*Bonos: Obtener los valores de la red normalizados en frecuencia e impedancia

$$T(\$) = - \frac{\frac{1}{R_1 R_3 C^2}}{\$^2 + \$ \frac{1}{R_2 C} + \frac{1}{R_3^2 C^2}} \quad ; \quad \$ = \frac{s}{\Omega_w} \quad ; \quad \Omega_w = \omega_0 = \frac{1}{R_3 C}$$

$$T(\$) = - \frac{\omega_0 \frac{1}{R_1 C}}{\$^2 + \$ \frac{\omega_0}{Q} + \omega_0^2} \rightarrow T(\$) = - \frac{\omega_0 \frac{1}{R_1 C}}{\omega_0^2 \$^2 + \$ \frac{\omega_0^2}{Q} + \omega_0^2}$$

$$T(\$) = - \frac{\frac{1}{\omega_0} \frac{\overset{\omega_0}{1}}{R_1 C} \cdot \left(\frac{R_3}{R_3}\right)}{\$^2 + \$ \frac{1}{Q} + 1}$$

$$\Rightarrow T(\$) = - \frac{\frac{R_3}{R_1}}{\$^2 + \$ \frac{1}{Q} + 1}$$

Escaneado con CamScanner

Tarea semanal 2

$$\Omega_\omega = \omega_0 = \frac{1}{R_3 C} = 1 \rightarrow C = \frac{1}{R_3}$$

$$\Omega_Z = R_3 \rightarrow \quad \boxed{C' = C\,\Omega_Z\,\Omega_\omega = \frac{1}{R_3} R_3\, 1 = 1}$$

$$\boxed{R_1' = \frac{R_1}{\Omega_Z} = \frac{R_3}{10}\frac{1}{R_3} = \frac{1}{10}}$$

$$\boxed{R_2' = \frac{R_2}{\Omega_Z} = \frac{3R_3}{R_3} = 3}$$

$$\boxed{R_3' = \frac{R_3}{\Omega_Z} = 1}$$

$$\boxed{R_4' = \frac{R_4}{\Omega_Z} = \frac{R_4}{R_3} = 1}$$

$\boxed{R_3 = R_4}$ → lo impongo yo

* Para poder simular desnormalicé con los siguientes valores:

$$\begin{cases} \omega_0 = 100 \text{ rad/seg} \\ R_3 = 1\,K\Omega \end{cases} \Rightarrow \begin{cases} R_1 = 100\,\Omega \\ R_2 = 3\,K\Omega \\ R_3 = 1\,K\Omega \\ R_4 = 1\,K\Omega \\ C = 10\,\mu F \end{cases}$$

$$\omega_0 = 2\pi f$$

$$f = \frac{\omega_0}{2\pi} = 15{,}915\ Hz$$

* Bonus: cálculo de las sensibilidades

$$\boxed{S_C^{\omega_0} = \frac{C}{\omega_0}\frac{\partial \omega_0}{\partial C} = \frac{C}{\frac{1}{R_3 C}}\frac{\partial}{\partial C}\left\{\frac{1}{R_3 C}\right\} = R_3 C^2\left(-\frac{1}{R_3 C^2}\right) = -1}$$

$$S_{R_2}^{Q} = \frac{R_2}{Q}\frac{\partial Q}{\partial R_2} \;;\quad Q = R_2 C\,\omega_0 \;;\quad \omega_0 = \frac{1}{R_3 C} \Rightarrow Q = R_2 C \frac{1}{R_3 C}$$

$$Q = \frac{R_2}{R_3}$$

$$\Rightarrow \boxed{S_{R_2}^{Q} = \frac{R_2}{\frac{R_2}{R_3}}\frac{\partial}{\partial R_2}\left\{\frac{R_2}{R_3}\right\} = \cancel{R_3}\frac{1}{\cancel{R_3}} = 1}$$

NOTA

$$S^{Q}_{R_3} = \frac{R_3}{Q}\,\frac{\partial Q}{\partial R_3} = \frac{R_3}{\frac{R_2}{R_3}}\,\frac{\partial}{\partial R_3}\left\{\frac{R_2}{R_3}\right\} = \frac{\cancel{R_3^2}}{\cancel{R_2}}\left(-\frac{\cancel{R_2}}{\cancel{R_3^2}}\right) = -1$$

Si el resultado de la sensibilidad es 1 o >0 es directamente proporcional, mientras que si es -1 o <0 es inversamente proporcional.

* Bonus: Butterworth