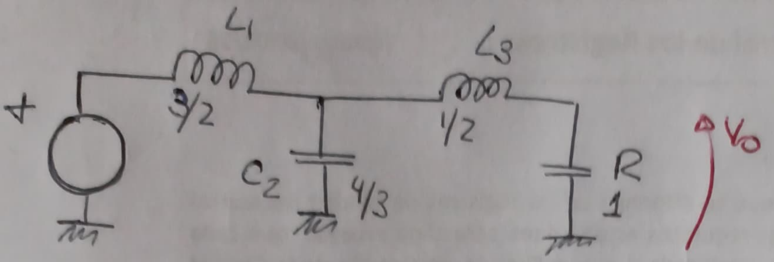
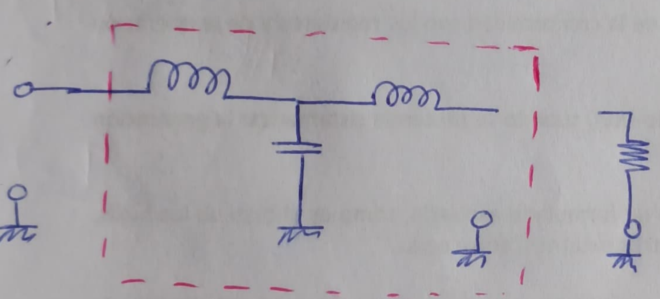
TAREA SEMANAL 7



PARTE I

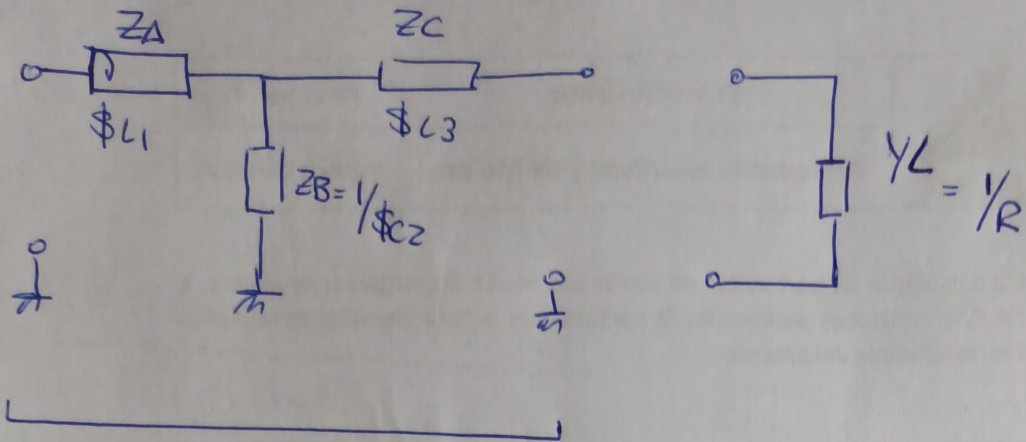
1. TRANSferencia

Podria pensar en cuadripolo cargado y hallar sus parámetros T → conociendo LA A' puedo obtener LA TF de Tensión



ES MÁS, ni siquiera necesito TODA LA MATRIZ, como está cargado $A' = A + B \cdot Y_L$.

otra opción sería hallar PARAM Z por simple inspección y llevarlo a los T



$$Z\alpha = \begin{pmatrix} Z_A + Z_B & Z_B \\ Z_B & Z_C + Z_B \end{pmatrix} \qquad T\beta = \begin{pmatrix} 1 & 0 \\ Y & 1 \end{pmatrix}$$

$$\begin{pmatrix} sL_1 + 1/sC_2 & 1/sC_2 \\ 1/sC_2 & sL_3 + 1/sC_2 \end{pmatrix} \qquad \begin{pmatrix} 1 & 0 \\ 1/R & 1 \end{pmatrix}$$

$$\begin{pmatrix} Z_{11} = \dfrac{s^2 \cdot L_1 \cdot C_2 + 1}{s \cdot C_2} & Z_{12} = \dfrac{1}{s \cdot C_2} \\ Z_{21} = \dfrac{1}{s \cdot C_2} & Z_{22} = \dfrac{s^2 \cdot L_3 \cdot C_2 + 1}{s \cdot C_2} \end{pmatrix} \qquad \begin{pmatrix} A = 1 & B = 0 \\ C = 1/R & D = 1 \end{pmatrix}$$

$$\begin{cases} V_1 = I_1 \cdot Z_{11} + I_2 \cdot Z_{12} \\ V_2 = I_1 \cdot Z_{21} + I_2 \cdot Z_{22} \end{cases}$$

$$A_\alpha = \frac{V_1}{V_2}\bigg|_{I_2 = 0} = \frac{Z_{11}}{Z_{21}} = \boxed{s^2 \cdot L_1 \cdot C_2 + 1 = A\alpha}$$

$$B\alpha = \frac{V_1}{(-I_2)}\bigg|_{V_2 = 0} \Rightarrow \begin{cases} V_1 = I_1 \cdot Z_{11} + I_2 \cdot Z_{12} \\ 0 = I_1 \cdot Z_{21} + I_2 \cdot Z_{22} \end{cases} > V_1 = -I_2 \frac{Z_{22}}{Z_{21}} \cdot Z_{11} + I_2 \cdot Z_{12}$$

$$\frac{V_1}{-I_2} = \frac{Z_{22}}{Z_{21}} \cdot Z_{11} - Z_{12} = \frac{\frac{\$^2 L_3 . C_2 + 1}{\cancel{\$ C_2}}}{\frac{1}{\cancel{\$ C_2}}} \cdot \frac{\$^2 . L_1 . C_2 + 1}{\$ C_2} - \frac{1}{\$ C_2}$$

$$= \frac{(\$^2 . L_3 . C_2 + 1)\ (\$^2 . L_1 . C_2 + 1)}{\$ C_2} - \frac{1}{\$ C_2}$$

$$= \frac{\$^{\cancel{4}\,2} . L_3 . L_1\, C_2^{\cancel{2}} + \cancel{\$^2}\, C_2 (L_3 + L_1) \cancel{+1} - \cancel{1}}{\cancel{\$^2} . C_2^{\cancel{2}}} = \boxed{\cancel{\$^2 . L_3 . L_1 . + \frac{(L_3+L_1)}{C_2} = B}}$$

ARRASTRA ERROR!!!

$$\cancel{\frac{\$^2 . C_2^2 . L_3 L_1 + C_2 (L_3 + L_1)}{C_2^2}} = \boxed{\$. L_3 . L_1 + \frac{L_3 + L_1}{C_2}}$$

B

~~AHORA~~ $A' = A + B . Y_L = \frac{V_1}{V_2}$ NO DAN unidades [ ]

$$A' = \$^2 . L_1 . C_2 + 1 + \frac{\$^2 L_3 . L_1}{R} + \frac{L_3 + L_1}{C_2 . R}$$

$$\cancel{\frac{V_2}{V_1} = A'^{-1}} = \quad A' = \frac{\$^2 . R . L_1 . C_2^2 + R . C_2 + \$^2 . L_3 . L_1 . C_2 + (L_3 + L_1)}{C_2 . R}$$

$$\cancel{A' = \$^2 (C_2^2 . L_1 R + C_2 . L_1 . L_3) + R}$$

$$A' = \frac{\$^2 (R . L_1 . C_2^2 + L_3 . L_1 . C_2) + R . C_2 + L_3 + L_1}{R . C_2}$$

$$A'^{-1} = \frac{R . C_2}{\$^2 (R . L_1 . C_2^2 + L_3 . L_1 . C_2) + R . C_2 + L_3 + L_1}$$

$$\frac{\$^{\cancel{4}\,3} \cdot L_3 \cdot L_1 \cdot C_2^{\cancel{2}} + \$^{\cancel{2}} \cdot \cancel{C_2}\,(L_3+L_1)}{\cancel{\$} \cdot \cancel{C_2}}$$

$$\$^3 \cdot L_3 \cdot L_1 \cdot C_2 + \$ \cdot (L_3+L_1)$$

$$A' = A + B \cdot Y_L$$

$$A' = \$^2 \cdot L_1 \cdot C_2 + 1 + \frac{\$^3 \cdot L_3 \cdot L_1 C_2 + \$(L_3+L_1)}{R}$$

$$A' = \$^3 \cdot \frac{L_3 L_1 C_2}{R} + \$^2 \cdot \frac{L_1 \cdot C_2 \cdot R}{R} + \frac{\$(L_3+L_1)}{R} + \frac{R}{R}$$

$$A' = \frac{\$^3 \cdot L_3 \cdot L_1 \cdot C_2 + \$^2 \cdot R \cdot L_1 \cdot C_2 + \$\,(L_3+L_1) + R}{R}$$

$$\frac{\cancel{\delta^{-3}} \cdot \cancel{\delta^{2}\Omega^{2}} \cdot \frac{\delta}{\cancel{\Omega}} + \cancel{\delta^{-2}} \cdot \cancel{\Omega} \cdot \Omega \cdot \cancel{\delta}\,\frac{\delta}{\cancel{\Omega}} + \cancel{\delta^{-1}} \cdot \cancel{\delta} \cdot \Omega + \Omega}{\Omega}$$

Unidades OK

$$\Rightarrow \boxed{\frac{V_2}{V_1} = A'^{-1} = R \Big/ \$^3 \cdot L_3 \cdot L_1 \cdot C_2 + \$^2 \cdot R \cdot L_1 \cdot C_2 + \$(L_3+L_1) + R}$$

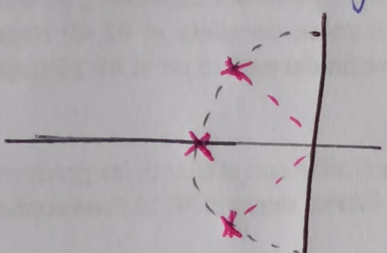
$$T_V(\$) = \frac{1}{\$^3 \cdot \cancel{\frac{3}{2}} \cdot \cancel{\frac{1}{2}} \cdot \cancel{\frac{4}{3}} + \$^2 \cdot 1 \cdot \cancel{\frac{3}{2}} \cdot \frac{4}{\cancel{3}} + \$\left(\frac{3}{2} + \frac{1}{2}\right) + 1}$$

$$T_V(\$) = \frac{1}{\$^3 + \$^2 \cdot 2 + \$ \cdot 2 + 1}$$

Verifico con calculadora

$P_1 = -1$

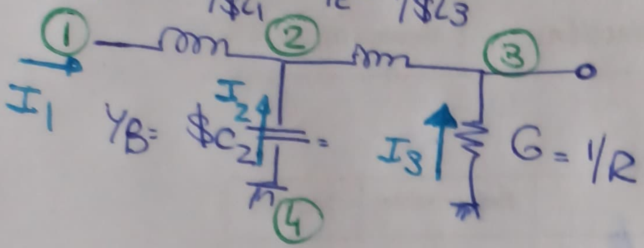
$P_2 = -0{,}5 \pm j\,0{,}86$ } → efectivamente están sobre circ. radio unitario



debería ver un F.L.P en spice Butter $n=3$ en $159\,\mathrm{mHz} \equiv 1\,r/s$ tengo mi LPF. ⇒ 05

PARTE II

$Y_A = 1/\$L_1 \qquad Y_C = 1/\$L_3$



$$\cancel{\begin{matrix} Y_A & -Y_A & \emptyset \\ -Y_A & Y_A+Y_B+Y_C & -Y_C \\ \emptyset & & \end{matrix}}$$

$\Sigma = \emptyset$

$\Sigma = \emptyset$

$$\begin{pmatrix} Y_A & -Y_A & \emptyset & \emptyset \\ -Y_A & Y_A+Y_B+Y_C & -Y_C & -Y_B \\ \emptyset & -Y_C & Y_C+G & -G \\ \emptyset & -Y_B & -G & Y_B+G \end{pmatrix}$$

Parece estar bien

$[I] = [y] . [V] \Rightarrow$ Busco $\dfrac{V_3}{V_1} = I$

$$A_{m_n}^{ij} = \operatorname{Sgn}(m-n) . \operatorname{Sgn}(i-j) . \frac{\underline{Y}^{\,mn}_{\;ij}}{\underline{Y}^{\,mn}}$$

$$\begin{vmatrix} -Y_A & \emptyset \\ Y_A+Y_B+Y_C & -Y_C \end{vmatrix} = Y_A . Y_C \qquad \frac{1}{\$L_1} \quad \frac{1}{\$L_3}$$

$$V^{34}_{14} = \frac{V_{34}}{V_{14}} = \underbrace{\operatorname{Sgn}(1-4)}_{(-1)} . \underbrace{\operatorname{Sgn}(3-4)}_{(-1)} \cdot \frac{\underline{Y}^{14}_{34}}{\underbrace{\underline{Y}^{34}_{34}}}$$

1

$14 \rightarrow$ elimino columnas

$34 \rightarrow$ elimino ~~columnas~~ filas

$$\begin{vmatrix} Y_A & -Y_A \\ -Y_A & Y_A+Y_B+Y_C \end{vmatrix}$$

$Y_A\,(Y_A+Y_B+Y_C) - Y_A^2 = Y_A . Y_B + Y_A . Y_C$

$\hat{V_1}$

$\cancel{\emptyset} \quad \cancel{-YC}$

$\emptyset \quad -YB$

$\cancel{YA \cdot YB + YA \cdot YC =}$

$$\cancel{\frac{1}{\$L_1} \cdot \$C2 + \frac{1}{\$L_1} \cdot \frac{1}{\$L3} = \frac{C2}{L_1} + \frac{1}{\$^2 \cdot L_1 \cdot L_3} = \frac{\$^2 \cdot L3 \cdot C2 + 1}{\$^2 \cdot L_1 \cdot L_3}}$$

$$\cancel{\Rightarrow (-1)(-1) \frac{\frac{1}{\$L1 \cdot \$L3}}{\frac{\$^2 \cdot L3 \cdot C2 + 1}{\$^2 \cdot L_1 \cdot L_3}} = \frac{1}{\$^2}}$$

$$V_{14}^{34} = \frac{V34}{V_{1,4}} = \operatorname{Sgn}(3-4)\operatorname{Sgn}(1-4) \cdot \frac{\underline{Y}^{34}_{14}}{\underline{Y}^{14}_{14}}$$

34 → filas
14 → columna

$$\underline{Y}^{34}_{14} = \begin{vmatrix} -YA & \emptyset \\ YA+YB+YC & -YC \end{vmatrix} = YA \cdot YC = \frac{1}{\$^2 \cdot L_1 \cdot L_3}$$

$$Y^{14}_{14} = \begin{vmatrix} YA+YB+YC & -YC \\ -Ye & YC+G \end{vmatrix} = (YA+YB+YC)(YC+G) - YC^2$$

$$YA \cdot YC + YA \cdot G + YB \cdot YC + YB \cdot G + YC \cdot G$$

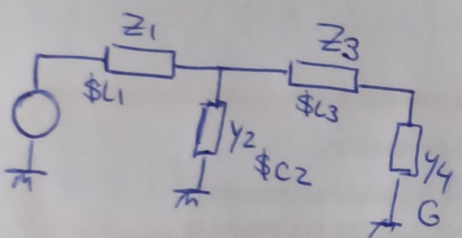
$$= \frac{1}{\$^2 \cdot L_1 \cdot L_3} + \frac{1}{\$L_1} G + \$C2 \cdot \frac{1}{\$L3} + \$C2 \cdot G + \frac{G}{\$L3} = \frac{1}{\$^2 \cdot L_1 \cdot L_3} + \frac{G}{\$L_1} + \frac{C2}{L3} + \$C2 \cdot G + \frac{G}{\$L3}$$

$$= \frac{1 + G \cdot \$L3 + \$^2 L_1 C2 + \$^3 L_1 L_3 C2 G + G \$L_1}{\$^2 \cdot L_1 \cdot L_3}$$

$$\Rightarrow \frac{\dfrac{1}{\$^2 \cdot L_1 \cdot L_3}}{\dfrac{\$^3 \cdot G \cdot L_3 \cdot L_1 \cdot C_2 + \$^2 L_1 \cdot C_2 + \$ G (L_1 + L_3) + 1}{\$^2 \cdot L_1 \cdot L_3}}$$

$$\boxed{V_{14}^{34} = \frac{1}{\$^3 \cdot G \cdot L_3 \cdot L_1 \cdot C_2 + \$^2 \cdot L_1 \cdot C_2 + \$ \cdot G (L_1 + L_3) + 1} = \frac{1}{\$^3 + \$^2\, 2 + \$ \cdot 2 + 1}}$$

Continuantes



$$\begin{bmatrix} Z_1 & 1 & \emptyset & \emptyset \\ -1 & Y_2 & 1 & \emptyset \\ \emptyset & -1 & Z_3 & 1 \\ \emptyset & \emptyset & -1 & Y_4 \end{bmatrix}$$

$$\det = Z_1 \cdot \begin{vmatrix} 1 & \emptyset & \emptyset \\ Y_2 & 1 & \emptyset \\ -1 & Z_3 & 1 \end{vmatrix} - 1 \begin{vmatrix} Z_1 & \emptyset & \emptyset \\ -1 & 1 & \emptyset \end{vmatrix}$$

$$-1 \begin{vmatrix} Z_3 & 1 \\ -1 & Y_4 \end{vmatrix}$$

$$\det = (Z_1) \underbrace{\begin{vmatrix} Y_2 & 1 & \emptyset \\ -1 & Z_3 & 1 \\ \emptyset & -1 & Y_4 \end{vmatrix}}_{Y_2 \begin{vmatrix} Z_3 & 1 \\ -1 & Y_4 \end{vmatrix} - 1 \begin{vmatrix} -1 & 1 \\ \emptyset & Y_4 \end{vmatrix}} - (1) \overbrace{\begin{vmatrix} -1 & 1 & \emptyset \\ \emptyset & Z_3 & 1 \\ \emptyset & -1 & Y_4 \end{vmatrix}}^{\text{desarrollo columnas}}$$

$$Z_1 \left\{ Y_2 \begin{vmatrix} Z_3 & 1 \\ -1 & Y_4 \end{vmatrix} - \begin{vmatrix} -1 & 1 \\ 0 & Y_4 \end{vmatrix} \right\} - (-1) \begin{vmatrix} Z_3 & 1 \\ -1 & Y_4 \end{vmatrix}$$

$$Z_1 \left(Y_2 \left(Z_3 . Y_4 - (-1) \right) - (-Y_4) \right) + Z_3 . Y_4 - (-1)$$

$$Z_1 \left[Y_2 \left(Z_3 \cdot Y_4 + 1 \right) + Y_4 \right] + Z_3 . Y_4 + 1$$

$$Z_1 . Y_2 \left(Z_3 . Y_4 + 1 \right) + Z_1 . Y_4 + \{ Z_3 . Y_4 + 1 \}$$

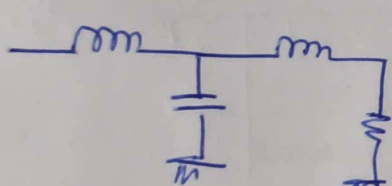
$$\$L_1 . \$C_2 \left(\$L_3 . G + 1 \right) + \$L_1 . G + \$L_3 . G + 1$$

$$= \boxed{\$^3 G L_3 L_1 \cdot C_2 + \$^2 L_1 C_2 + \$ \cdot G (L_3 + L_1) + 1 = T_V(\$)^{-1}}$$

Parte III $\rightarrow$ $Y_B(\$) = Y(\$) . \$$ $\rightarrow$ $Y_L(\$) = \frac{1}{\$L} \cdot \$$

$Y_C(\$) = \$^2 . C$

$Y_G(\$) = \$. G$



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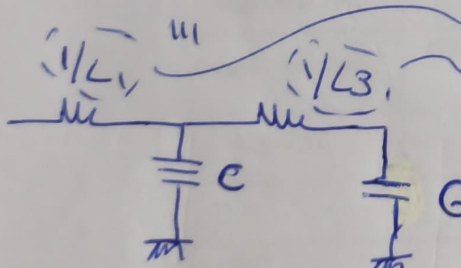
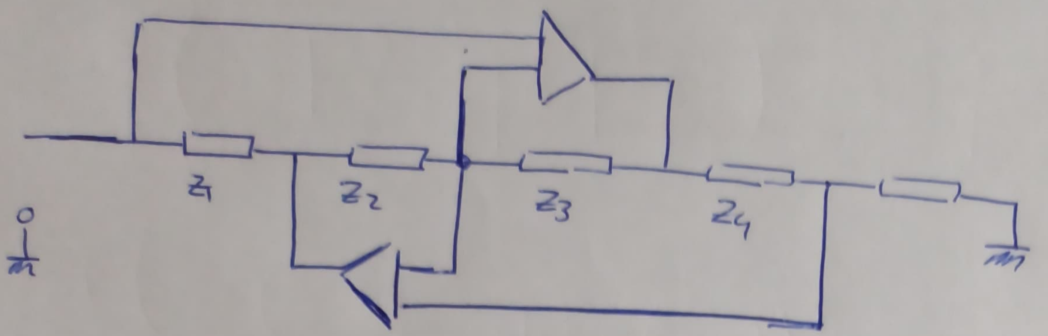


Recordar que no son impedancias !!!

Trabajo con $Y \Rightarrow \cdot \$$

Trabajo con $Z \Rightarrow \cdot \frac{1}{\$}$



$$Y_{FDNR} = s^2 C \Rightarrow \frac{1}{s^2 C} = Z_{FDNR} = \frac{Z_1 Z_3 Z_5}{Z_2 \cdot Z_4}$$

Si:

$Z_1 = Z_5 = C$

$R_2 = R_3 = R \rightarrow \qquad Z_{FDNR} = \frac{1}{s^2 C^2} \frac{1}{R_4}; \quad D = C^*$

$R_4 \rightarrow$ libre

Adopto $C = 1$

$R = 4/3$