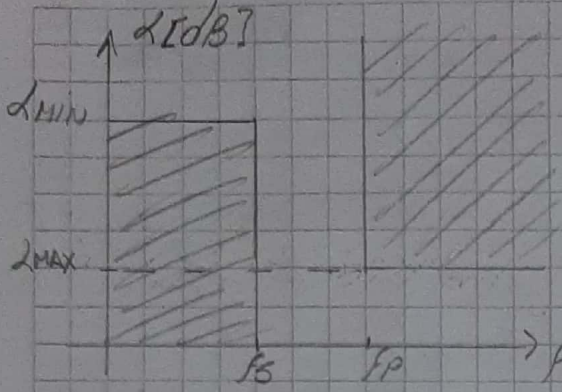
Lugano Damian | T54 | HOJA Nº 1 | FECHA



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

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

$f_p = 40\,KHz$

$f_s = 10\,KHz$

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 $N = 3$

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

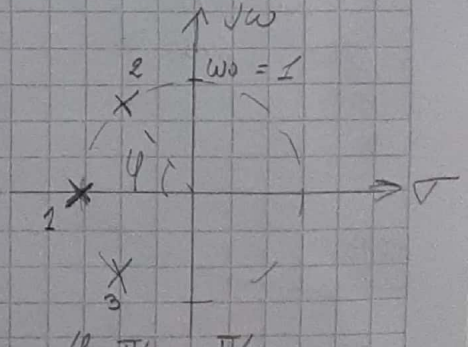
$w_B = w_p \cdot \varepsilon^{-1/n} = \varepsilon^{-1/3} = 1{,}255$ ↳ Desnormalización para Butter

Transferencia para Butterworth de orden 3 (conocido)

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

↳ 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

$$T_{MP_3}(s) = \frac{e^{-2/3}}{s^2 + s \cdot e^{-1/3} + e^{-2/3}} \cdot \frac{e^{-1/3}}{s + e^{-1/3}}$$

$$T_{MP_3}(s) = \frac{1,575}{s^2 + s\,1,255 + 1,575} \cdot \frac{1,255}{s + 1,255}$$

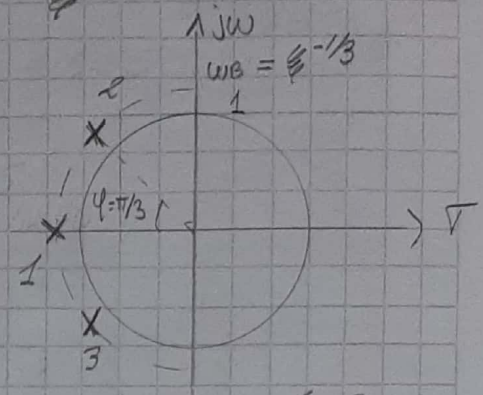


Diagrama de P y Z del FLp prototipo

Polos : $P_1 = -1,255$

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

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

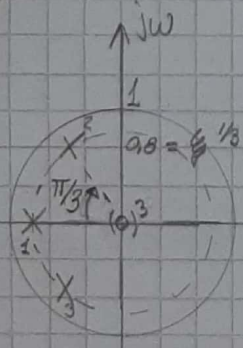
$$\Rightarrow T_{HP_{3\,HP}} = T_{MP_{3\,LP}}(1/s) = \frac{e^{-2/3}}{1/s^2 + 1/s\; e^{-1/3} + e^{-2/3}} \cdot \frac{e^{-1/3}}{1/s + e^{-1/3}}$$

$$\Rightarrow T_{MP_{3\,HP}}(s) = \frac{s^2\, e^{-2/3}}{s^2 \cdot e^{-2/3} + s \cdot e^{-1/3} + 1} \cdot \frac{s \cdot e^{-1/3}}{s + e^{1/3}}$$

$$T_{HP3_{HP}}(s) = \frac{s^2}{s^2 + s\, e^{1/3} + e^{2/3}} \cdot \frac{s}{s + e^{1/3}}$$

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

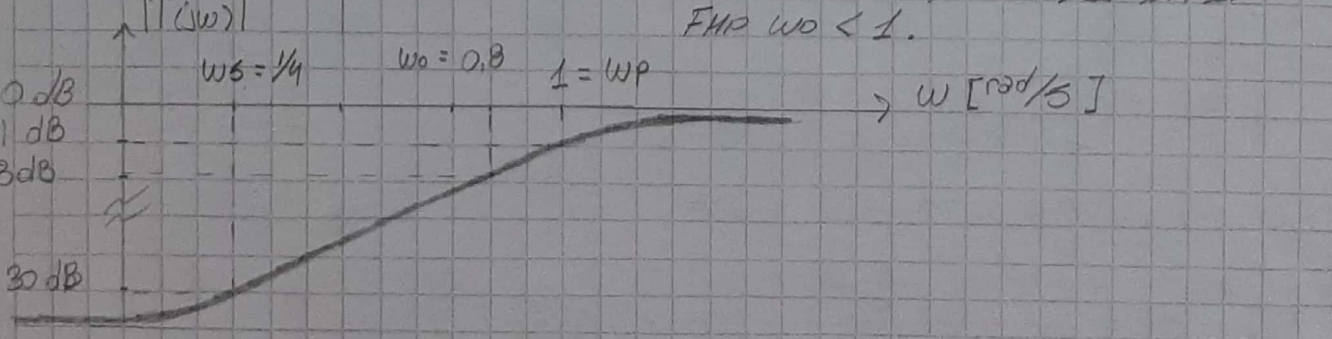
2) Diagrama de P y Z del FHP



$P_1 = -0,797$

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

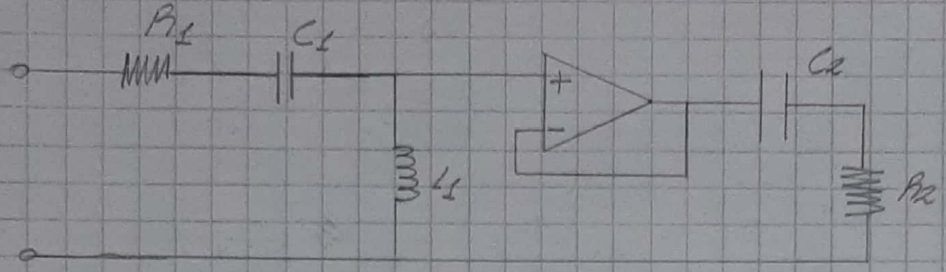
El diagrama de polos y Zeros del filtro pasa bajos prototipo se mapea en otro plano jw pero con la transformación 1/s.
Como en el FLp $w_0 > 1$ en el FHP $w_0 < 1$.



NOTA 14.37 → 16.30

17.00

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



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

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

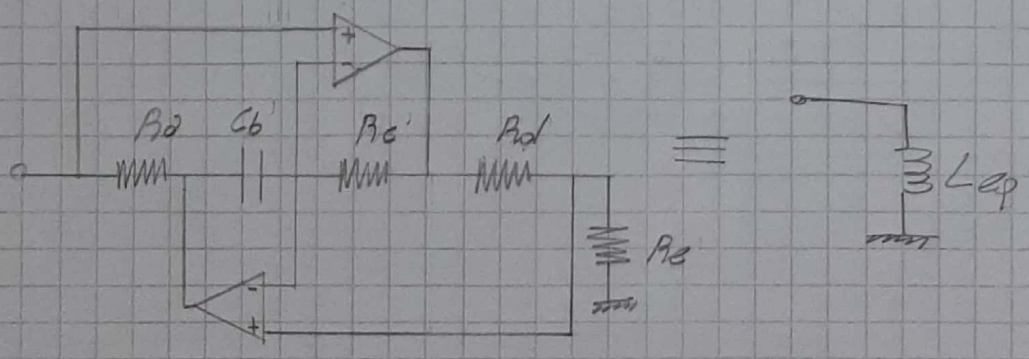
$C_2 = \frac{1}{0,797} = 1,255 = \frac{4}{\pi}$; determino $C_1 = C_2 = C$

$\begin{cases} \frac{R_1}{L_1} = 0,797 \\ \frac{1}{L_1 C} = 0,635 \end{cases}$ $\quad L_1 = \frac{1}{C \cdot 0,635} = 1,255 = \frac{4}{\pi}^{-1/3}$

$\Rightarrow R_1 = L_1 \cdot 0,797 = 1$

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

4) Uso el GIC de antoniou para activar el inductor



$Z_{in} = \frac{Ra\,Rc\,Re}{\frac{1}{sCb}\,Rd} = sCb\frac{Ra\,Rc\,Re}{Rd}$ si $R = Ra = Rc = Rd = Re$

$\Rightarrow Z_{in} = sLeq$ siendo $Leq = Cb\,R^2$

NOTA

En este caso $\angle \varphi = 1$ $\Rightarrow$ $C_b B^2 = 1{,}255 = \beta^{-1/3}$

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