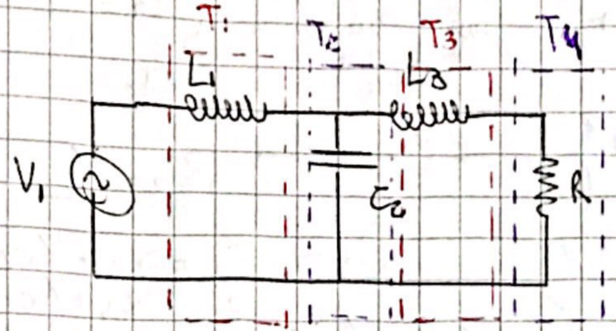
Tarea Semanal 7

$$T_1 = \begin{bmatrix} 1 & sL_1 \\ 0 & 1 \end{bmatrix} \quad T_2 = \begin{bmatrix} 1 & 0 \\ sC_2 & 1 \end{bmatrix}$$



$$T_3 = \begin{bmatrix} 1 & sL_3 \\ 0 & 1 \end{bmatrix} \quad T_4 = \begin{bmatrix} 1 & 0 \\ G & 1 \end{bmatrix}$$

$$T_{TOT} = T_1 \cdot T_2 \cdot T_3 \cdot T_4 = \begin{bmatrix} 1 & sL_1 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ sC_2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & sL_3 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ G & 1 \end{bmatrix}$$

$$T_{TOT} = \begin{bmatrix} s^2 L_1 C_2 + 1 & sL_1 \\ sC_2 & 1 \end{bmatrix} \cdot \begin{bmatrix} sL_3 G + 1 & sL_3 \\ G & 1 \end{bmatrix}$$

$$T_{TOT} = \begin{bmatrix} (s^2 L_1 C_2 + 1)(sL_3 G + 1) + sL_1 G & X \\ X & X \end{bmatrix} \Rightarrow \text{Solo me interesa A}$$

$$A = \left.\frac{V_1}{V_2}\right|_{I_2=0} = \frac{1}{H(s)}$$

$$A = s^3 L_1 L_3 C_2 G + s^2 L_1 C_2 + sL_3 G + 1 \Longrightarrow \boxed{H(s) = \frac{1}{A} = \frac{\frac{1}{L_1 L_3 C_2 G}}{s^3 + s^2 \frac{1}{L_3 G} + s \frac{L_1 + L_3}{L_1 C_2 L_3} + \frac{1}{L_1 L_3 C_2 G}}}$$

Si $L_1 = 3/2$

$L_3 = 1/2$

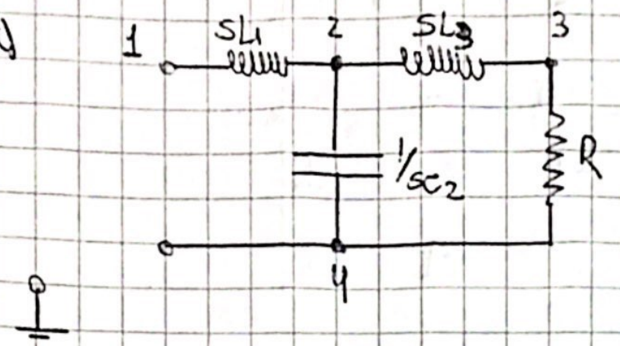
$C_2 = \frac{4}{3}$

$R = 1$

$$\Longrightarrow \boxed{H(s) = \frac{1}{s^3 + s^2 \cdot 2 + s \cdot 2 + 1}}$$

Parte II

a)



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

b)

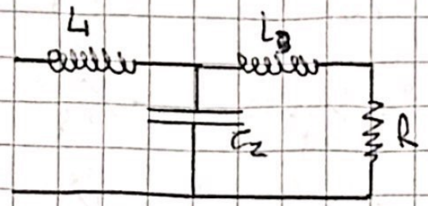
$$H(s) = \frac{V^{34}}{V^{14}} = sig(1-4)\cdot sig(3-4)\cdot \frac{Y^{mn}_{ij}}{Y^{mn}_{mn}} = \underbrace{\underbrace{sig(-3)}_{-1}\cdot \underbrace{sig(-1)}_{-1}}_{=1} \cdot \frac{\begin{vmatrix} -\frac{1}{sL_1} & \frac{1}{sL_1}+\frac{1}{sL_3}+sC_2 \\ 0 & -\frac{1}{sL_3} \end{vmatrix}}{\begin{vmatrix} \frac{1}{sL_1}+\frac{1}{sL_3}+sC_2 & -\frac{1}{sL_3} \\ -\frac{1}{sL_3} & \frac{1}{sL_3}+G \end{vmatrix}}$$

$$Y^{34}_{14} = \begin{vmatrix} -\frac{1}{sL_1} & \frac{1}{s(L_1+L_3)}+sC_2 \\ 0 & -\frac{1}{sL_3} \end{vmatrix} = \frac{1}{s^2 L_1 L_3}$$

$$Y^{34}_{34} = \begin{vmatrix} \frac{1}{sL_1}+\frac{1}{sL_3}+sC_2 & -\frac{1}{sL_3} \\ -\frac{1}{sL_3} & \frac{1}{sL_3}+G \end{vmatrix} = \overbrace{\left(\frac{1}{sL_3}+G\right)\left(\frac{1}{sL_1}+\frac{1}{sL_3}+sC_2\right)}^{\frac{1}{s^2L_1L_3}+\cancel{\frac{1}{s^2L_3^2}}+\frac{C_2}{L_3}+\frac{G}{sL_1}+\frac{G}{sL_3}+sC_2G} - \cancel{\frac{1}{s^2L_3^2}} = \frac{s^3L_1L_3CG + s^2L_1C_2 + sL_3G + sL_1G + 1}{s^2L_1L_3}$$

$$\boxed{H(s) = \frac{Y^{34}_{14}}{Y^{34}_{34}} = \frac{\frac{1}{L_1L_3C_2R}}{s^3 + s^2\frac{1}{L_3G} + s\frac{L_1+L_3}{L_1C_2L_3} + \frac{1}{L_1L_3C_2G}}}$$

c) Método de continuantes.



$$\longrightarrow A = \begin{bmatrix} sL_1 & 1 & 0 & 0 \\ -1 & sC_2 & 1 & 0 \\ 0 & -1 & sL_3 & 1 \\ 0 & 0 & -1 & G \end{bmatrix}$$

$$H(s) = \frac{1}{\det A} \quad \Rightarrow \quad \det A = sL_1 \cdot \mathrm{Adj}(a_{11}) + 1 \cdot \mathrm{adj}(a_{12})$$

$$\det A = sL_1 \cdot \left(sC_2 \cdot \left(sL_3G + 1 \right) + G \right) + sL_3G + 1$$

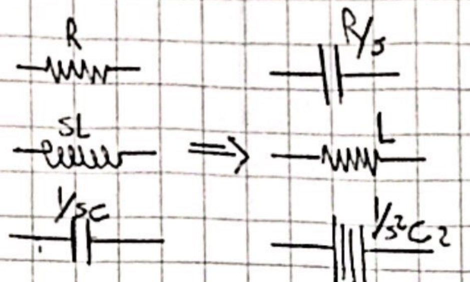
$$\det A = sL_1 \left[\left(s^2 L_3 C_2 G + sC_2 \right) + G \right] + sL_3G + 1$$

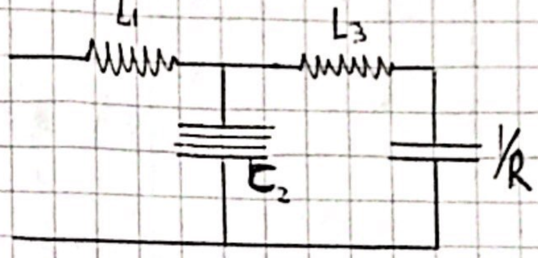
$$\det A = s^3 L_1 L_3 C_2 G + s^2 L_1 C_2 + sL_1 G + sL_3 G + 1$$

$$H(s) = \frac{1}{\det A} = \frac{\frac{1}{L_1 L_3 C_2 G}}{s^3 + s^2 \frac{1}{L_3 G} + s \frac{L_1 + L_3}{L_1 G L_3} + \frac{1}{L_1 L_3 C_2 G}}$$

Parte III

Bruton

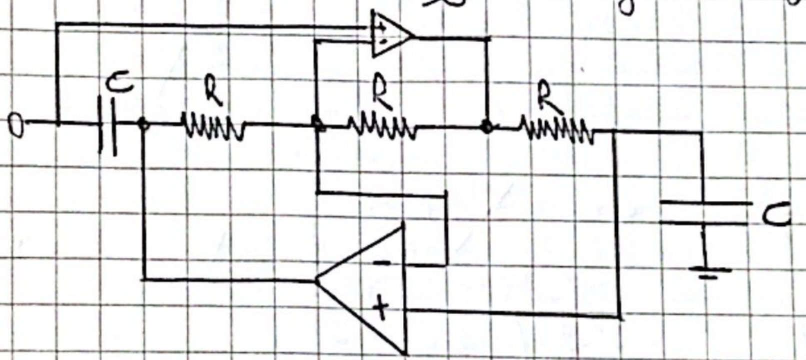




donde para simular el $\frac{1}{s^2C}$ usamos un GIC

La Impedancia del FDNR es $F(s) = \frac{Z_1 Z_3 Z_5}{Z_2 Z_4}$.

En este caso conviene utilizar un GIC con $Z_1 \to C$ y $Z_5 \to C$ dado que el supercap está en derivación! Entonces $Z_1 = \frac{1}{sC} = Z_5$ y $Z_2 = Z_3 = Z_4 = R$



$$F(s) = \frac{1}{s^2 C^2 \cdot R} \Longrightarrow \boxed{C_2 = C^2 R}$$

- Dado que la transformación de Bruton es una aplicación de un modelo, la potencia que se disiparía en la R_b de un parlante se disiparía en las resistencias internas del FDNR, pero el circuito No será de utilidad para satisfacer dicha aplicación (parlante).