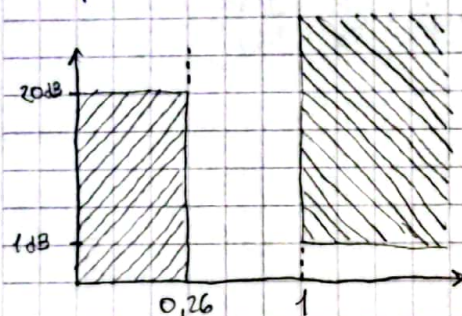
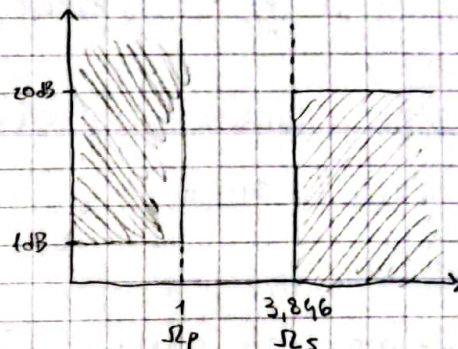


TP laboratorio

Filtro Chebyshev $F_s = 1,2 \text{ KHz}$ $F_c = 4,6 \text{ KHz}$ con atenuación en banda de paso de 1dB como MAX y en banda de stop 20dB como min



$$\begin{aligned}\omega_s &= 7,54 \text{ KHz} \\ \omega_{s-n} &= 0,26 \\ \omega_p &= 28,9 \text{ KHz} \\ \omega_{p-n} &= 1\end{aligned}$$



$$\epsilon^2 = 10^{\frac{\alpha_{\max}/10}{} - 1} \rightarrow \boxed{\epsilon = 0,509}$$

$$\alpha_{\min} = 10 \log_{10} [1 + \epsilon^2 \cosh^2(n \cdot \cosh^{-1}(\Omega_s))] \rightarrow \boxed{n=2} \rightarrow 23,27 \checkmark$$

$$C_2(\omega) = 2\omega \cdot C_1(\omega) - C_0(\omega)$$

$$C_0(\omega) = 1$$

$$C_1(\omega) = \omega$$

$$C_2(\omega) = 2\omega^2 - 1$$

$$|T(\omega)|^2 = \frac{1}{1 + \epsilon^2 (2\omega^2 - 1)^2} = \frac{1}{1 + 4\epsilon^2 \omega^4 - 4\epsilon^2 \omega^2 + \epsilon^2}$$

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

$$\frac{1}{4\epsilon^2 s^4 + 4\epsilon^2 s^2 + \epsilon^2 + 1} = \frac{1}{As^2 + Bs + C} = \frac{1}{As^2 - Bs + C}$$

$$C = \sqrt{\epsilon^2 + 1} = 1,122 \quad A = 2\epsilon = 1,018$$

$$4\epsilon^2 = 2A \cdot C - B^2 \rightarrow B = 1,117$$

$$T(s) = \frac{1}{1,018s^2 + 1,117s + 1,122} = \frac{0,98}{s^2 + 1,097s + 1,102}$$

TRANSFORM.
PB \rightarrow PA

$$T(s) = \frac{s^2}{1,122s^2 + 1,117s + 1,018}$$

$$\left[T(s) = \frac{0,9s^2}{s^2 + 0,995s + 0,91} \right]$$

$$\omega_0 = 0,953$$

$$Q = 0,958$$

$$H = 0,9$$

NOTA

IMPLEMENTACIÓN CON UAF42 (EQ DE DISEÑO)

$$\bullet \frac{V_{HP}}{V_i} = \frac{A_{HP} \beta^2}{\beta^2 + \beta \frac{\omega_n}{Q} + \omega_n^2}$$

$$\bullet \omega_n^2 = \frac{R_2}{R_1 R_{F1} R_{F2} C_1 C_2}$$

$$\bullet Q = \frac{1 + \frac{R_4(R_G + R_Q)}{R_G R_Q}}{1 + \frac{R_2}{R_1}} \sqrt{\frac{R_2 R_{F1} C_1}{R_1 R_{F2} C_2}}$$

$$\bullet A_{HP} = \frac{1 + \frac{R_2}{R_1}}{R_G \left(\frac{1}{R_G} + \frac{1}{R_Q} + \frac{1}{R_4} \right)}$$

VALORES INTERNOS DEL INTEGRADO:

$$\bullet R_1 = R_2 = R_4 = 50k\Omega$$

$$\bullet C_1 = C_2 = 1nF = C$$

OBJETIVO

$$\bullet \omega_n = 0,953 \cdot 2\pi \cdot 4,6kHz = 27544,72Hz$$

$$\bullet Q = 0,958 \quad \bullet A_{HP} = 0,9$$

DISEÑO

$$[R_{F1} = R_{F2} = R_F]$$

$$Q = \frac{1 + R_4(R_G // R_Q)}{2}$$

$$\omega_n^2 = \frac{1}{R_F^2 C^2}$$

$$A_{HP} = \frac{2}{R_G \left(\frac{1}{R_G} + \frac{1}{R_Q} + \frac{1}{R_4} \right)}$$

$$Q = \frac{1 + 50k(R_G // R_Q)}{2} \Rightarrow R_G // R_Q \cong 54,22k\Omega \rightarrow [R_Q = 817,5k\Omega]$$

$$A_{HP} = \frac{2}{R_G \left(\frac{1}{R_G // R_Q} + \frac{1}{50k} \right)} = \frac{2}{R_G \left(\frac{1}{54,22k} + \frac{1}{50k} \right)} \Rightarrow [R_G = 58,76k\Omega]$$

$$\omega_n^2 = \frac{1}{R_F^2 C^2} \rightarrow [R_F = 36,34k\Omega]$$

NORMALIZACIÓN

$$R_G = 56k\Omega$$

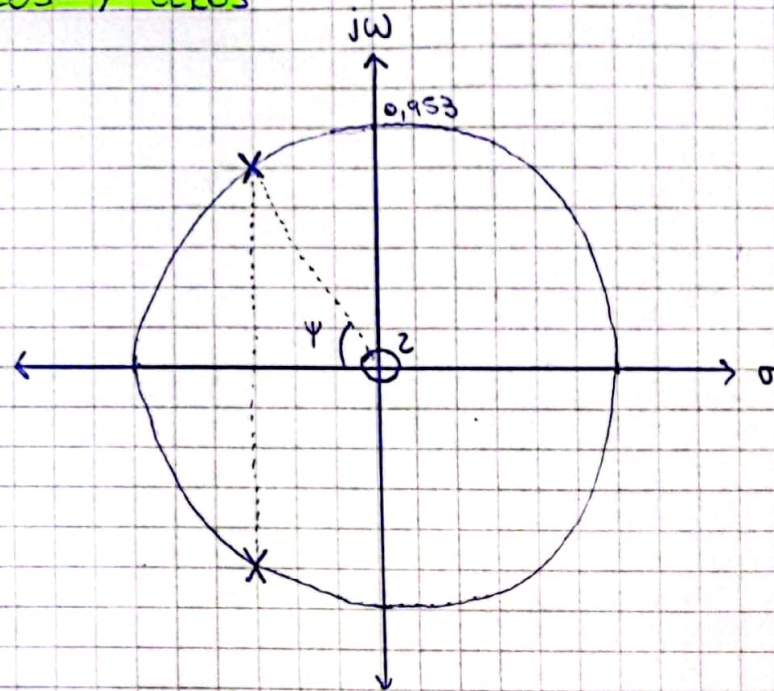
$$R_Q = 820k\Omega$$

$$R_F = 33k\Omega \text{ ó } 39k\Omega$$

$$\left\{ \begin{array}{l} \omega_n = 25641Hz \\ Q = 0,977 \\ A_{HP} = 1,023 \end{array} \right.$$

valores ajustados
con pinchos

POLOS Y CEROS



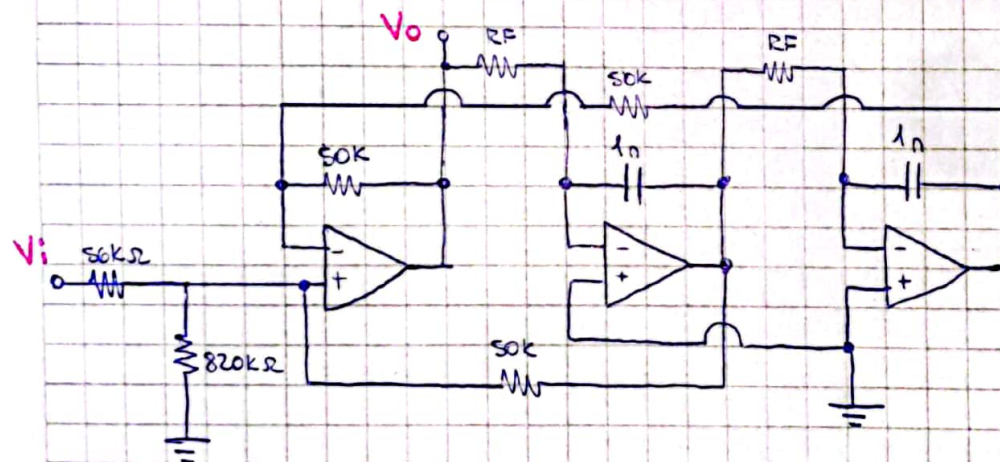
$$\omega_0 = 0,953$$

$$Q = 0,958$$

$$Q = \frac{\omega_0}{2\cos\psi}$$

$$\psi = 60,16^\circ$$

CIRCUITO CON UAF42 Y VALORES COMERCIALES



$$R_F = 33k - 39k$$