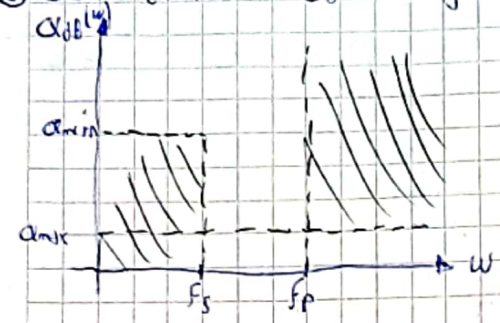
Tarea Semanal 4

①y② Se tiene la siguiente plantilla



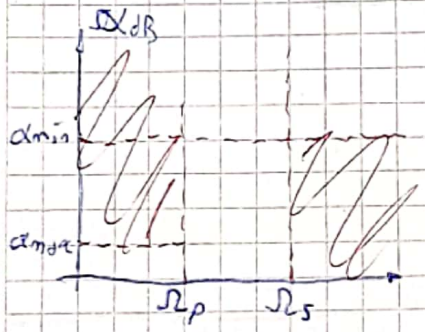
$f_p = 40$ kHz $\quad \alpha_{max} = 1$ dB

$f_s = 10$ kHz $\quad \alpha_{min} = 30$ dB

$\Omega_\omega = 2\pi f_p \Rightarrow \omega_p = 1$

$\omega_s = 0{,}25$

Aplicando el núcleo de transformación $\Omega = \frac{1}{\omega} \Rightarrow \Omega_\omega = \frac{1}{2\pi f_p}$



$\Omega_s = \frac{1}{\omega_s} = 4$

$\Omega_p = \frac{1}{\Omega_p} = 1$

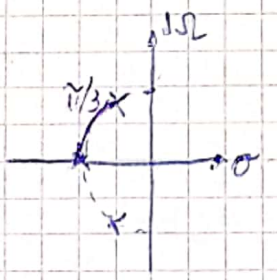
$\varepsilon^2 = 10^{\alpha_{max}/10} - 1 = 0{,}25 \Rightarrow \Omega_b = \frac{\Omega_\omega}{\varepsilon^{1/3}} = \frac{1}{2\pi f_p \cdot \varepsilon^{1/3}}$

Para Máx Planicidad

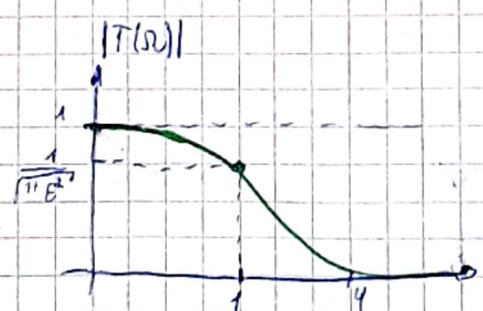
$\alpha_{min} = 10 \log(1 + \varepsilon^2 \Omega_s^{2n}) \Rightarrow$ **n = 3**

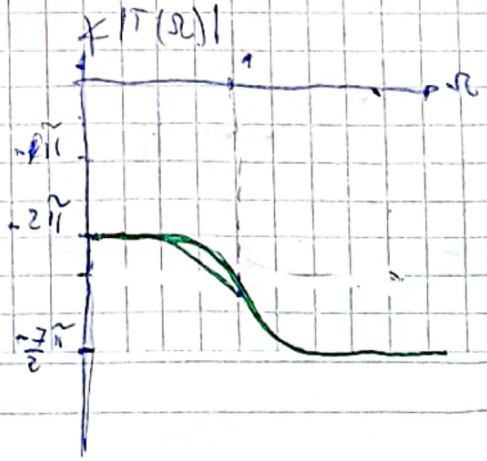
Diagrama de polos y ceros filtro prototipo

$Q = \frac{1}{2\cos(\pi/3)}$



$T(\$) = \frac{1}{\$+1} \cdot \frac{1}{\$^2 + \$\,2\cos(\pi/3) + 1} = \frac{1}{\$^3 + 2\$^2 + 2\$ + 1}$



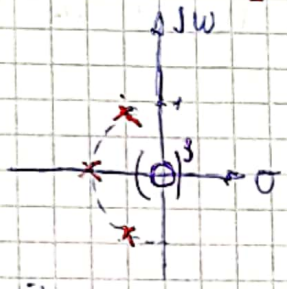


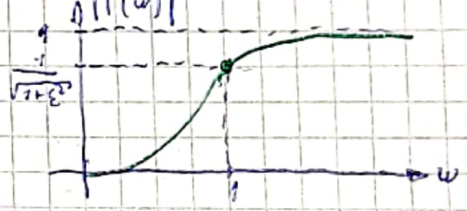
Para llegar al filtro pedido volvemos a aplicar el núcleo de transformación

$$\$ = \frac{1}{S} \quad ; \quad \omega_p = \frac{1}{\Omega_p} = 1 \quad ; \quad \omega_s = \frac{1}{\Omega_s} = 0{,}25 \quad ; \quad \Omega\omega = \frac{1}{\Omega_n} = 2\hat{1}F_0\,\varepsilon^{*1/3}$$

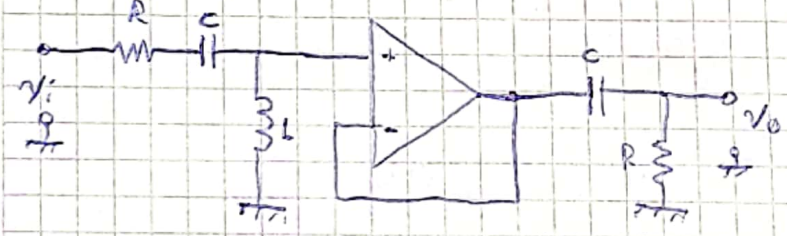
$$T(S) = T(\$)\Big|_{\$=1/S} = \frac{1}{\frac{1}{S^2} + \frac{1}{S} 2\cos\hat{11}/3 + 1} \cdot \frac{1}{\frac{1}{S} + 1}$$

$$\left[T(S) = \frac{S^2}{1 + S\,2\cos\hat{11}/3 + S^2} \cdot \frac{S}{1+S} \right]$$





③ Circuito pasivo

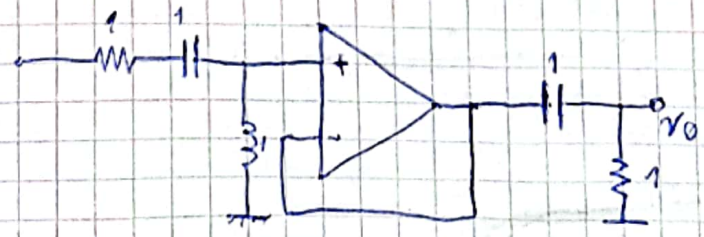


$$T(S) = \frac{S^2}{S^2 + S\frac{R}{L} + \frac{1}{LC}} \cdot \frac{S}{S + \frac{1}{RC}}$$

$$\omega_0^2 = \frac{1}{LC} = 1 \Rightarrow C = \frac{1}{L} = \frac{1}{RQ} \qquad \frac{1}{RC} = 1 \Rightarrow C = \frac{1}{R}$$

$$\frac{1}{Q} = \frac{R}{L} \Rightarrow L = RQ \qquad \Omega_z = R$$

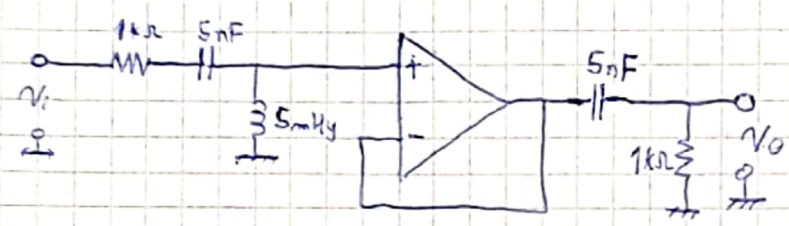
$$C' = \frac{1}{Q} \quad ; \quad L' = Q \quad ; \quad R' = 1 \qquad Q = 2\cos(\hat{11}/3) = 1$$



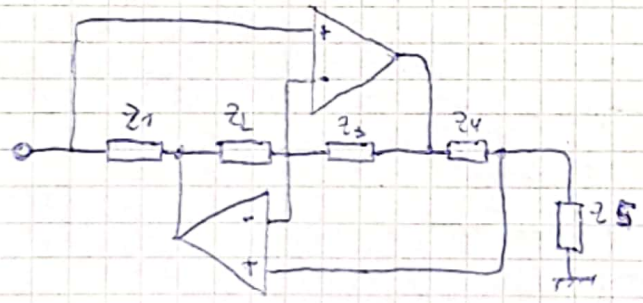
Tomando como $\Omega_2 = R = 1k$ resulta:

$$R = R' \cdot \Omega_2 = 1K\Omega \; ; \quad C = \frac{C'}{\Omega_2 \Omega_w} = \frac{1}{1k_\Omega 2\pi F_p \varepsilon^{1/3}} \simeq 5nF$$

$$L = \frac{L' \cdot \Omega_2}{\Omega_w} = \frac{1 \cdot 1k\Omega}{2\pi F_p \varepsilon^{1/3}} \simeq 5mHy$$

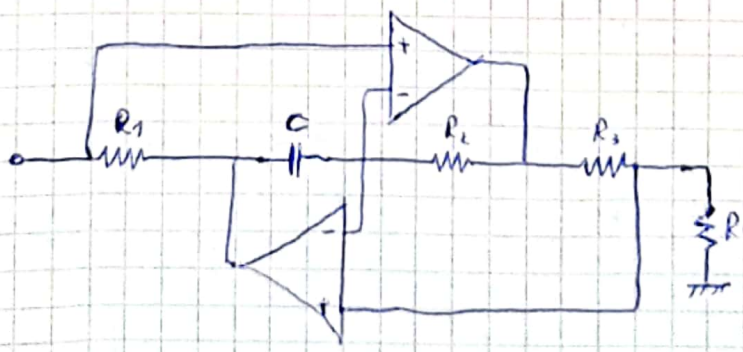


④ GIC de Antoniou



$$Z_i = \frac{Z_1 Z_3 Z_5}{Z_2 Z_4}$$

Necesito reemplazar el inductor por lo que $Z_i = SL$ por lo que:



$$Z_i = \frac{SC R_1 R_3 R_5}{R_2}$$

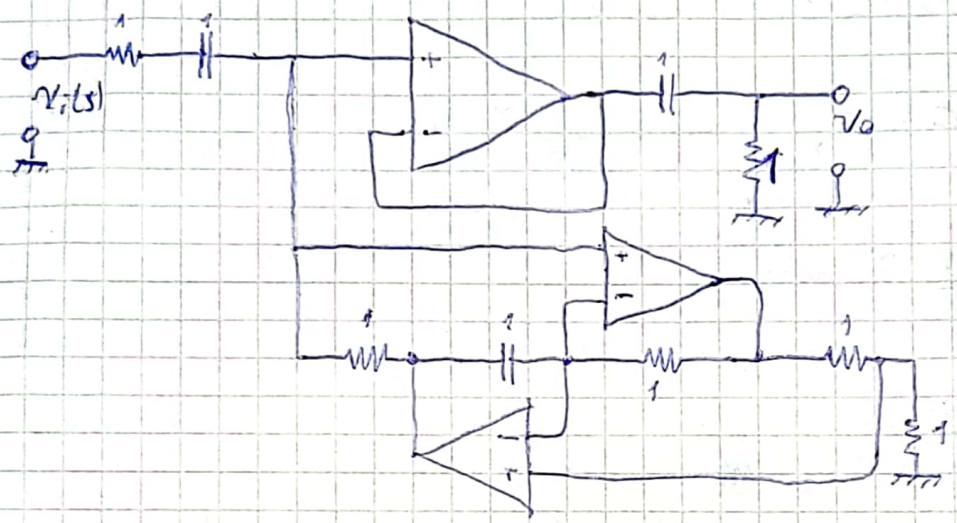
$$Z_i = SCR^2$$

Si $R_1 = R_2 = R_3 = R_5 = R$

Si esta Normalizado

$$Z_i = SL = S \cdot 1 = SCR^2$$

$$CR^2 = 1 \Rightarrow C = 1 \quad y \quad R = 1$$



Si se desnormaliza

$Leq = C \cdot R^2 = 5\,mHy$; si usamos $C = 5nF$ y $R = 1K \rightarrow Leq = 5mHy$