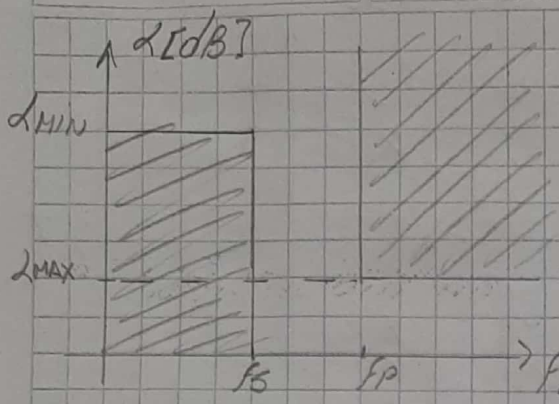
Lugano Damian | T54 | HOJA Nº 1 | FECHA



$\alpha_{MAX} = 1\,dB$

$\alpha_{MIN} = 30\,dB$

$f_p = 40\,KHz$

$f_s = 10\,KHz$

Normalizo en frecuencia $\Omega_w = 2\pi \cdot 40\,KHz$

$w_p = 1$ y $w_s = 1/4$

Para el F_{LP} prototipo $\Rightarrow$ $\begin{cases} w_{p_{LP}} = \dfrac{1}{w_{p_{HP}}} = 1 \\ w_{s_{LP}} = \dfrac{1}{w_{p_{HP}}} = 4 \end{cases}$

$\varepsilon^2 = 10^{\frac{\alpha_{MAX}}{10}} - 1 = 0,256$

$\alpha_{MIN} = 10 \log\left(1 + \varepsilon^2 w_s^{2N}\right)$

↳ Itero con N $\quad \alpha_{MIN_2} = 18,23\,dB$

$\alpha_{MIN_3} = 30,21\,dB \Rightarrow$ ELIJO $N = 3$

$$|T_c(jw)|^2 = \frac{1}{1 + \varepsilon^2 w^{2N}} = \frac{1}{1 + \left(\frac{w}{\varepsilon^{-1/n}}\right)^{2n}}$$

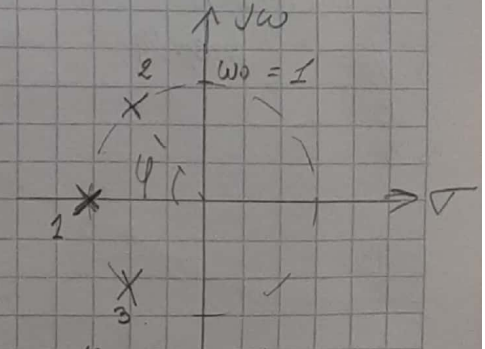
$w_B = w_p \cdot \varepsilon^{-1/n} = \varepsilon^{-1/3} = 1,255$ ↳ Denormalización para Butter

Transferencia para Butterworth de orden 3 (conocida)

$$T_{B_3}(s) = \frac{1}{s^2 + s + 1} \cdot \frac{1}{s+1}$$

↳ Lo desnormalizo en frec de Butter

$$T_{HP_3}(s) = \frac{w_B^2}{s^2 + s \cdot \frac{w_B}{Q} + w_B^2} \cdot \frac{w_B}{s + w_B}$$



Como $\psi = \pi/n = \pi/3$

$\Rightarrow Q = \dfrac{1}{2\cos\pi/3} = 1$

NOTA 12:00 → 13:00

$$T_{HP_3}(s) = \frac{1,575}{s^2 + s.1,255 + 1,575} \cdot \frac{1,255}{s + 1,255}$$

Polos : $P_1 = -1,255$

$P_{2,3} = -0,628 \pm j\,1,087$

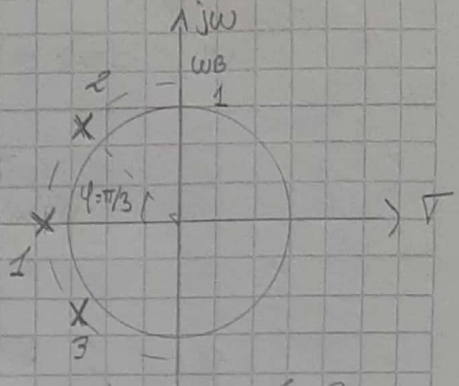


Diagrama de P y Z del F_{LP} prototipo

Para pasar de $F_{LP} \rightarrow F_{HP}$ uso el método de Transformación $p(s) = 1/s$

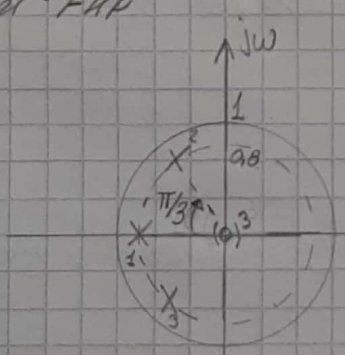
$$\Rightarrow T_{HP_{3\,HP}} = T_{HP_{3\,LP}}(1/s) = \frac{1,575}{1/s^2 + 1/s\,1,255 + 1,575} \cdot \frac{1,255}{1/s + 1}$$

$$\Rightarrow T_{HP_{3\,HP}}(s) = \frac{s^2\,1,575}{s^2.1,575 + s.1,255 + 1} \cdot \frac{s.1,255}{s+1}$$

$$T_{HP_{3\,HP}}(s) = \frac{s^2}{s^2 + s\frac{1,255}{1,575} + \frac{1}{1,575}} \cdot \frac{s}{s + \frac{1}{1,255}}$$

$$T_{HP_{3\,HP}}(s) = \frac{s^2}{s^2 + s.0,797 + 0,635} \cdot \frac{s}{s + 0,797}$$

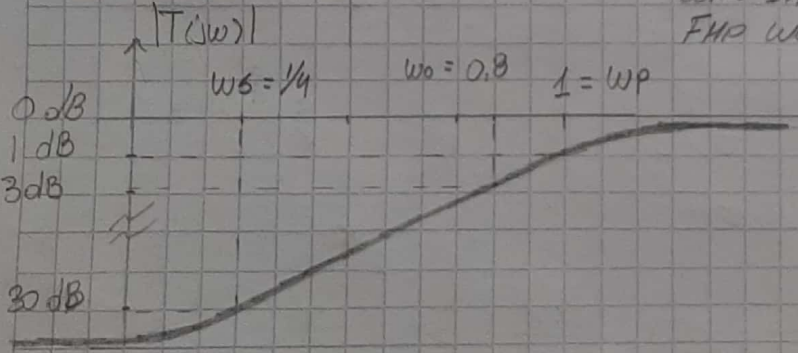
2) Diagrama de P y Z del FHP



$P_1 = -0,797$

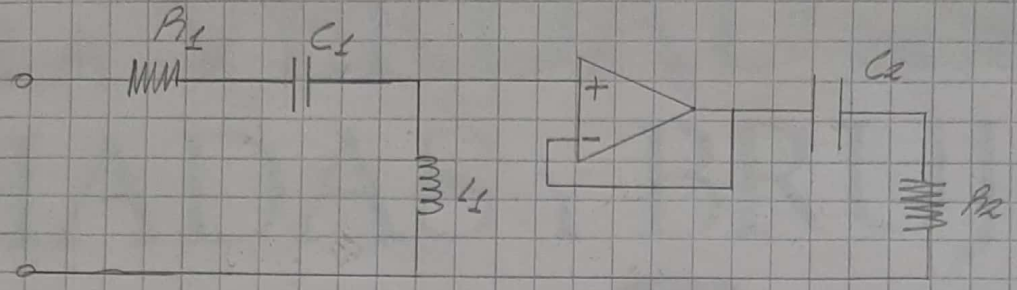
$P_{2,3} = -0,398 \pm j\,0,69$

El diagrama de polos y Zeros del filtro pasa bajos prototipo se mapea en otro plano jw pero con la transformación 1/s.
Como en el FLP $w_0 > 1$ en el FHP $w_0 < 1$.



NOTA 14.37 →

3) $T_{HP3_{HP}}(s) = \frac{s^2}{s^2 + s\,0{,}797 + 0{,}635} \cdot \frac{s}{s + 0{,}797}$



$T_{HP3_{HP}} = \frac{s^2}{s^2 + s\frac{R_1}{L_1} + \frac{1}{L_1 C}} \cdot \frac{s^2}{s + \frac{1}{C_2 R_2}}$

$\frac{1}{C_2 R_2} = 0{,}797$ elijo como $L_2 = R_2 \Rightarrow R_2 = 1$

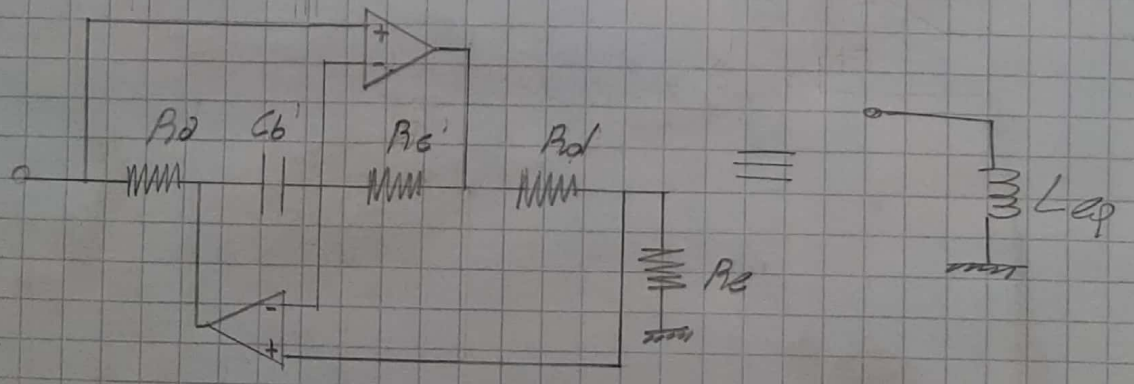
$C_2 = \frac{1}{0{,}797} = 1{,}255 = \frac{1}{\omega}$; determino $C_1 = C_2 = C$

$\begin{cases} \frac{R_1}{L_1} = 0{,}797 \\ \frac{1}{L_1 C} = 0{,}635 \end{cases}$ $L_1 = \frac{1}{C \cdot 0{,}635} = 1{,}255 = \frac{1}{\omega}$

$\Rightarrow R_1 = L_1\, 0{,}797 = 1$

$\Rightarrow \boxed{R_1 = R_2 = R = 1}$ $\boxed{C_1 = C_2 = 1{,}255}$ $\boxed{L_1 = 1{,}255}$

4) Uso el GIC de antoniou para activar el inductor



$Z_{in} = \frac{R_a R_c R_e}{\frac{1}{sC_b} R_d} = sC_b \frac{R_a R_c R_e}{R_d}$ Si $R = R_a = R_c = R_d = R_e$

$\Rightarrow Z_{in} = sL_{eq}$ Siendo $L_{eq} = C_b R^2$

NOTA

En este caso $\angle \varphi = \angle 1 \Rightarrow C_b B^2 = 1{,}255 = \not{B}^{-1/3}$

Propongo $\boxed{B = 1}$ y $\boxed{C_b = C = 1{,}255}$