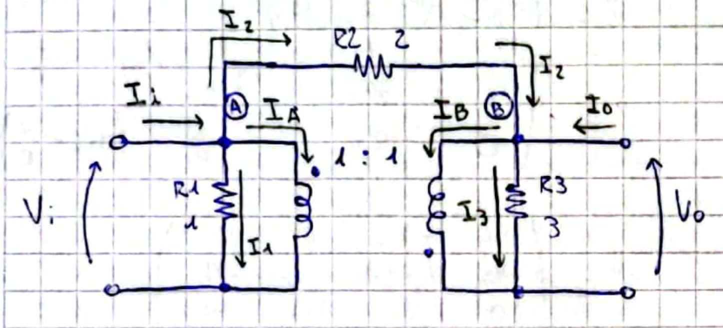
TP SEMANAL N°6

(1) CÁLCULO DE PARAMETROS Z

- Ya de antemano se intentó calcular usando teoría de cuadripolos pero los parámetros Z del transformador fueron imposibles de sacar. Por eso se optó por otro método:



Ecuaciones de trafo

$$\begin{cases} V_1 = -V_2 \cdot a \\ I_1 = I_2/a \end{cases}$$

Trafo de relación 1:1

$$\begin{cases} V_1 = -V_2 \\ I_1 = I_2 \end{cases}$$

NODOS

(A) $I_i = \dfrac{V_i}{1} + \dfrac{V_i - V_o}{2} + I_A$

(B) $\dfrac{V_i - V_o}{2} = I_B + \dfrac{V_o}{3} - I_o$

TRAFO

$I_o = 0 \Rightarrow I_B = \dfrac{V_i}{2} - \dfrac{V_o}{2} - \dfrac{V_o}{3} = \dfrac{V_i}{2} - \dfrac{5V_o}{6}$

(C) $\begin{cases} V_i = -V_o \\ I_A = I_B \end{cases}$

(C) → (B) $I_B = \dfrac{8}{6} V_i = \dfrac{4}{3} V_i = I_A \Rightarrow$ (A) $I_i = V_i + \dfrac{V_i}{2} + \dfrac{V_i}{2} + \dfrac{4}{3} V_i$

$$\left[\frac{V_i}{I_i} = \frac{3}{10} = 0{,}3 = Z_{11}\right]$$

$V_o = -V_i \Rightarrow \left[\dfrac{V_o}{I_i} = -0{,}3 = Z_{21}\right]$

Impongo $I_i = 0$

$-I_A = \dfrac{V_i - V_o}{2} + \dfrac{V_i}{1}$ → $V_o = -V_i$, $I_A = I_B$ → $-I_B = \dfrac{-2V_o}{2} - V_o \Rightarrow \left[I_B = 2V_o\right]$ (1)

(1) → (B) $-\dfrac{2V_o}{2} = 2V_o + \dfrac{V_o}{3} - I_o \Rightarrow I_o = V_o\left(1 + 2 + \dfrac{1}{3}\right) \Rightarrow \left[\dfrac{V_o}{I_o} = 0{,}3 = Z_{22}\right]$

$V_o = -V_i \Rightarrow \left[\dfrac{V_i}{I_o} = -0{,}3 = Z_{12}\right]$

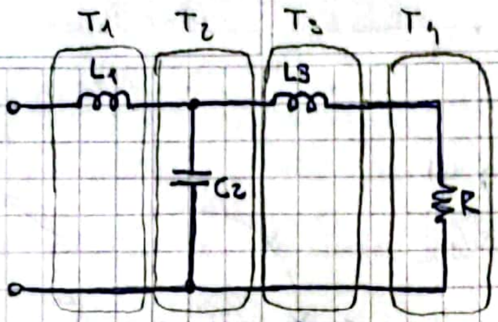
$$\left[Z = \begin{pmatrix} 0{,}3 & -0{,}3 \\ -0{,}3 & 0{,}3 \end{pmatrix} \right]$$

NOTA

HOJA Nº

FECHA

2



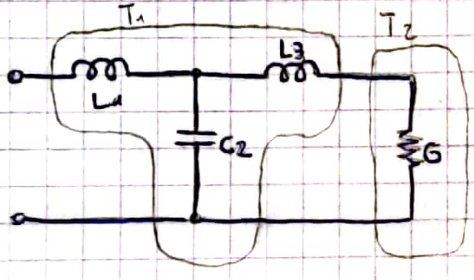
FORMA 1

$$T_1 = \begin{pmatrix} 1 & sL_1 \\ 0 & 1 \end{pmatrix} \quad T_2 = \begin{pmatrix} 1 & 0 \\ sC & 1 \end{pmatrix} \quad T_3 = \begin{pmatrix} 1 & sL_3 \\ 0 & 1 \end{pmatrix} \quad T_4 = \begin{pmatrix} 1 & 0 \\ G & 1 \end{pmatrix}$$

$$T_{12} = \begin{pmatrix} 1+s^2L_1C & sL_1 \\ sC & 1 \end{pmatrix} \qquad T_{123} = \begin{pmatrix} 1+s^2L_1C & sL_3+s^3L_1L_3C+sL_1 \\ sC & s^2L_3C+1 \end{pmatrix}$$

$$T_{1234} = \begin{pmatrix} 1+s^2L_1C+sG(L_1+L_3)+s^3L_1L_3CG & s(L_1+L_3)+s^3L_1L_3C \\ sC+s^2L_3CG+G & s^2L_3C+1 \end{pmatrix}$$

FORMA 2



RED "T"

$$Z_1 = \begin{pmatrix} \frac{s^2L_1C+1}{sC} & \frac{1}{sC} \\ \frac{1}{sC} & \frac{s^2L_3C+1}{sC} \end{pmatrix} = \begin{pmatrix} Z_A+Z_B & Z_B \\ Z_B & Z_C+Z_B \end{pmatrix}$$

$$\Delta Z_1 = \frac{(s^2L_1C+1)(s^2L_3C+1)-1}{s^2C^2}$$

$$\Delta Z_1 = \frac{s^4L_1L_3C^2 + s^2C(L_1+L_3)}{s^2C^2} = s^2L_1L_3C + \frac{L_1+L_3}{C}$$

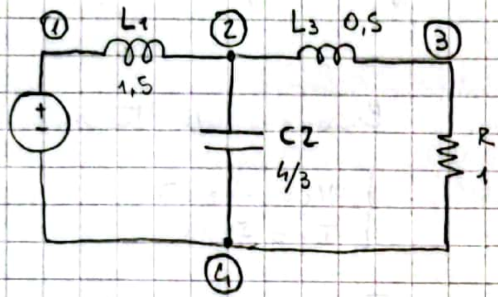
Se llega a la misma matriz intermedia T_{123}

$$T_1 = \begin{pmatrix} \frac{Z_{11}}{Z_{21}} & \frac{\Delta Z}{Z_{21}} \\ \frac{1}{Z_{21}} & \frac{Z_{22}}{Z_{21}} \end{pmatrix} = \begin{pmatrix} s^2L_1C+1 & s^3L_1L_3C+s(L_1+L_3) \\ sC & s^2L_3C+1 \end{pmatrix} = T_{123} \checkmark$$

$$\left[\frac{V_o}{V_i} = \frac{1}{A} = \frac{1}{s^3L_1L_3CG+s^2L_1C+sG(L_1+L_3)+1} = \frac{\frac{1}{L_1L_2CG}}{s^3+s^2\frac{1}{L_3G}+s\frac{L_1+L_3}{L_1L_3C}+\frac{1}{L_1L_2CG}} \right]$$

NOTA

CÁLCULOS CON MAI



$$Y = \begin{pmatrix} \frac{1}{sL_1} & -\frac{1}{sL_1} & 0 & 0 \\ -\frac{1}{sL_1} & \left(sC_2+\frac{1}{sL_1}+\frac{1}{sL_3}\right) & -\frac{1}{sL_3} & -sC_2 \\ 0 & -\frac{1}{sL_3} & \left(\frac{1}{sL_3}+\frac{1}{R}\right) & -\frac{1}{R} \\ 0 & -sC_2 & -\frac{1}{R} & \left(sC_2+\frac{1}{R}\right) \end{pmatrix}$$

$$Y = \begin{pmatrix} Y_a & -Y_a & 0 & 0 \\ -Y_a & Y_a+Y_b+Y_c & -Y_c & -Y_b \\ 0 & -Y_c & Y_c+G & -G \\ 0 & -Y_b & -G & Y_b+G \end{pmatrix}$$

$$\frac{V_o}{V_i} = A^{ij}_{mn} = \mathrm{sgn}(i-j)\,\mathrm{sgn}(m-n)\cdot\frac{\underline{Y}^{mn}_{ij}}{\underline{Y}^{mn}_{mn}} = \frac{V_{ij}}{V_{mn}}$$

$$A^{34}_{14} = (-1)\cdot(-1)\cdot\frac{\underline{Y}^{14}_{34}}{\underline{Y}^{14}_{14}}$$

$$Y^{14}_{34} = \begin{pmatrix} -\frac{1}{sL_1} & sC+\frac{1}{sL_1}+\frac{1}{sL_3} \\ 0 & -\frac{1}{sL_3} \end{pmatrix} \Rightarrow \underline{Y}^{14}_{34} = \frac{1}{s^2L_1L_3}$$

$$Y^{14}_{14} = \begin{pmatrix} \frac{s^2L_1L_3C+L_1+L_3}{sL_1L_3} & -\frac{1}{sL_3} \\ -\frac{1}{sL_3} & \frac{sL_3G+1}{sL_3} \end{pmatrix} \Rightarrow \underline{Y}^{14}_{14} = \frac{s^3L_1L_3^2CG+sL_3G(L_1+L_3)+s^2L_1L_3C+L_1+L_3}{s^2L_1L_3^2} - \frac{1}{s^2L_3^2}$$

$$\underline{Y}^{14}_{14} = \frac{s^3L_1L_3^2CG+s^2L_1L_3C+sL_3G(L_1+L_3)+L_3}{s^2L_1L_3^2}$$

$$\frac{\underline{Y}^{14}_{34}}{\underline{Y}^{14}_{14}} = \frac{\frac{1}{s^2L_1L_3}}{\frac{s^3L_1L_3^2CG+s^2L_1L_3C+sL_3G(L_1+L_3)+L_3}{s^2L_1L_3^2}} = \frac{L_3}{s^3L_1L_3^2CG+s^2L_1L_3C+sL_3G(L_1+L_3)+L_3}$$

$$\frac{V_o}{V_i} = \frac{1}{s^3L_1L_3CG+s^2L_1C+sG(L_1+L_3)+1}$$

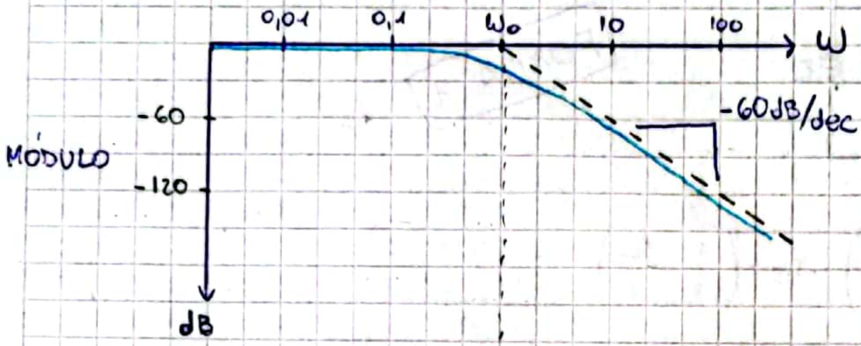
$$\boxed{\frac{V_o}{V_i} = \frac{\frac{1}{L_1L_3CG}}{s^3+s^2\frac{1}{L_3G}+s\frac{L_1+L_3}{L_1L_3C}+\frac{1}{L_1L_3CG}}}$$

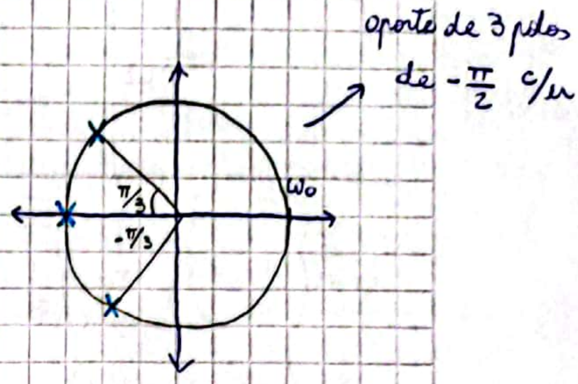
REEMPLAZANDO VALORES

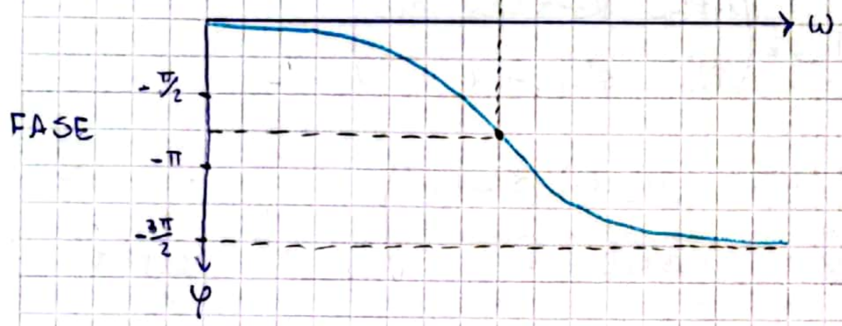
$$\frac{V_o}{V_i} = \frac{1}{s^3 + s^2.2 + s\,2 + 1} = \frac{1}{s^2 + s.2 + 1} \cdot \frac{1}{s + 1}$$

$\omega_o = 1$

$Q = 0{,}5$







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