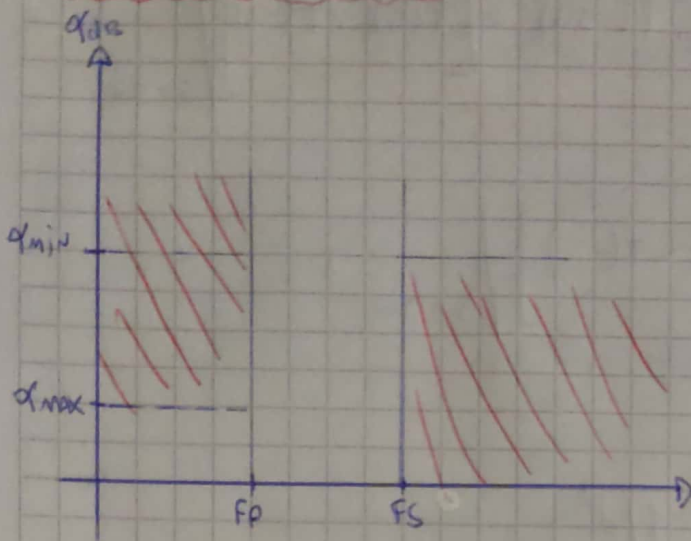


TAREA SEMANAL 3



$$\alpha_{\max} = 10 \text{ dB}$$

$$\alpha_{\min} = 12 \text{ dB}$$

$$f_p = 1,5 \text{ KHz}$$

$$f_s = 3 \text{ KHz}$$

$$\xi^2 = 10^{\alpha_{\max}/10} - 1 \Rightarrow \xi^2 = 10^{1/10} - 1 \Rightarrow \xi^2 = 0,2589$$

$$\xi = 0,5088$$

$$\alpha_{\min}(n) = 10 \log \left(1 + \xi^2 \frac{W_{S_n}^{2n}}{W_{S_n}^2} \right); \quad \omega_w = 2\pi f_p; \quad W_{S_n} = 2\pi f_s / \omega_w$$

$$W_{S_n} = 2$$

$$\alpha_{\min}(1) = 10 \log \left(1 + 0,2589 \cdot 2^{2 \cdot 1} \right) \Rightarrow \alpha_{\min}(1) \approx 3,087 \text{ dB}$$

$$\alpha_{\min}(2) = 10 \log \left(1 + 0,2589 \cdot 2^{2 \cdot 2} \right) \Rightarrow \alpha_{\min}(2) \approx 7,1116 \text{ dB}$$

$$\alpha_{\min}(3) = 10 \log \left(1 + 0,2589 \cdot 2^{2 \cdot 3} \right) \Rightarrow \alpha_{\min}(3) \approx 12,4176 \text{ dB}$$

$\alpha_{\min} = 12 \text{ dB}$
 OPEN 3

TRANSFERENCIA DE MÁXIMA PLANICIDAD DE ORDEN 3

PARTIMOS DE : $|T(j\omega)|^2 = T(j\omega) \cdot T(-j\omega) = \left[T(s) \cdot T(-s) \right] \Big|_{s=j\omega}$

$$|T(j\omega)|^2 = \frac{1}{1 + \left\{ \frac{1}{2} \right\}^2 \cdot \omega^2 \frac{2n}{3}} = \left[T(s) \cdot T(-s) \right] \Big|_{s=j\omega}$$

si $\omega = s/s \Rightarrow |T(s/s)|^2 = \frac{1/\frac{1}{2}}{\frac{1}{2} + (s/s)^6}$

$s^2 \cdot s^2 \cdot s^2 = (-1)(-1)(-1) = -1$

$$|T(s)|^2 = \frac{1/\frac{1}{2}}{\frac{1}{2} - s^6}$$

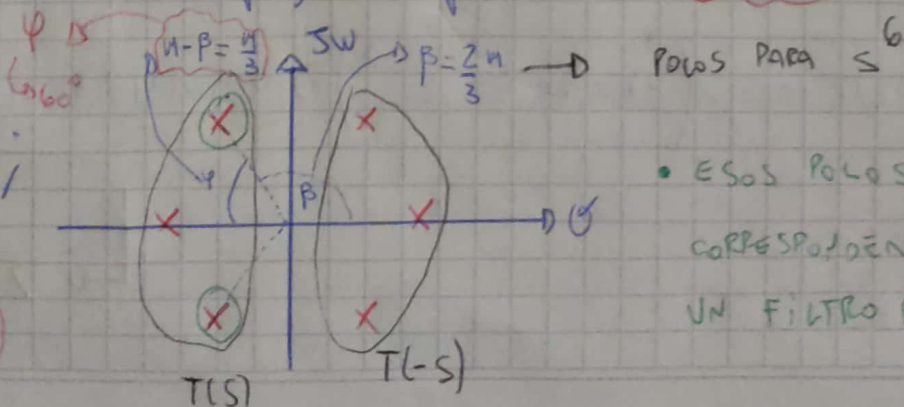
$$|T(s)|^2 = \frac{\omega_0^2}{s^2 + \frac{\omega_0}{Q}s + \omega_0^2} \cdot \frac{\omega_0}{s + \omega_0} \cdot \frac{\omega_0^2}{s^2 - \frac{\omega_0}{Q}s + \omega_0^2} \cdot \frac{\omega_0}{-s + \omega_0}$$

$$\omega_0^6 = 1/\frac{1}{2} \Rightarrow \omega_0 = \sqrt[6]{1/\frac{1}{2}} = \sqrt[6]{0,2589} \Rightarrow \omega_0 = 1,2526$$

$$Q = \frac{1}{2 \cos \phi}$$

$$Q = \frac{1}{2 \cos 60^\circ} = 1$$

2.1



• ESOS POLOS
CORRESPONDEN A
UN FILTRO DE ORDEN 2

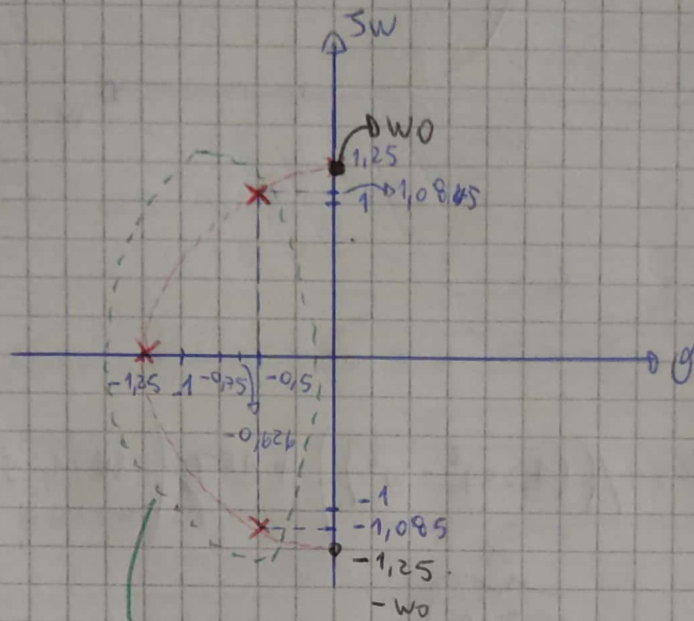
ENTONCES: $T(s) = \frac{(1,2526)^2}{s^2 + 1,2526s + (1,2526)^2} \cdot \frac{1,2526}{s + 1,2526}$

$\rightarrow s_1 = 1,25$

$s_2 = -0,626 + j1,085$

$s_3 = -0,626 - j1,085$

b)



POLOS DE TRANSFERENCIA DE MAX. PLANICIDAD DE ORDEN 3.

$$T(\omega) = T(s) \Big|_{s=j\omega} = \frac{(1,25)^2}{-\omega^2 + 1,25j\omega + (1,25)^2} \cdot \frac{1,2526}{j\omega + 1,2526}$$

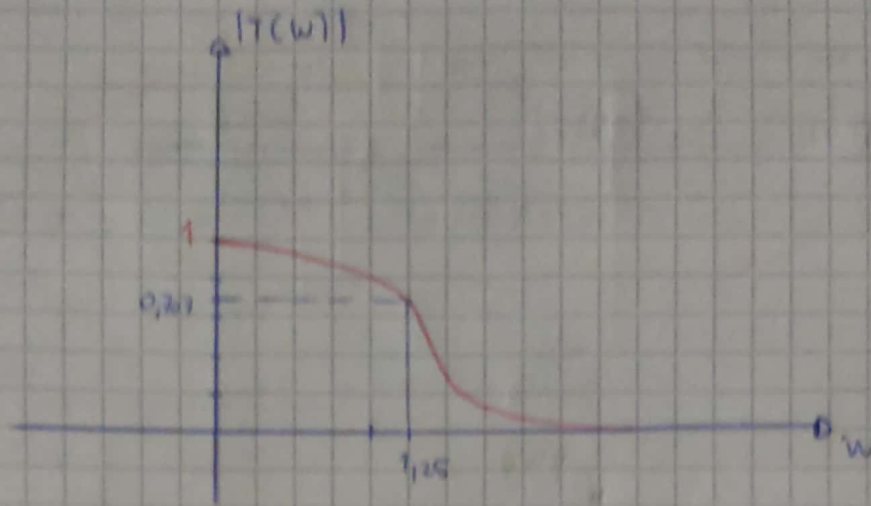
$$|T(\omega)| = \frac{1,2526^2}{\sqrt{(1,25^2 - \omega^2)^2 + \omega^2 \cdot 1,25^2}} \cdot \frac{1,2526}{\sqrt{1,25^2 + \omega^2}}$$

$|T(\omega=0)| = 1$

$|T(\omega \rightarrow \infty)| = 0$

$|T(\omega = \omega_0)| = \frac{1}{\sqrt{2}} \cdot 1 = \frac{1}{\sqrt{2}}$
 $\omega_0 = 1,25$

MODULE:



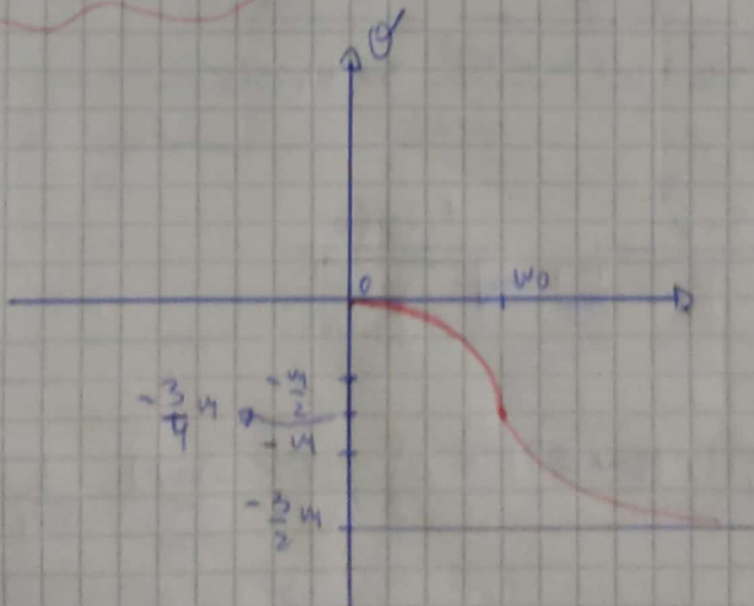
FASE:

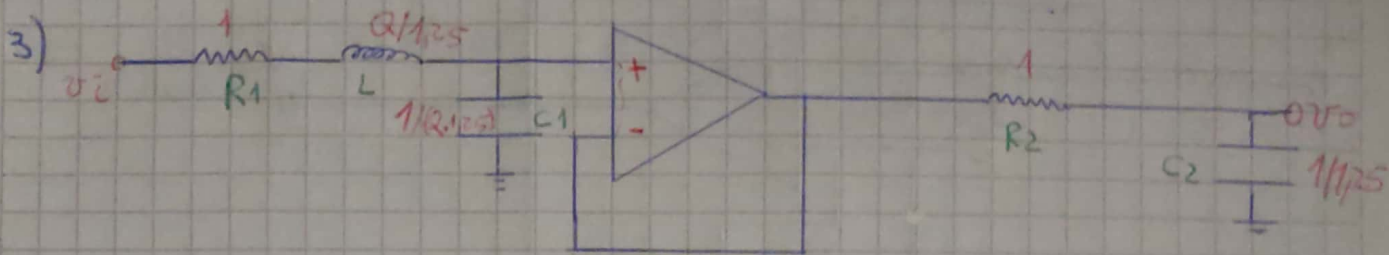
$$\phi(w) = 0^\circ - \left(\text{ARCTG} \left(\frac{1,25w}{((1,25)^2 - w^2)} \right) + \text{ARCTG} \left(\frac{w}{1,25} \right) \right)$$

$$- \text{ARCTG} \left(0^- \right)$$

$$\phi(0) = 0^\circ; \quad \phi(w \rightarrow \infty) = -\pi - \frac{\pi}{2} = -\frac{3\pi}{2}$$

$$\phi(w_0) = -\frac{\pi}{2} - \frac{\pi}{4} = -\frac{3\pi}{4}$$





4) $C = 100 \text{ nF}$ (LOS DOS) ; $\Delta \omega_0 = 24 \text{ FP} = 24 \cdot 1500 \text{ Hz}$

$$C = \frac{C_N}{(\omega_0 R_2)} \rightarrow \Delta Z = \left(\omega_0 \cdot C / C_N \right)^{-1} \Rightarrow \Delta Z = 1 / \left[(\omega_0 \cdot C) 1,25 \right]$$

NORMALIZADA

$$R = \Delta Z = ?$$

$$C_{N1} = 1 / (Q^{1,25}) \quad Q = 1 \rightarrow C_{N1} = 1$$

$$C_{N2} = 1$$

$$\rightarrow \Delta Z_1 = \Delta Z_2 = \left(24 \cdot 1,5 \text{ KHz} \cdot 100 \text{ nF} / 1 \right)^{-1} \cdot 1,25$$

$$R_1 = R_2 = \Delta Z = (1,18 \text{ m}\Omega)^{-1} \Rightarrow R_1 = R_2 = 0,85 \text{ K}\Omega$$

$$L = L_N \cdot \frac{\Delta Z}{\Delta \omega} \Rightarrow L = 1 \cdot 0,85 \text{ K}\Omega / (24 \cdot 1500 \text{ Hz} \cdot 1,25)$$

$$L = 0,072 \approx 72,051 \text{ mH}$$

$$s = S / \omega_0 \rightarrow S = s \cdot \omega_0$$

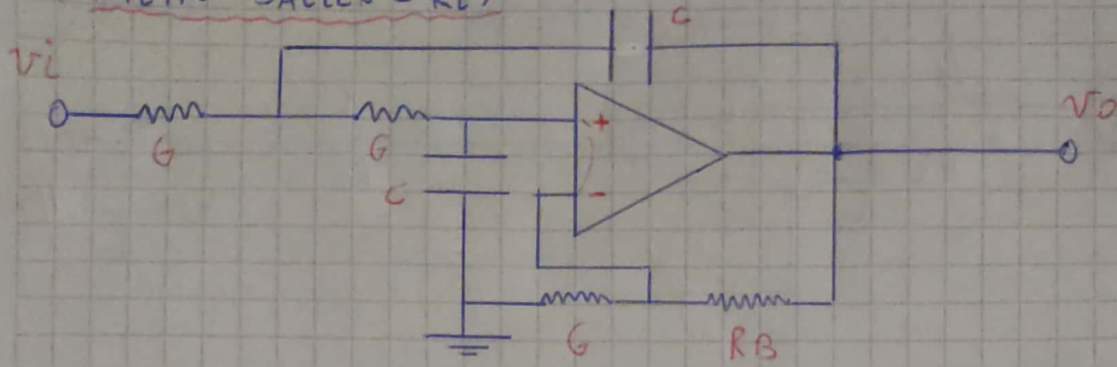
$$T(s) = \frac{\omega_0^2}{s^2 \omega_0^2 + s \frac{\omega_0^2}{Q} + \omega_0^2} \cdot \frac{\omega_0}{s \omega_0 + \omega_0} \rightarrow T(s) = \frac{1}{s^2 + \frac{1}{Q}s + 1} \cdot \frac{1}{s + 1}$$

$$L \text{ Si } \omega_0 = 1$$

$$\text{Si } \omega_0 = 24 \text{ FP} \Rightarrow T(s) = \frac{\omega_0^2}{s^2 + \frac{\omega_0}{Q}s + \omega_0^2} \cdot \frac{\omega_0}{s + \omega_0}$$

NOTA

5) FILTRO Sallen-Key



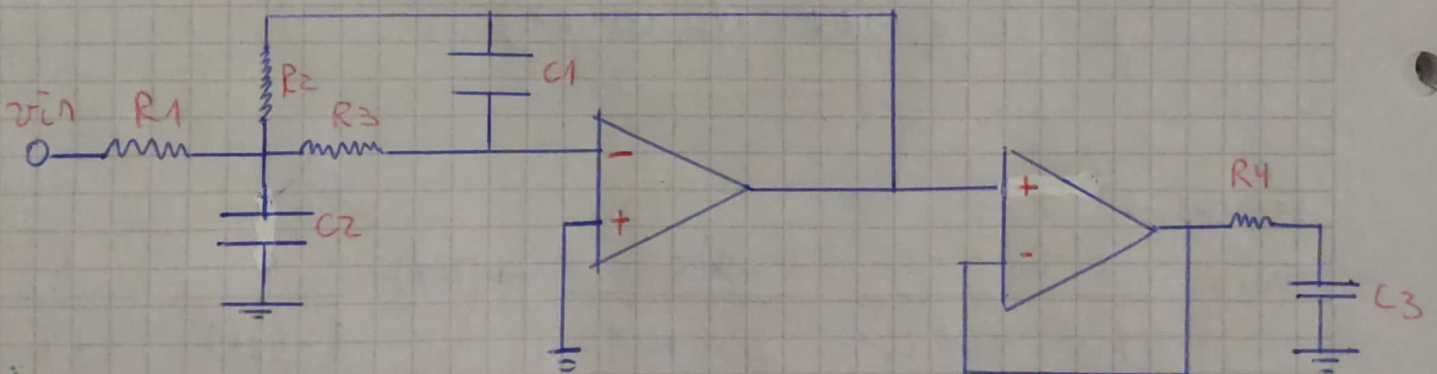
$$T(s) = \frac{K \omega_0^2}{s^2 + \frac{\omega_0}{Q} s + \omega_0^2}$$

$$; \omega_0 = \frac{1}{RC} ; R = 1/G$$

$$Q = \frac{1}{3-K} ; K = \frac{R+R_B}{R}$$

Si $R_B = 0 \rightarrow K = 1 ; Q = 1/3 \rightarrow$ NO ME SIRVE, Q DEBE VALER 1.

MULTIPLE FEED BACK (VERSIÓN PASA BAJOS)



PASA BAJOS
DE 2º ORDEN

1º ORDEN

$$\omega_0 = \frac{1}{R_2 R_3 C_1 C_2} ; K = R_2 / R_1 ; Q = \frac{R_1 \sqrt{R_2 R_3 C_2}}{\sqrt{C_1} (R_1 R_2 + R_2 R_3 + R_1 R_3)}$$

$$K=1 \rightarrow R_1=R_2 ; Q=1 = \frac{\cancel{R_2} \sqrt{R_2 R_3 C_2}}{\sqrt{C_1} (\cancel{R_2} R_2^2 + R_2 R_3 + \cancel{R_2} R_3)} = \frac{\sqrt{R_2 R_3 C_2}}{\sqrt{C_1} (R_2 + 2R_3)}$$

$$\sqrt{C_1} (R_2 + 2R_3) = \sqrt{R_2 R_3 C_2}$$

$$R_1=R_2=R_3=1 \rightarrow \sqrt{C_1} \cdot 3 = \sqrt{C_2}$$

$$9 = \frac{C_2}{C_1} \rightarrow C_2 = 9C_1$$

$$\overset{\omega_0}{1} = \frac{1}{C_1 C_2}$$

$$C_1 \cdot C_2 = 1$$

$$C_1 \cdot 9C_1 = 1 \rightarrow C_1 = \sqrt{1/9} ; C_2 = 9 \frac{1}{C_1}$$

$$C_1 = 1/3$$

$$C_2 = 3$$