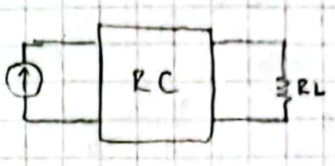
TS 12

(1)
(2) $\dfrac{-I_2}{I_1} = H \dfrac{\$^2 + 5\$ + 4}{\$^2 + 8\$ + 12}$ $\left.\begin{matrix} z_1 = -1 \\ z_2 = -4 \end{matrix}\right\}$ (*)



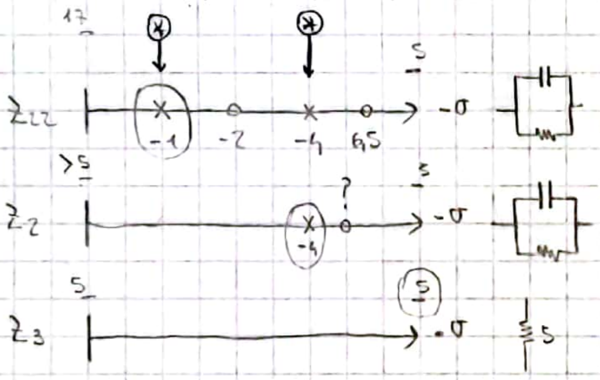
$Z_{21} = 6H$

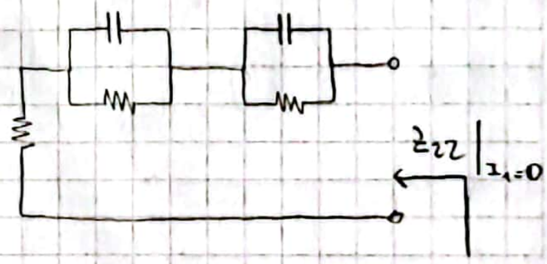
$-\dfrac{I_2}{I_1} = \dfrac{Z_{21}}{RL + Z_{22}}$ ⟶ Como esta expresión conviene para NO disipativos, la cambio.

$RL = 1$ por normas $\Rightarrow -\dfrac{I_2}{I_1} = T(\$) = \dfrac{Z_{21}}{1 + Z_{22}} \Rightarrow Z_{22} = \dfrac{Z_{21}}{T(\$)} - 1$

$$Z_{22} = 6H \frac{1}{H} \frac{\$^2 + 8\$ + 12}{\$^2 + 5\$ + 4} - 1 = \frac{6\$^2 + 48\$ + 72 - \$^2 - 5\$ - 4}{\$^2 + 5\$ + 4}$$

$$Z_{22} = \frac{5\$^2 + 43\$ + 68}{\$^2 + 5\$ + 4} = 5 \frac{(\$+2)(\$+6{,}5)}{(\$+4)(\$+1)}$$ ⟶ Cumple alternancia ✓
⟶ Cumple $Z_{22}(0) > Z_{22}(\infty)$





(b)

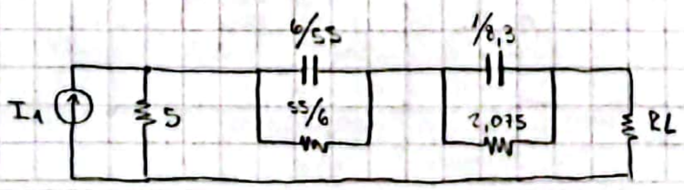
$$\lim_{\$ \to -1} (\$+1) \cdot 5 \cdot \frac{(\$+2)(\$+6{,}5)}{(\$+4)(\$+1)} = \frac{55}{6} = k_1$$ $\begin{matrix} C_1 = 6/55 \\ R_1 = 55/6 \end{matrix}$ $\qquad \dfrac{1}{\$\frac{1}{k_1} + \frac{\sigma_i}{k_1}}$

$$Z_2 = \frac{5\$^2 + 43\$ + 68}{(\$+1)(\$+4)} - \frac{55/6}{\$+1} = \frac{5\$^2 + 43\$ + 68 - 55/6\,\$ - 110/3}{(\$+1)(\$+4)}$$

$$Z_2 = \frac{5\$^2 + 203/6\,\$ + 94/3}{(\$+1)(\$+4)} \cong \frac{5\cancel{(\$+1)}(\$+5{,}66)}{\cancel{(\$+1)}(\$+4)} = 5\frac{(\$+5{,}66)}{(\$+4)}$$

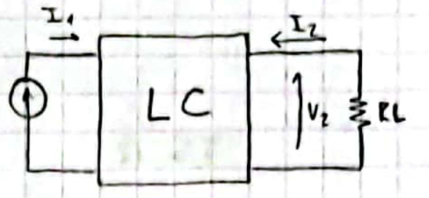
$$\lim_{\$ \to -4} \cancel{(\$+4)}\, 5 \frac{(\$+5{,}66)}{\cancel{\$+4}} = 8{,}3 = k_2$$ $\begin{matrix} C_2 = 1/8{,}3 \\ R_2 = 2{,}075 \end{matrix}$

$$Z_4 = \frac{5\$ + 28{,}3 - 8{,}3}{(\$+4)} = \frac{5(\$+4)}{\$+4} = 5 \longrightarrow R_3 = 5$$



② ⓐ

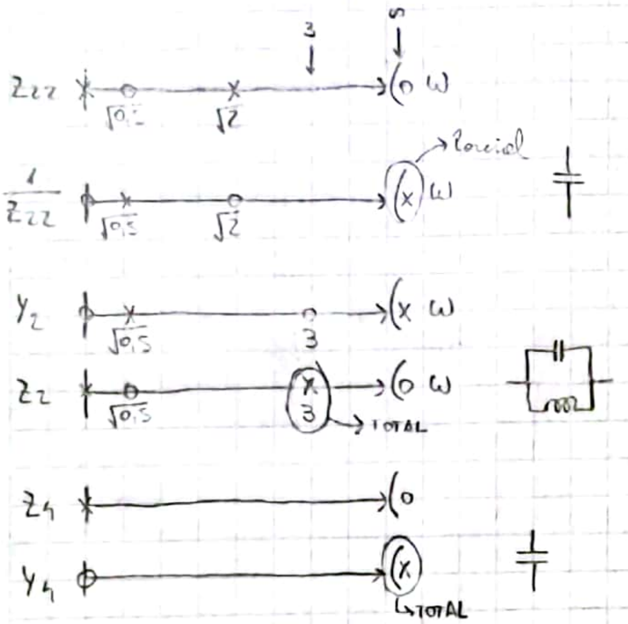
$$T(s) = \frac{V_2}{I_1} = k\,\frac{s^2+9}{s^3+2s^2+2s+1}$$

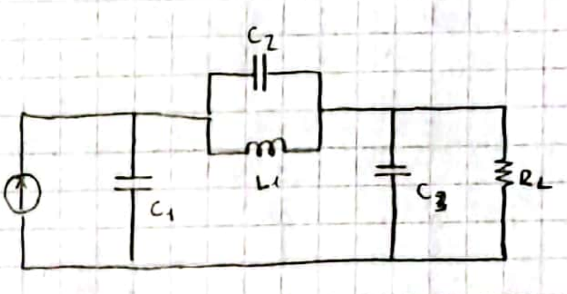


$$V_2 = Z_{21} I_1 + Z_{22} I_2 \Rightarrow \left.\frac{V_2}{I_1}\right|_{I_2=-\frac{V_2}{RL}} = \frac{Z_{21}}{1+\frac{Z_{22}}{RL}} \Rightarrow RL=1 \Rightarrow \frac{Z_{21}}{1+Z_{22}}$$

$$T(s) = \frac{Z_{21}}{1+Z_{22}} = k\,\frac{s^2+9}{s^3+2s + 2s^2+1}$$

$$T(s) = k\,\frac{\frac{s^2+9}{s^3+2s}}{1+\frac{2s^2+1}{s^3+2s}} = k\,\frac{\overbrace{\frac{s^2+9}{s(s^2+2)}}^{Z_{21}}}{1+\underbrace{\frac{2(s^2+0{,}5)}{s(s^2+2)}}_{Z_{22}}}$$





$$\frac{1}{Z_{22}} = \frac{1}{2}\,\frac{s(s^2+2)}{s^2+0{,}5}$$

$$\left.Y_2\right|_{s^2=-9} = 0 = \left.\frac{0{,}5s^3+s}{s^2+0{,}5} - k'_\infty s\right|_{s^2=-9} \Rightarrow k'_\infty = \frac{0{,}5(-9+2)}{-9+0{,}5} = \frac{7}{17} \rightarrow C = \frac{7}{17}$$

$$Y_2 = \frac{0{,}5s^3+s}{s^2+0{,}5} - s\,\tfrac{7}{17} = \frac{0{,}5s^3+s-s^3\,7/17 - s\,7/34}{s^2+0{,}5} = \frac{\frac{3}{34}s^3 + s\frac{27}{34}}{s^2+0{,}5} = \frac{3/34\,(s^2+9)\,s}{s^2+0{,}5}$$

$$\lim_{s^2\to -9} \frac{(s^2+9)}{s}\,\frac{(s^2+0{,}5)\frac{34}{3}}{(s^2+9)s} = 2k_1 = \frac{289}{27} \Rightarrow \frac{2k_1 s}{s^2+\omega^2} = \frac{1}{s\frac{1}{2k_1}+\frac{\omega^2}{2k_1 s}} \rightarrow C = {}^{27}/_{289} \quad L = {}^{289}/_{243}$$

$$Z_4 = \frac{34(s^2+0{,}5)}{3(s^2+9)s} - \frac{\frac{289}{27}s}{s^2+9} = \frac{\frac{34}{3}s^2+\frac{17}{3}-\frac{289}{27}s^2}{(s^2+9)s} = \frac{s^2\frac{17}{27}+\frac{17}{3}}{(s^2+9)s} = \frac{\frac{17}{27}(s^2+9)}{(s^2+9)s} = \frac{1}{s\,\frac{27}{17}}$$

$$Z_4 \Rightarrow C = \frac{27}{17}$$