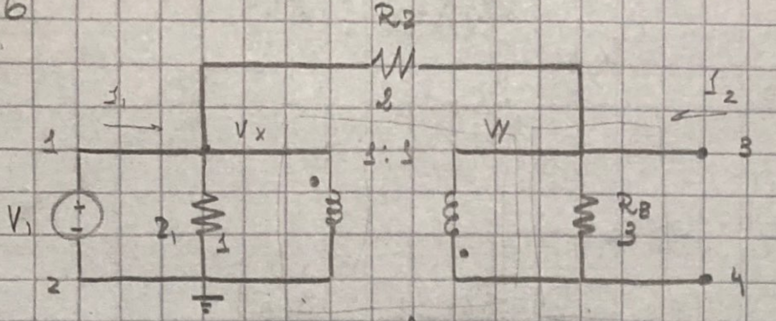
TS6

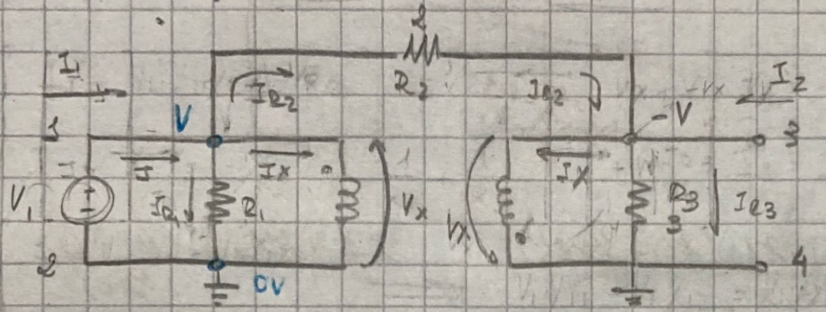
1)



$$T_{TF1} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

$V_x = -V_y$

$I_x = I_y$



$$I_1 = I_{r_1} + I_x + I_{R2} = \frac{V_1}{R_1} + I_x + \frac{2V}{R_2}$$

$I_{R2} = I_{R3} + I_x$

$I_x = I_{R2} - I_{R3} = \frac{2V}{R_2} + \frac{V}{R_3}$

$$I_1 = \frac{V}{R_1} + \frac{V}{R_3} + \frac{2V}{R_2} + \frac{2V}{R_2} = V_1\left(\frac{1}{R_1} + \frac{1}{R_3} + \frac{2}{R_2}\right)$$

$$Z_{11} = \left.\frac{V_1}{I_1}\right|_{I_2=0} = \left(\frac{1}{R_1} + \frac{1}{R_3} + \frac{2}{R_2}\right)^{-1} = \frac{3}{10} = 0{,}3\,\Omega$$

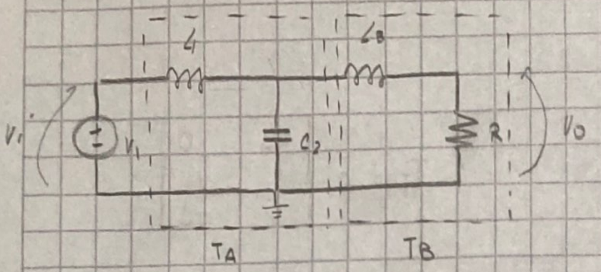
$$Z_{12} = Z_{21} = \left.\frac{V_1}{I_2}\right|_{I_1=0} = \left.\frac{V_2}{I_1}\right|_{I_2=0} = \left.\frac{-V_1}{I_1}\right|_{I_2=0} = -0{,}3\,\Omega$$

$V_2 = V_{R3} = -V_1$

$$Z_{22} = \left.\frac{V_2}{I_2}\right|_{I_1=0} = \left.\frac{-V_1}{I_2}\right|_{I_1=0} = -Z_{12} = 0{,}3\,\Omega$$

Ej #2

$L_1 = 1,5 \quad C_2 = 4/3 \quad L_3 = 0,5 \quad R = 1$



$$T_A = \begin{bmatrix} s^2 L_1 C_2 + 1 & s L_1 \\ s C_2 & 1 \end{bmatrix}$$

$$A = \left.\frac{V_1}{V_2}\right|_{-I_2=0} \qquad B = \left.\frac{V_1}{-I_2}\right|_{V_2=0}$$

$$C = \left.\frac{I_1}{V_2}\right|_{-I_2=0} \qquad D = \left.\frac{I_1}{-I_2}\right|_{V_2=0}$$

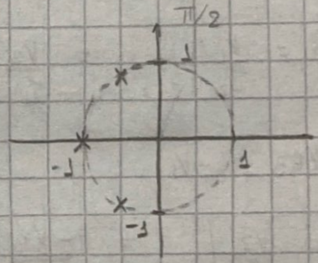
$$T_B = \begin{bmatrix} \frac{sL_3}{R_1} + 1 & sL_3 \\ \frac{1}{R_1} & 1 \end{bmatrix}$$

$$T_A \cdot T_B = T_{TOT} = \begin{bmatrix} \dfrac{L_1/C_2 + (R_1 + sL_3)(sL_1 + 1/sC_2)}{R/sC_2} & sL_1 + sL_3 + \dfrac{sL_1 \cdot sL_3}{1/sC_2} \\ \dfrac{R_1 + 1/sC_2 + sL_3}{R_1/sC_2} & \dfrac{sL_3 + 1/sC_2}{1/sC_2} \end{bmatrix}$$

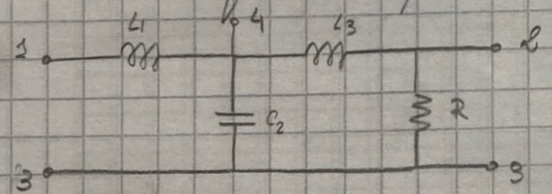
con Python

$$H(s) = \frac{1}{A} = \frac{1}{1,5s + (0,5s+1)(2s^2+1)} = \frac{1}{s^3 + 2s^2 + 2s + 1}$$

$$H(s) = \frac{1}{(s+1)\,(s+e^{j2/3\pi})\,(s+e^{-j2/3\pi})}$$



b) Saco la referencia para obtener la MAI



$$Y = \begin{bmatrix} 1/sL_1 & 0 & 0 & -1/sL_1 \\ 0 & 1/sL_3 + 1/R & -1/R & -1/sL_3 \\ 0 & -1/R & 1/R + sC_2 & -sC_2 \\ -1/sL_1 & -1/sL_3 & -sC_2 & \frac{1}{sL_1} + \frac{1}{sL_3} + sC_2 \end{bmatrix}$$

c) $A^{ij}_{mn} = A^{23}_{13} = \text{sgn}(2-3) \cdot \text{sgn}(1-3) \cdot \dfrac{Y^{13}_{23}}{Y^{23}_{23}}$

(Con Python)

$$A^{23}_{13} = \frac{R_1}{s^3 C_2 L_1 L_3 + s^2 R C_2 L_1 + s(L_1 + L_3) + R_1} = \frac{1}{s^3 + 2s^2 + 2s + 1}$$

NOTA