Tarea semana 3

① T(s)

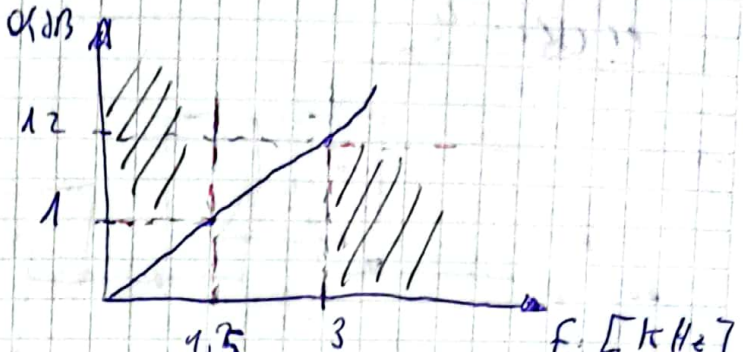
$\alpha_{max} = 1$ dB

$\alpha_{min} = 12$ dB

$f_p = 1500$ Hz

$f_s = 3000$ Hz

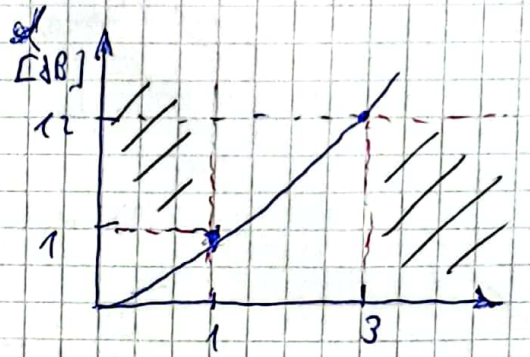
Máxima planicidad *



Normalización:

$\Omega_w = 2\pi \cdot 1500$ Hz

$\bar{W}_p = \frac{W_p}{\Omega_w} = 1 \frac{rad}{s}$ $\quad \bar{W}_s = \frac{W_s}{\Omega_w} = \frac{2\pi 3000}{2\pi 1500} = 2 \frac{rad}{s}$



Obtención parámetro ε

$\alpha_{max} \neq 3$ dB $\Rightarrow$ No es Butterworth * $\Rightarrow \varepsilon \neq 1$

$\alpha_{dB} = 10 \log (1 + \varepsilon^2 W^{2n})$

$\alpha_{max} = 1 = 10 \log (1 + \varepsilon^2)$

$\varepsilon^2 = 10^{1/10} - 1 = 0,25$

$\varepsilon = 0,5$

NOTA

Obtención del orden "n" del filtro

$n = 3$

$\alpha_{dB}|_n > \alpha_{min}$

Por iteración:

$$\alpha_{dB}|_{n=1} = 10\log\left(1 + (0{,}5)^2 \cdot 2^{2\cdot 1}\right) = 3{,}01\ dB$$

$$\alpha_{dB}|_{n=2} = 10\log\left(1 + (0{,}5)^2 \cdot 2^{2\cdot 2}\right) = 7\ dB$$

$$\alpha_{dB}|_{n=3} = 10\log\left(1 + (0{,}5)^2 \cdot 2^{2\cdot 3}\right) = 12{,}3\ dB > 12\ dB$$

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

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

$$|T|^2 = \frac{4}{4+\omega^6} = \frac{e}{(s+a)(s^2+bs+d)} \cdot \frac{e}{(-s+a)(s^2-bs+d)}$$

$$(-s^2+a^2)(s^4+ds^2-b^2s^2+ds^2+d^2)$$

$$-s^6-ds^4+b^2s^4-ds^4-d^2s^2+a^2s^4+a^2ds^2-a^2b^2s^2+a^2ds^2+a^2d^2$$

$$a^2+b^2-2d=0$$

$$-d^2+a^2d-a^2b^2+a^2d=0$$

$$a^2d^2=4 \Rightarrow ad=2 \Rightarrow d=2/a$$

$$a^2+b^2-\frac{4}{a}=0 \Rightarrow b^2=\frac{4}{a}-a^2$$

$$-\frac{4}{a^2}+2a-a^2\left(\frac{4}{a}-a^2\right)+2a=0$$

$$\cancel{4/a}-\frac{4}{a^2}-\cancel{4a}+a^4=0 \Rightarrow a^6=4 \Rightarrow \boxed{a=1{,}2599}$$

$b = 1,2599$

$d = 1,5874$

$e^2 = 4 \Rightarrow e = \cancel{-2} \vee \boxed{e = 2 \quad (FRP)}$

$$T(s) = \frac{2}{(s+\sqrt[3]{2})(s^2+\sqrt[3]{2}s+\sqrt[3]{4})} = \frac{2}{(s+\sqrt{8})(s^2+\sqrt{8}s+8)}$$