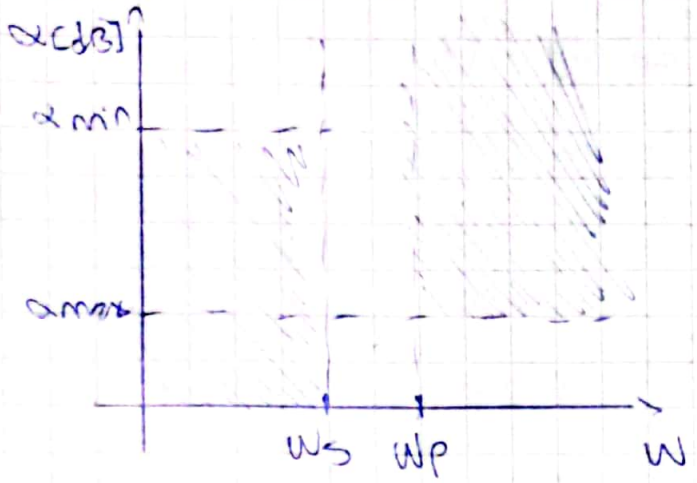
Tarea Semanal 3:



$\alpha_{max} = 1\,dB$; $\alpha_{min} = 35\,dB$

$W_p = 2\pi . f_p = 2\pi . 3500Hz = 7000\pi\ r/s$

$W_s = 2\pi . f_s = 2\pi . 1000Hz = 2000\pi\ r/s$

$W_p' = 1$; $W_s' = 7/7$

1) Convierto plantilla a pasabajos:

$W_{p_{LP}} = 1$; $W_{s_{LP}} = \frac{7}{2} = 3,5$

Máxima planicidad:

- $\varepsilon^2 = 10^{\alpha_{max}/10} - 1 = 0,259$
- Itero para orden:

$n = 2$: $\alpha_{min_2} = 10 \cdot \log(1 + \varepsilon^2 . W_s^{2.2}) = 16\,dB$

$n = 4$: $\alpha_{min_4} = 37,65\,dB > \alpha_{min}$

MP Orden 4:

$$|T(jW)|^2 = \frac{1}{1 + \varepsilon^2 . W^{2.4}} \; ; \; |T(jW)|^2\Big|_{W=\frac{s}{j}} = \frac{1}{1 + \varepsilon^2 \cdot s^8}$$

- Busco W_{Butter}: $W_B = \varepsilon^{-1/n} \cdot W_p = 1{,}184$; $Q = \frac{1}{2\cos\Psi}$

Para $n=4$:

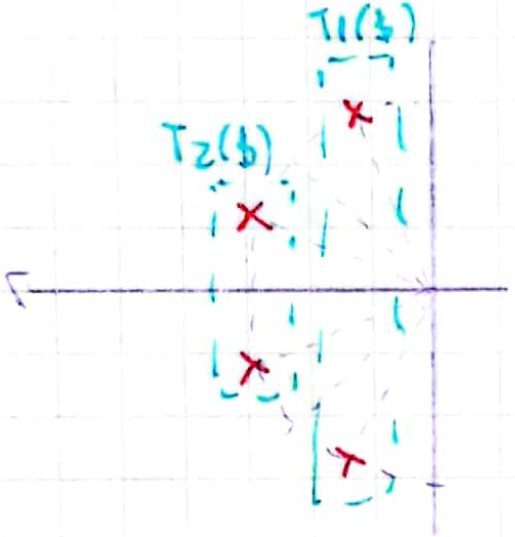
T1 $p_{1-2} = -0{,}382 \pm j\,0{,}923$; T2 $p_{34} = -0{,}923 \pm j\,0{,}382$

Reconstruyo polinomios:

$$T_1(\$) = \frac{1}{\$^2 + 0{,}7654\$ + 1} \quad ; \quad T_2(\$) = \frac{1}{\$^2 + 1{,}8478\$ + 1}$$

$$1/\ T(\$) = \frac{1}{T_1(\$)\ T_2(\$)} \longrightarrow T(\$) = T_1(\$) \cdot T_2(\$)$$

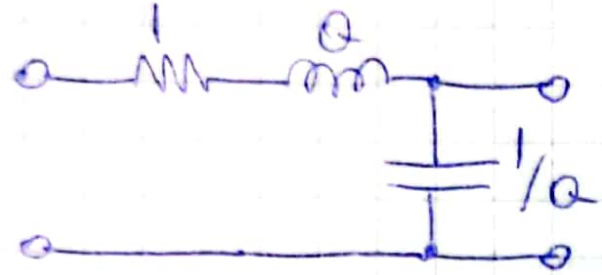
Diagrama:



$n = 4$

- $\pi/2N = \frac{\pi}{8}$ primer polo
- $\frac{\pi}{4}$ espaciamiento

2) $T_1(\$)$: Diseño filtro LP equivalente



$Q = 1,306$; $L' = 1,306$; $C' = 0,7654$

Desnormalizo en W_B: $L = 1,1103$

$C = 0,646$

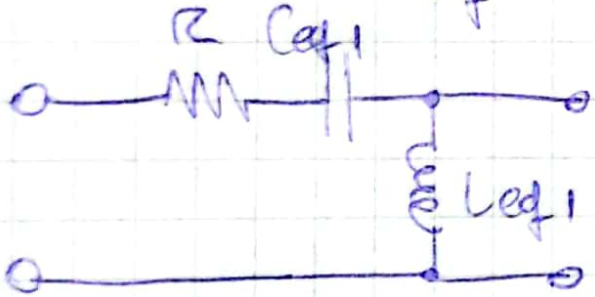
- Pasos equivalente:

$p = k(\$) = \frac{1}{\$}$; $Z_{LP\_R}(p) = Z_{LP\_R}(\$) = R$

$Z_{LP\_L}(p) = p \cdot L = \frac{L}{\$} = \frac{1}{C_{eq} \cdot \$} = Z_{HP\_C}(\$)$

$Z_{LP\_C}(p) = \frac{1}{p \cdot C} = \frac{\$}{C} = L_{eq} \cdot \$ = Z_{HP\_L}(\$)$

$C_{eq} = \frac{1}{L}$; $L_{eq} = \frac{1}{C}$



$R = 1$; $C_{eq1} = 0,9$; $L_{eq} = 1,548$

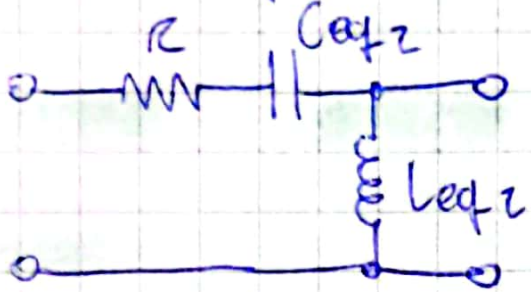
$T_2(b)$: $Q = 0,541$

Pasobajos $L' = Q = 0,541$; $C' = \frac{1}{Q} = 1,848$

Desnormalizo con W_B: $L_2 = 0,457$

$C_2 = 1,56$

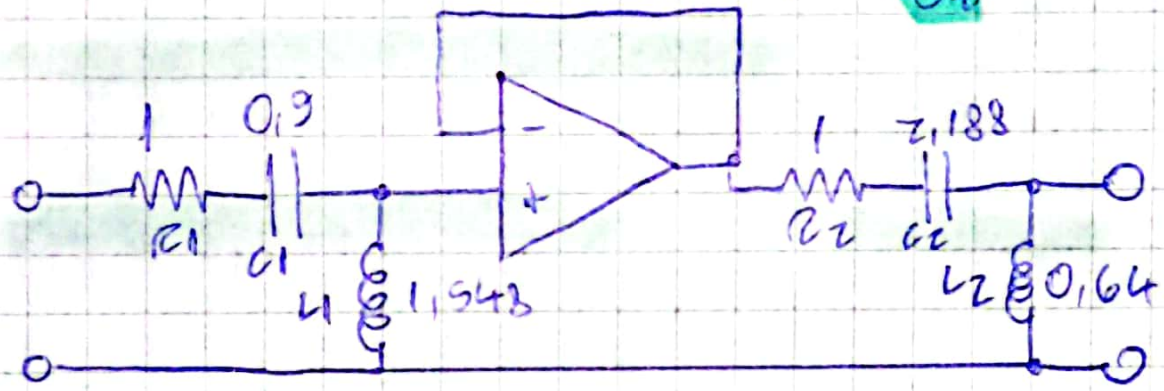
Pasobajos equivalente:



$R = 1$

$Ceq_2 = \frac{1}{L_2} = 2,188$

$Leq_2 = \frac{1}{C_2} = 0,641$



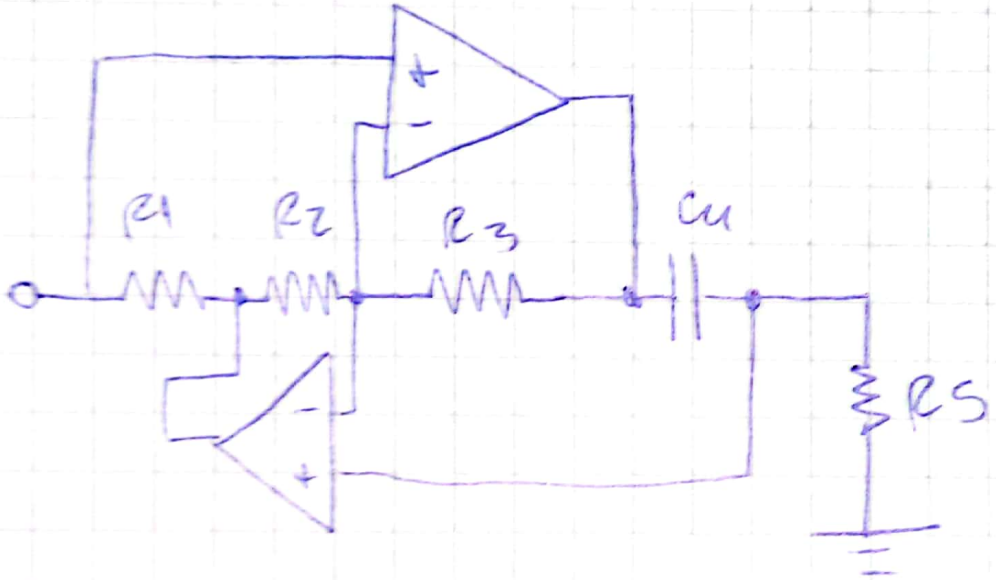
3) $Z_N = \Omega_Z = 1K$; $\Omega_W = 7000\pi$ r/s

$R = R' \cdot \Omega_Z = 1K\Omega$

$C_1 = \frac{C_1'}{\Omega_Z \cdot \Omega_W} = 40,92\ nF$ $\quad C_2 = \frac{C_2'}{\Omega_Z \cdot \Omega_W} = 99,49\ nF$

$L_1 = L_1' \cdot \frac{\Omega_Z}{\Omega_W} = 70,4\ mHy$ $\quad L_2 = L_2' \cdot \frac{\Omega_Z}{\Omega_W} = 29,14\ mHy$

4) Utilizo GIC:



$$Leq = \frac{C4 R1 R3 RS}{R2}$$

Frecuencia crítica del diseño

- Selección Schaumann:

$R2 = R3$; $C4 = ?$; $GS = \omega p \cdot C4$

~~$Leq = C4\ R1\ \omega p\ C4$~~

~~$Leq = C4^2\ \omega p\ R1$~~

- Para $L_1 = 70{,}4$ mHy:

$70{,}4\ mHy = C_4^2 \cdot W_p \cdot R_1$ } No

- $L_{eq} = \frac{C_4 \cdot R_1 \cdot R_A}{R_A} \cdot \frac{1}{W_p \cdot C_4} = \frac{R_1}{W_p}$

- Para $L_1 = 70{,}4$ mHy:

$70{,}4\ mHy = \frac{R_1}{7000\pi} \rightarrow R_1 = 1548{,}17\ \Omega \cong 1K\Omega$

$R_2 = R_3 = 1K\Omega$; $R_5 = \frac{1}{W_p \cdot C_4}$; $C_4 = 1nF \rightarrow R_5 = 45472\Omega$

$R_5 \cong 47K$

- Para $L_2 = 29{,}14$ mHy:

$29{,}14\ mHy = \frac{R_1}{7000\pi} \rightarrow R_1 = 640{,}82\ \Omega \cong 630\Omega$

$R_2 = R_3 = 1K\Omega$; $C_4 = 1nF \rightarrow R_5 = 45472\Omega \cong 47K\Omega$