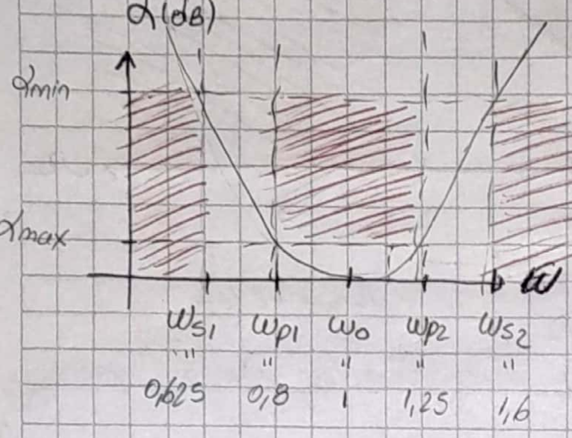
19:24

HOJA Nº 1 de 2

FECHA

Trabajo Semanal 4 bis



$\alpha_{max} = 3\,dB$

$\alpha_{min} = 20\,dB$

$f_{p1} = 1600\,kHz$

$f_{p2} = 2500\,kHz$

$f_{s1} = 1250\,kHz$

$f_{s2} = 3200\,kHz$

a) $f_0 = \sqrt{f_{p1} \cdot f_{p2}}$; $f_0 = 2000\,kHz$

$\Omega_\omega = \omega_0 = 2\pi f_0 \Rightarrow \underline{\omega_0 = 1}$

$$p = K(s) = Q \cdot \frac{s^2+\omega_0^2}{s\,\omega_0} = Q \cdot \frac{s^2+1}{s}$$

$$Q = \frac{\omega_0}{BW} = \frac{2\pi f_0}{2\pi(f_{p2}-f_{p1})} = \frac{f_0}{f_{p2}-f_{p1}} \;;\; \underline{Q = \frac{20}{9}}$$

$$\therefore p = \frac{20}{9} \cdot \frac{s^2+1}{s^2} \;;\; j\Omega = p\Big|_{s=j\omega} = \frac{20}{9}\,\frac{(j\omega)^2+1}{(j\omega)} = \frac{20}{9} \cdot \frac{1-\omega^2}{j\omega}$$

$$j\Omega = \frac{20}{9} \cdot \frac{1-\omega^2}{j\omega} \cdot \frac{j}{j} \;;\; \Omega = \frac{20}{9} \cdot \frac{\omega^2-1}{\omega}$$

$\omega_0 = 1 \longrightarrow \Omega_0 = 0$

$\omega_{s1} = 0{,}625 \rightarrow \Omega_{s1} = \frac{-13}{6} \simeq -2{,}167$

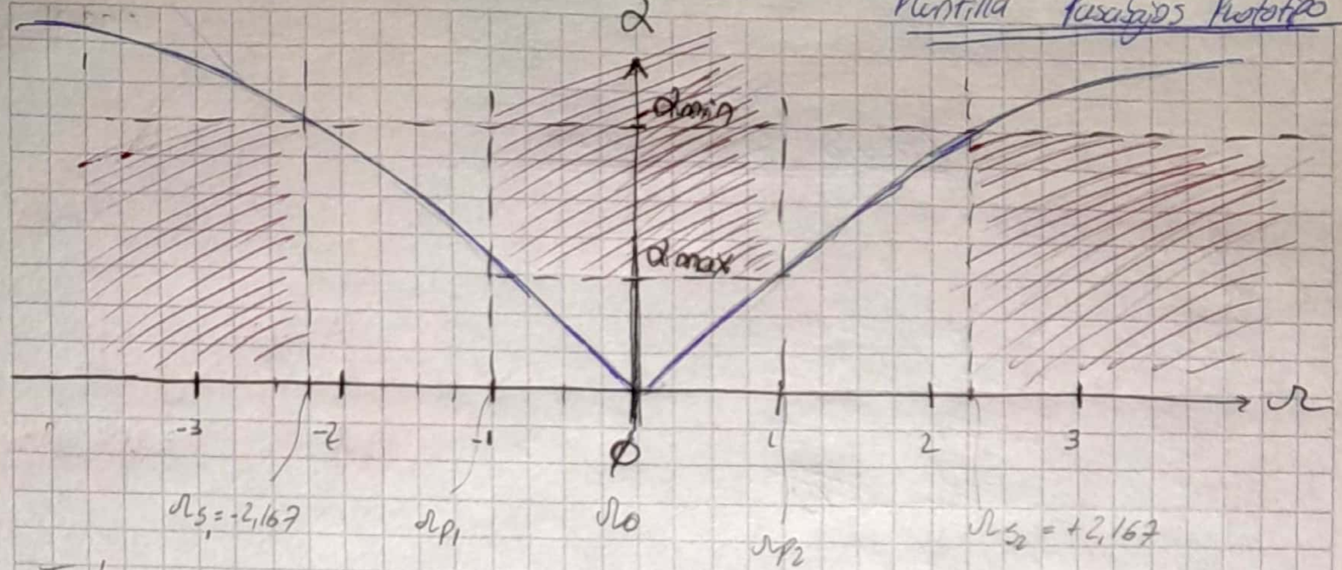
$\omega_{p1} = 0{,}8 \rightarrow \Omega_{p1} = -1$

$\omega_{p2} = 1{,}25 \rightarrow \Omega_{p2} = +1$

$\omega_{s2} = 1{,}6 \rightarrow \Omega_{s2} = \frac{13}{6} \simeq 2{,}167$

NOTA

Plantilla Pasabajos Prototipo



Tendría que elegir el Ω_s más chico, pero en este caso son iguales.

$\varepsilon^2 = 10^{\frac{\alpha_{max}(dB)}{10}} - 1$; $\underline{\varepsilon^2 \approx 1}$ (Butter)

$\alpha_{min}(dB) = 10\log\left(1+\varepsilon^2 \cdot \Omega_s^{2n}\right) = 10\log\left(1+1 \cdot 2{,}167^{2n}\right)$

$n=1 \rightarrow 7{,}539\ dB$

$n=2 \rightarrow 13{,}6\ dB$

$n=3 \rightarrow 20{,}17\ dB \Rightarrow \underline{n=3}$

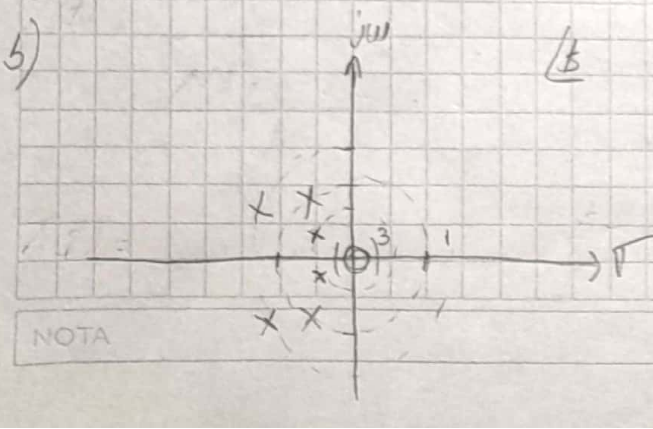
$T_{B3}(p) = \dfrac{1}{(p+1)(p^2+p+1)}$, pero como necesito 10dB de ganancia es la banda de paso, $\approx 3{,}16$ veces

$T_{B3}(p) = \dfrac{3{,}16}{(p+1)(p^2+p+1)}$

Usando Numpy, obtengo $T_{BP}(s)$ ya factorizada en secciones de orden 2.

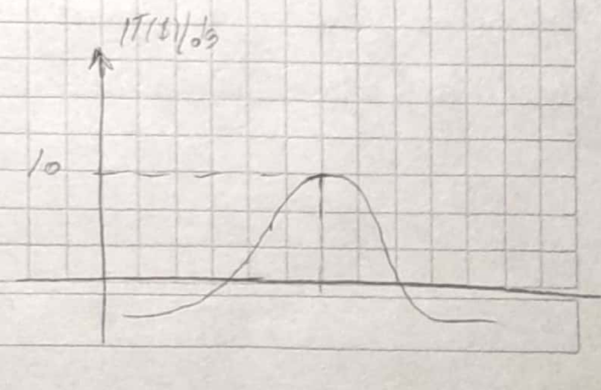
$$T_{BP}(s) = \frac{s \cdot 1{,}452}{s^2+s \cdot 0{,}45+1} \cdot \frac{s \cdot 0{,}3382}{s^2+s \cdot 0{,}2683+1{,}476} \cdot \frac{s \cdot 0{,}5864}{s^2+s \cdot 0{,}1817+0{,}6773}$$

b)



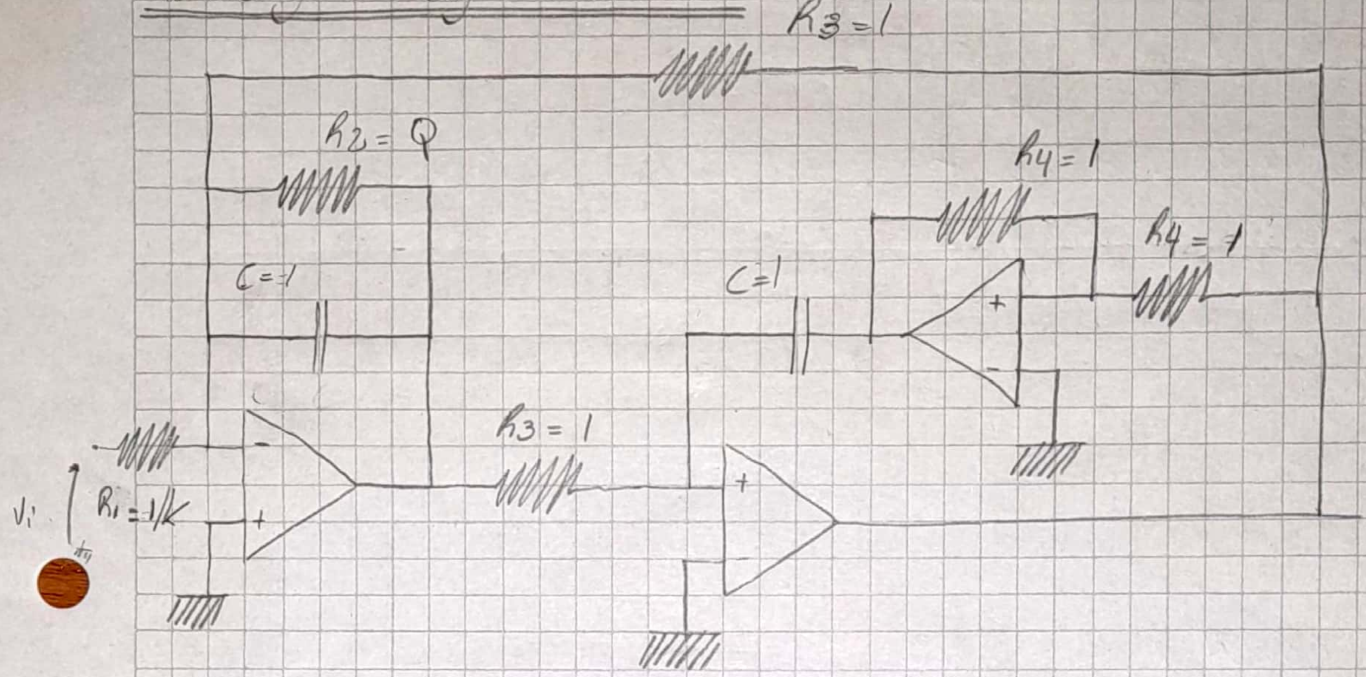
$\angle s$

c)



NOTA

Ackerberg-Mosberg Normalizado



$R_1 = 1/k$ $\quad C = 1$

$R_2 = Q$ $\quad$ e implementa $T_{BP_2}(s) = \dfrac{s(-k)}{s^2 + s \cdot \frac{1}{Q} + 1}$

$R_3 = 1$

$R_4 = 1$

Tengo que ajustar los valores de R_1 y R_2 solamente.

Sección 1, $W_0 = 1$

$R_1 = \dfrac{1}{k} = \dfrac{1}{1,452}$; $R_1 \cong 0,689$

$\dfrac{1}{Q} = 0,45 \Rightarrow Q = 2,222 \Rightarrow R_2 = 2,222$

$$\boxed{\begin{aligned} R_1 &= 0,689 \\ R_2 &= 2,222 \end{aligned}}$$

Sección 2

$W_0 = \sqrt{1,476} \Rightarrow W_0 \cong 1,215 \Rightarrow$ Hay que desnormalizar los componentes con $\Omega_w = 1,215$

$\Rightarrow$ Ahora el capacitor vale $C' = \dfrac{C}{\Omega_w}$; $C' = 0,823$

Con el nuevo valor de C, estoy implementando la función

$$T(\$) = \frac{-\$. K . 1{,}215}{\$^2 + \$^2 . \frac{1{,}215}{\varphi} + (1{,}215)^2}$$

$K . 1{,}215 = 0{,}3382 \Rightarrow K = 0{,}2784 \Rightarrow R_1 = \frac{1}{K} \Rightarrow \underline{R_1 = 3{,}59}$

$\frac{1{,}215}{\varphi} = 0{,}2683 \; ; \; \varphi = 4{,}53 \Rightarrow \underline{R_2 = 4{,}53}$

$$\Rightarrow \boxed{\begin{matrix} R_1 = 3{,}59 & C = 0{,}823 \\ R_2 = 4{,}53 & \end{matrix}}$$

Sección 3

$W_0^2 = 0{,}6773 \Rightarrow W_0 = 0{,}823 \; ; \; C' = \frac{C}{\Omega w} = \frac{C}{w_0} \; ; \; \underline{C' = 1{,}215}$

$$\therefore T(\$) = \frac{-\$. K . 0{,}823}{\$^2 + \$. \frac{0{,}823}{\varphi} + 0{,}823^2}$$

$K . 0{,}823 = 0{,}5864 \; ; \; K = 0{,}7125 \; ; \; \underline{R_1 = 1{,}4}$

$\frac{0{,}823}{\varphi} = 0{,}1817 \; ; \; \varphi = 4{,}53 \; ; \; \underline{R_2 = 4{,}215}$

$$\Rightarrow \boxed{\begin{matrix} R_1 = 1{,}4 & C = 1{,}215 \\ R_2 = 4{,}215 & \end{matrix}}$$

NOTA