3 \;|\; \tfrac{5}{2}s^2+s^4 \\ \quad -(2s+\tfrac{4}{5}s^3) \quad \tfrac{4}{5s} \\ \quad\quad \tfrac{5}{2}s^2+s^4 \;|\; \tfrac{1}{5}s^3 \\ \quad\quad -\tfrac{5}{2}s^2 \quad \tfrac{25}{2s} \\ \quad\quad\quad \tfrac{1}{5}s^3 \;|\; s^4 \\ \quad\quad\quad -\tfrac{1}{5}s^3 \quad \tfrac{1}{5s} \\ \quad\quad\quad\quad 0 \end{array}$$

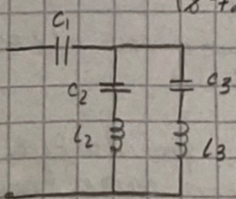




2) $Y(s) = \dfrac{3s(s^2+7/3)}{(s^2+2)(s^2+5)}$

$$sL_2 + \frac{1}{sC_2} \Rightarrow j\omega L_2 - j\frac{1}{\omega L_2} \Rightarrow L_2 - \frac{1}{C_2} = 0 \Rightarrow L_2 = \frac{1}{C_2}$$

cable



$$\frac{1}{Y} - Z_1 = Z_2 \qquad Z_2\Big|_{s=j\sqrt{?}} = 0 \qquad k_0' = \frac{(s^2+2)(s^2+5)}{3s(s^2+7/3)} \cdot s\Big|_{s=j1} = \frac{(-1+2)(-1+5)}{3(-1+7/3)} = 1$$

$C_1 = 1$

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

$$\frac{1}{Z_2} = Y_3 + Y_4 \qquad 2k_1 = \lim_{s^2 \to -1} \frac{\cancel{s^2+1}}{s} \cdot \frac{3s(s^2+7/3)}{(s^2+3)\cancel{(s^2+1)}} = \frac{4}{2} = 2$$

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

NOTA

$(j\omega)^2 = -1+1$

$$Y_2 = \frac{2s}{s^2+1} + \frac{s}{s^2+3}$$

$$\frac{2k\,s}{s^2+\omega^2} = \left(sL_2 + \frac{1}{sC_2}\right)^{-1} = \left(\frac{s^2L_2C_2+1}{sC_2}\right)^{-1} = \frac{s/L_2}{s^2+1/C_2L_2}$$

L_2 y C_2 xq resuenan en 1 r/s

$$\begin{cases} L_2 = 1/2k_1 = 1/2 \\ C_2 = \dfrac{2k_1}{\omega_1^2} = 2 \end{cases} \qquad \begin{cases} L_3 = 1 \\ C_3 = 1/3 \end{cases} \qquad C_1 = 1$$

$$sL + \frac{1}{sC} = \frac{s^2LC+1}{sC} \qquad Y_P = \frac{sC_2}{s^2L_2C_2+1} + \frac{sC_3}{s^2L_3C_3+1} = \frac{sC_2(s^2L_3C_3+1)+sC_3(s^2L_2C_2+1)}{(s^2L_2C_2+1)(s^2L_3C_3+1)}$$

$$Z = \frac{1}{sC_1} + \frac{(s^2L_2C_2+1)(s^2L_3C_3+1)}{sC_2(s^2L_3C_3+1)+sC_3(s^2L_2C_2+1)} = \frac{sC_2(s^2L_3C_3+1)+sC_3(s^2L_2C_2+1)+sC_1(s^2L_2C_2+1)(s^2L_3C_3+1)}{sC_1\left[(s^2L_3C_3+1)+sC_3(s^2L_2C_2+1)\right]}$$

$\rightarrow sC_2$

$$Z = \frac{2\cancel{s}(s^2/3+1)+\frac{1}{3}\cancel{s}(s^2+1)+\cancel{s}(s^2+1)(s^2/3+1)}{\cancel{s}\left[s\,2(s^2/3+1)+s\,\frac{1}{3}(s^2+1)\right]} = \frac{\frac{2}{3}s^2+2+s^2/3+1/3+s^4/3+s^2\cdot 4/3+1}{s\left(\frac{2}{3}s^2+2+\frac{s^2}{3}+\frac{1}{3}\right)}$$

$$Z = \frac{s^4/3+s^2\cdot 7/3+10/3}{s(s^2+7/3)} = \frac{s^4+s^2\cdot 7+10}{3s(s^2+7/3)} = \frac{(s^2+5)(s^2+2)}{3s(s^2+7/3)}$$ ✓ :)

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