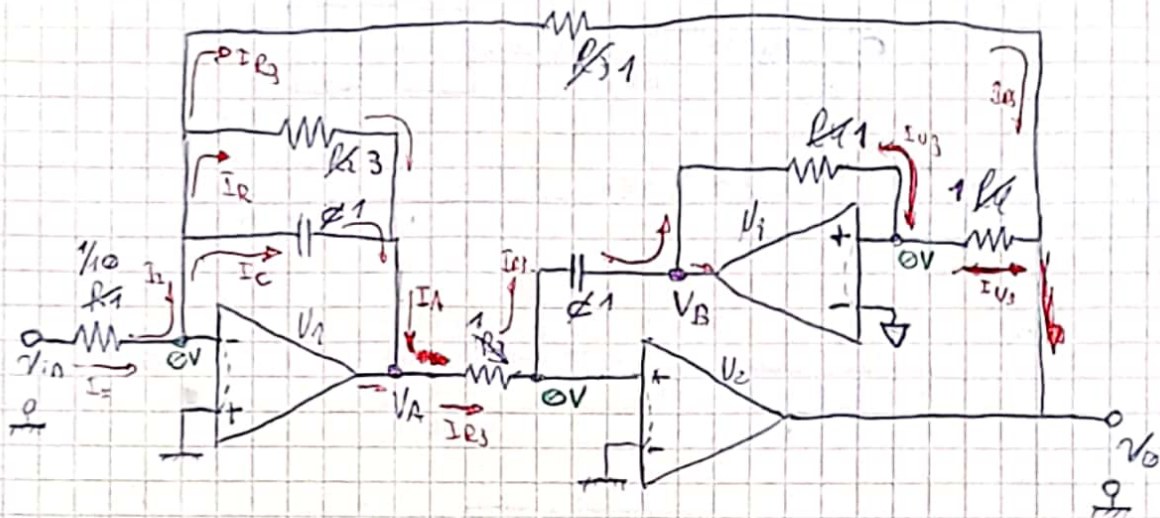


Tarea Semanal 2

HOJA N°

FECHA



$$I_A = \frac{0V - V_A}{R_2} = -V_A \cdot \frac{(SCR_2 + 1)}{R_2}$$

$$I_i = \frac{V_i}{R_1} = I_A + I_{R3} = I_A + \frac{0V - V_0}{R_3} \Rightarrow \frac{V_i}{R_1} = -V_A \frac{(SCR_2 + 1)}{R_2} - \frac{V_0}{R_3}$$

$$\frac{V_A}{R_3} = -V_B \cdot SC \Rightarrow V_A = -V_B \cdot SCR_3 ; \frac{V_B}{R_4} = -\frac{V_0}{R_4}$$

$$V_A = V_0 \cdot SCR_3$$

$$\frac{V_i}{R_1} = -\frac{V_0 \cdot SCR_3 (SCR_2 + 1)}{R_2} - \frac{V_0}{R_3}$$

$$\frac{V_i}{R_1} = -V_0 \left(\frac{S^2 C^2 R_2 R_3^2}{R_1 R_3} + \frac{SCR_3^2}{R_2 R_3} + \frac{R_2}{R_3} \right)$$

$$T(s) = \frac{V_0}{V_i} = - \frac{R_2 R_3}{S^2 C^2 R_1 R_2 R_3^2 + SCR_3^2 + R_2 R_3}$$

$$T(s) = \frac{1}{S^2 + S \cdot \frac{1}{R_2 C R_3} + \frac{1}{C^2 R_3^2}} = \frac{\frac{1}{R_2 C R_3}}{S^2 + S \cdot \frac{1}{R_2 C R_3} + \frac{1}{C^2 R_3^2}}$$

$$\omega_0^2 = \frac{1}{C^2 R_3^2} ; Q = \omega_0 C R_2$$

NOTA $\omega_0 = \frac{1}{C R_1} \Rightarrow Q = \frac{R_2}{R_1}$

Ahora:

$$\omega_0 = 1 \Rightarrow 1 = \frac{1}{CR_3} \Rightarrow \boxed{C = \frac{1}{R_3}}$$

$$Q = 3 \Rightarrow 3 = \frac{R_2}{R_3} \Rightarrow \frac{R_2}{R_3} = 3 \Rightarrow \boxed{R_2 = 3R_3}$$

$$|T(0)|_{dB} = 20 \text{ dB} \Rightarrow |T(0)| = 10 \Rightarrow \left. \frac{k \omega_0^1}{s^2 + s \frac{\omega_0 + \omega_0^1}{Q}} \right|_{s=0} = 10$$

$$\frac{k \omega_0^1}{(0)^2 + (0) \frac{\omega_0 + \omega_0^1}{Q}} = 10 \Rightarrow \frac{k \omega_0^1}{\omega_0^1} = 10 \Rightarrow k = 10$$

$$k = \frac{R_3}{R_1} = 10 \Rightarrow \boxed{R_1 = \frac{R_3}{10}}$$

Tomando como norma de impedancia $\Omega_3 = R_3$

$$R_1' = \frac{R_1}{R_3} = \frac{1}{10} \quad C' = \frac{1}{R_1} R_3 = 1 \quad R_4' = \frac{R_4}{R_3} = 1$$

$$R_2' = \frac{3R_3}{R_3} = 3 \quad R_3' = \frac{R_3}{R_3} = 1$$

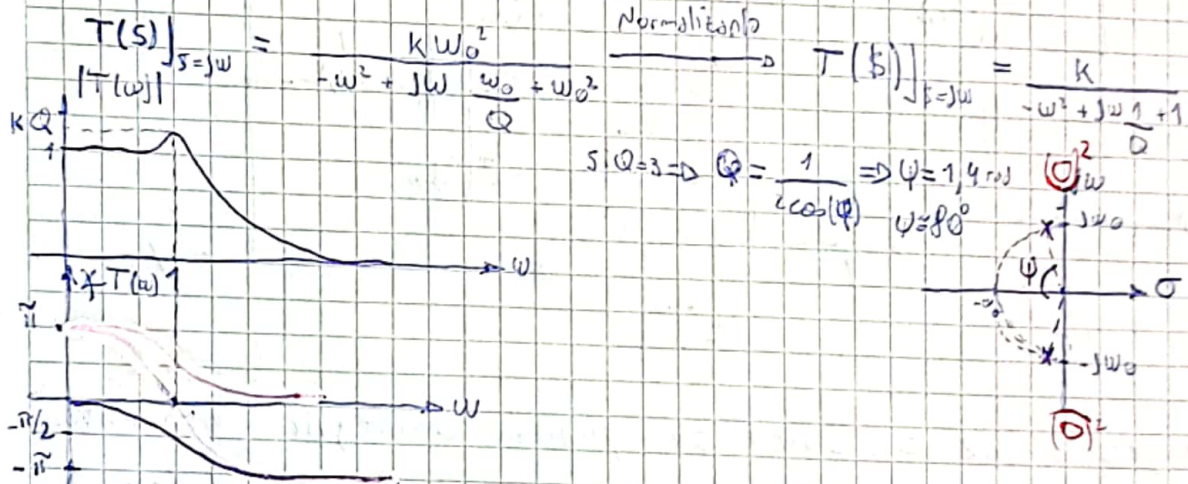
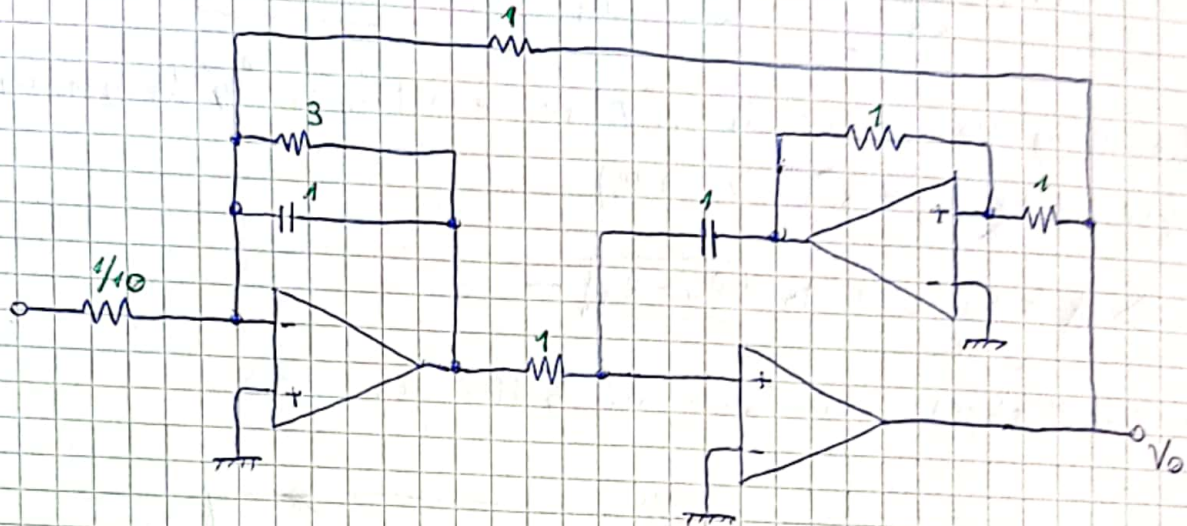
⊛ Como R_4 No influye en la transferencia, la igualo a R_3 para simplificar

$$S_C^{\omega_0} = \frac{C}{\omega_0} \cdot \frac{\partial \omega_0}{\partial C} = \frac{C}{\frac{1}{CR_3}} \cdot \frac{\partial (1/CR_3)}{\partial C} = C^2 R_3 \cdot \frac{-R_3}{C^2 R_3^2} = -1$$

$$S_{R_2}^Q = \frac{R_2}{Q} \cdot \frac{\partial Q}{\partial R_2} = \frac{R_2}{R_2/R_3} \cdot \frac{1}{R_3} = 1$$

$$S_{R_3}^Q = \frac{R_3}{Q} \cdot \frac{\partial Q}{\partial R_3} = \frac{R_3}{\frac{R_2}{R_3}} \cdot \left(\frac{-R_2}{R_3^2} \right) = -1$$

La red normalizada resulta:

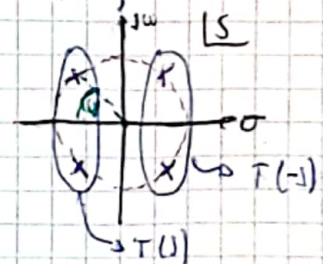


Para que la red cumpla con una transferencia Butterworth:

$$|T_{bz}(\omega)|^2 = \frac{1}{1 + \omega^4} \Rightarrow |T(s)|^2 = T(s) \cdot T(-s) = |T_{bz}(\omega)|^2 \Big|_{\omega=s}$$

$$|T(s)|^2 = \frac{1}{1 + \left(\frac{s}{j}\right)^4} = \frac{1}{1 + s^4}$$

$$s^4 = -1 \Rightarrow s = 1e^{j\frac{\pi + 2k\pi}{4}}$$



$$T(s) = \frac{1}{s^4 + s \frac{1}{1+1}}$$

$$Q = \frac{1}{2\cos\phi} = \frac{1}{2\cos(\pi/4)} = \frac{1}{\sqrt{2}}$$

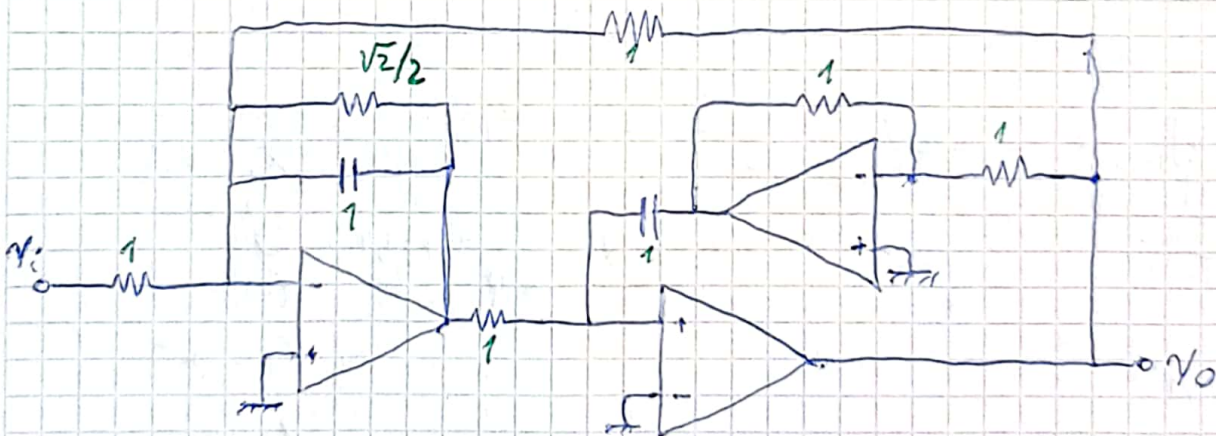
En Nuestro circuito:

$$Q = \frac{R_2}{R_3} \Rightarrow \frac{\sqrt{2}}{2} = \frac{R_2}{R_3} \Rightarrow \boxed{R_2 = R_3 \frac{\sqrt{2}}{2}}$$

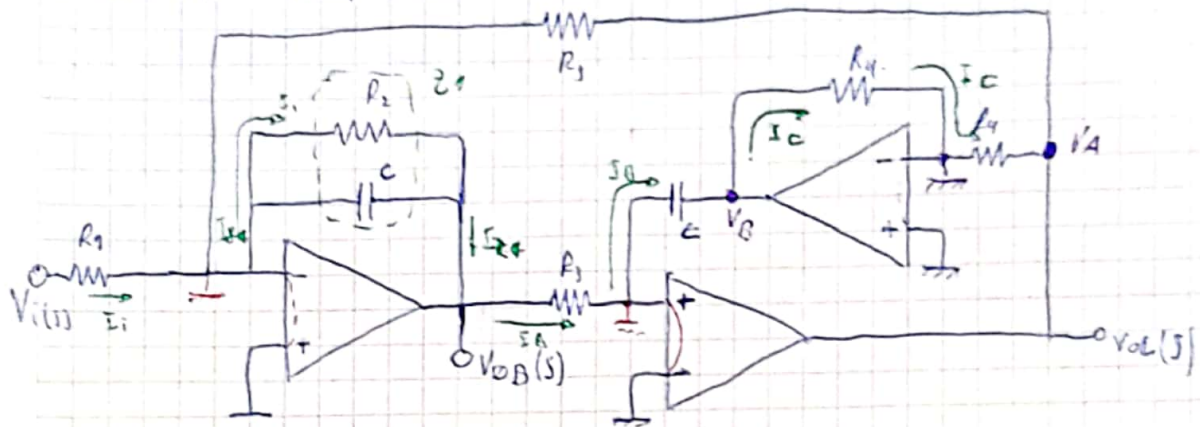
La norma de Frecuencia NO se ve alterada ^{pero} la ganancia
Si (se desea que sea de 0dB)

$$\Rightarrow K = \frac{R_3}{R_1} = 1 \Rightarrow \boxed{R_1 = R_3} -$$

Ackerberg-Mosberg con transferencia Butterworth



Pasa banda con Estructura Akerberg mosberg



$$Z_1 = \frac{1/R_2}{s + 1/R_2C}$$

$$\frac{V_i}{R_1} = I_{A3} + I_{Z1}$$

$$\frac{V_i}{R_1} = -V_{OB} \cdot \frac{sCR_2 + 1}{R_2} - \frac{V_A}{R_3}$$

$$\frac{V_{OB}}{R_3} = -V_{OB} \cdot sC$$

$$\frac{V_{OB}}{R_3} = -\frac{V_A}{R_3} \Rightarrow V_{OB} = -V_A$$

$$\frac{V_{OB}}{R_3} = V_A sC$$

$$V_A = \frac{V_{OB}}{sCR_3}$$

$$\frac{V_i}{R_1} = -V_{OB} \frac{sCR_2 + 1}{R_2} - \frac{V_{OB}}{sCR_3}$$

$$\frac{V_i}{V_{OB}} = -R_1 \left(\frac{sCR_2 + 1}{R_2} + \frac{1}{sCR_3} \right)$$

$$\frac{V_i}{V_{OB}} = -R_1 \left(\frac{s^2 C^2 R_2 R_3^2 + sCR_2 + R_3^2}{sCR_2 R_3^2} \right)$$

$$\frac{V_{OB}(s)}{V_i(s)} = - \frac{sCR_1 R_2 R_3^2}{s^2 C^2 R_2 R_3^2 + sCR_2 + R_3^2} \Rightarrow - \frac{s \cdot \frac{1}{CR_1}}{s^2 + s \frac{1}{CR_2} + \frac{1}{C^2 R_3^2}}$$

$$T_{AP}(s) = - \frac{R_2}{R_1} \cdot \frac{s \frac{1}{CR_1}}{s^2 + s \frac{1}{CR_2} + \frac{1}{C^2 R_3^2}}$$

$$K = \frac{R_2}{R_1} ; \omega_0 = \frac{1}{CR_3}$$

$$\frac{\omega_0}{Q} = \frac{1}{CR_2} \Rightarrow Q = \omega_0 \cdot CR_2 = \frac{R_2}{R_3}$$

NOTA