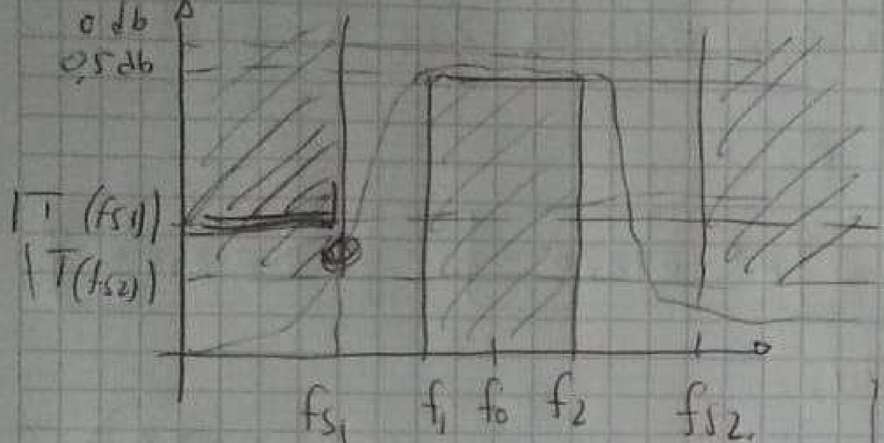
TS5

Pasabanda $\omega_0 = 2\pi\, 22\,kHz$ $Q = 5$.

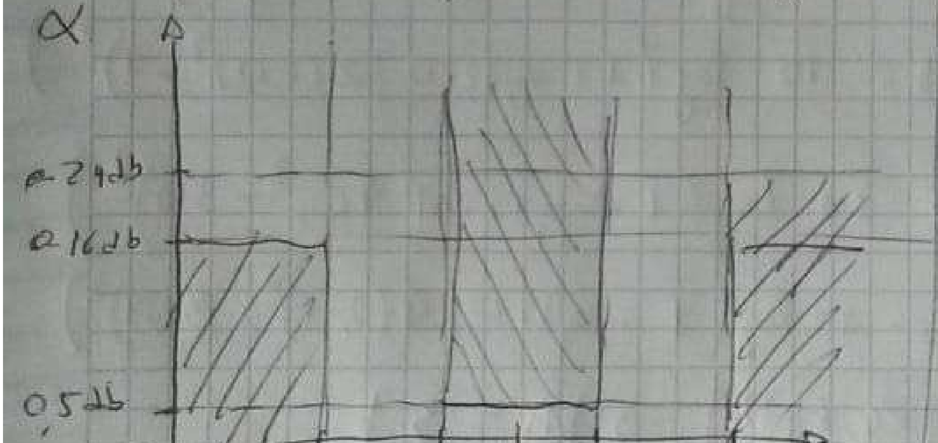
Cheby ripple $0{,}5\,db$

$$|T(f_{S_1})| = -16\,db \qquad f_{S_1} = 17\,kHz$$

$$|T(f_{S_2})| = -24\,db \qquad f_{S_2} = 36\,kHz$$



Pasamos a la plantilla normalizada



Ahora Transformo en Prototipo PB para lo cual

$$\Omega_S = Q \cdot \frac{(\omega_S^2 - 1)}{\omega_S}$$

$$\Omega_{S_1} = \left| \frac{5 \cdot (0{,}772^2 - 1)}{0{,}772} \right| \Rightarrow \Omega_{S_1} = 2{,}6166$$

$$\Omega_{S_2} = \left| \frac{5 \cdot (1{,}6363^2 - 1)}{1{,}6363} \right| \Rightarrow \Omega_{S_2} = 5{,}1258$$

Calculo auxiliar

$$Q = \frac{\omega_0}{B} = 5$$

$\Downarrow$

normalizo

$$5 = \frac{1}{B} \Rightarrow B = 0{,}2$$

$$\text{y } \omega_0^2 = \omega_2\, \omega_1$$

$\Downarrow$

$$\Omega_0^2 = \Omega_2\, \Omega_1$$

$$\Omega_2 - \Omega_1 = 0{,}2$$

$$\Omega_2 \Omega_1 = 1 \Rightarrow \Omega_2 = \frac{1}{\Omega_1}$$

$\Downarrow$

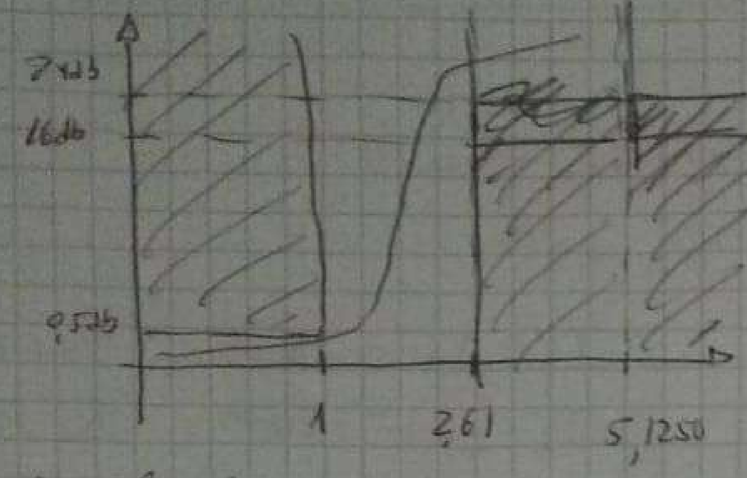
$$\frac{1}{\omega_1} - \omega_1 = 0{,}2$$

$$\frac{1 - \omega_1^2}{\omega_1} = 0{,}2$$

$$0 = \omega_1^2 + 0{,}2\,\omega_1 - 1$$

$$\boxed{\begin{aligned} \omega_1 &= 0{,}904 \\ \omega_2 &= 1{,}1049 \end{aligned}}$$

Con lo cual.-



Con lo cual elegimos banda de stop $\omega_s = 2{,}61$, $\alpha = 24\,db$

Ahora ~~...~~ calculamos ε.

$$\varepsilon^2 = 10^{\frac{0,5}{10}} - 1 \Rightarrow \boxed{\varepsilon^2 = 0{,}1220} \qquad \boxed{\varepsilon = 0{,}3493}$$

Determinamos n para cheby.

$n=2$ $\quad 16\,db = 10 \log\left(1 + \varepsilon^2 (2\omega_s^2 - 1)^2\right)$

$\times \quad 16\,db = 10 \log\left(1 + 0{,}1220\,(2(2{,}61)^2 - 1)^2\right)$

$n=3$ $\quad 16\,db - 10 \log\left(1 + 0{,}1220\,(4\omega_s^3 - 3\omega)^2\right)$

$\checkmark \quad 16\,db = 10 \log\left(1 + 0{,}1220\,(4(2{,}61)^3 - 3\,2{,}61)^2\right)$

$$\boxed{26{,}89\,db} \Rightarrow \boxed{n = 3}$$

luego construimos la función transfer.

$$\left|T(j\omega)\right|^2_{\omega=\frac{s}{j}} = \frac{1}{1+\varepsilon^2(4\omega^3 - 3\omega)^2}$$

$$\left|T(s)\right|^2 = \frac{1}{1+\varepsilon^2\left(16\omega^6 - 24\omega^4 + 9\omega^2\right)}\Bigg|_{\omega=\frac{s}{j}}$$

$$|T(\$)|^2 = \frac{1}{-\varepsilon^2 16 \$^6 + \varepsilon^2 24 \$^4 - \varepsilon^2 9 \$^2 + 1}$$

$$|T(\$)|^2 = \frac{1/\varepsilon^2 16}{-\$^6 - \$^4 \frac{3}{2} - 0{,}5625 \$^2 + \frac{1}{\varepsilon^2 16}}$$

~~$|T(\$)|^2$~~ buscamos las raíces en software.

$$\$_1 = -0{,}62645$$
$$\$_2 = -0{,}31325 \pm 1{,}0219 j$$

$$T(\$) = \frac{0{,}5122}{(\$ + 0{,}62645) \cdot (\$^2 + 0{,}6264 \$ + 1{,}14244)}$$

ahora:

$$\$ = 5 \left(\frac{s^2 + 1}{s} \right)$$

$$T(s) = \frac{0{,}5122}{\left(5\left(\frac{s^2+1}{s}\right) + 0{,}62645\right)\left(5^2\left(\frac{s^2+1}{s}\right)^2 + 0{,}62645\left(5\left(\frac{s^2+1}{s}\right)\right) + 1{,}14244\right)}$$

$$T(s) = \frac{0{,}5122}{\frac{5s^2 + 5 + 0{,}62645}{s} \quad \frac{25(s^4 + 2s^2 + 1) + s(3{,}1325 s^2 + 3{,}1325) + 1{,}14244}{s^2}}$$

HOJA Nº

FECHA

$$\frac{0{,}5122\, s^3}{(5s^2+s+0{,}62695s)\left[(25s^4+2s^2+1)+s(3{,}1305s^2+3{,}1305s)+1{,}4244\right]}$$

$$s^3\left(\frac{0{,}5122}{125}\right)= 0{,}005$$

$$[illegible]\, s^6 + 0{,}26s^5 + 3{,}12s^4 + 0{,}49s^3 + 3{,}12s^2 + 0{,}26s + 1$$