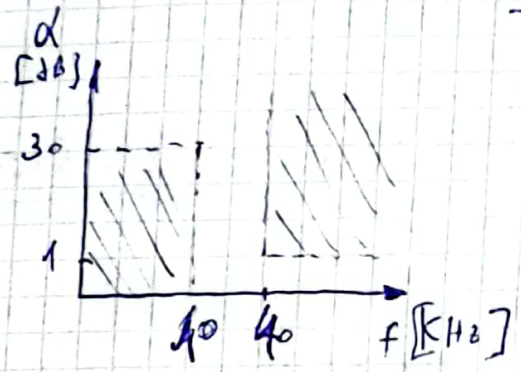
Tarea semanal 4



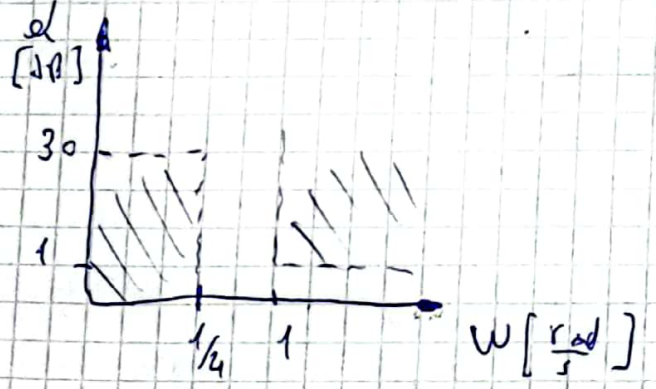
PASA - ALTOS

(1)

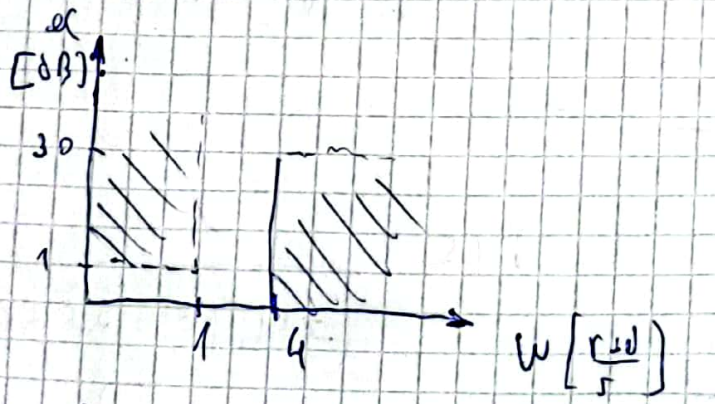
Normalización

$\Omega_w = 2\pi 40 \cdot 10^3$

$W_p = 1$ $\quad W_s = 1/4$



Pasabajos prototipo



$W_p = 1$ $\quad W_s = 4$ $\quad \Omega_w = 2\pi 10 \cdot 10^3$

NOTA

Obtención de "ε"

$$\alpha_{dB}\Big|_{n} = 10 \log \left(1 + \varepsilon^2 \cdot w^{2n}\right)$$

$$\alpha_{max} = 1 = 10 \log \left(1 + \varepsilon^2\right) \Rightarrow \varepsilon^2 = 0{,}26 \Rightarrow \boxed{\varepsilon = 0{,}51}$$

Obtención del orden "n"

$$\alpha_{dB}\Big|_{n=4} = 10 \log \left[1 + (0{,}51)^2 \cdot 4^{2 \cdot 4}\right] = 42{,}31 \text{ dB}$$

$$\alpha_{dB}\Big|_{n=3} = 10 \log \left[1 + (0{,}51)^2 \cdot 4^{2 \cdot 3}\right] = 30{,}27 \text{ dB} > \alpha_{min} \checkmark$$

$$\boxed{n = 3}$$

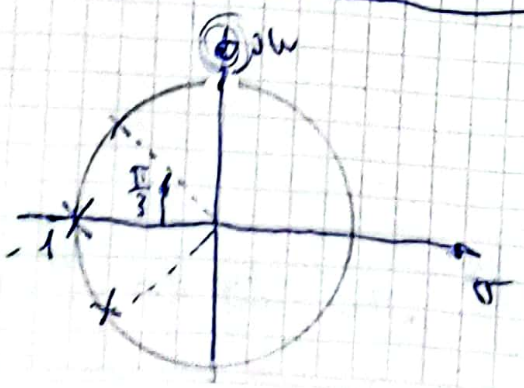
Normalización por Butterworth:

$$W_B = 2\pi f_p \, \varepsilon^{+\frac{1}{n}}$$

$$W_B = 2\pi \cdot 40 \cdot 10^3 \, (0{,}51)^{\frac{1}{3}}$$

$$\boxed{W_B = 200.799 \; \frac{rad}{s}}$$

Diagrama de polos y ceros



$$T(s) = \frac{1}{(s+1)(s^2 + as + 1)}$$

$$a = 2 \cos \frac{\pi}{3} = \boxed{1}$$

Polos = $\{-1 ; \frac{1}{2} \pm \frac{\sqrt{3}}{2}\}$

$$T(s) = \frac{1}{s^3 + 2s^2 + 2s + 1}$$

Transferencia filtro pasabajos prototipo

Transformación pasa-altos

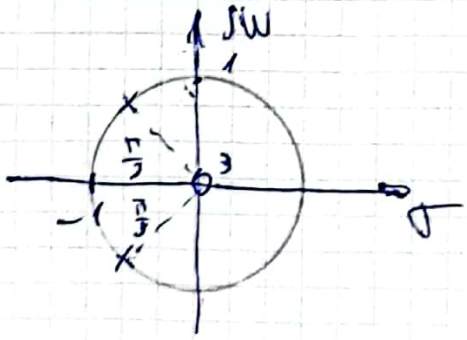
$$W_{LP} = \frac{1}{W_{HP}}$$

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

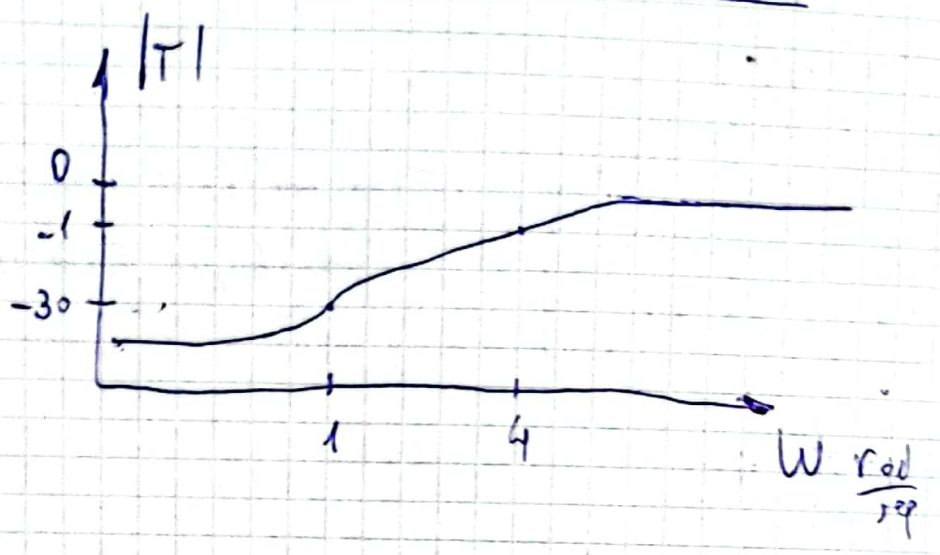
$$T(s) = \frac{1}{\frac{1}{s} + 1} \cdot \frac{s^2}{(s^2 + s + 1)}$$

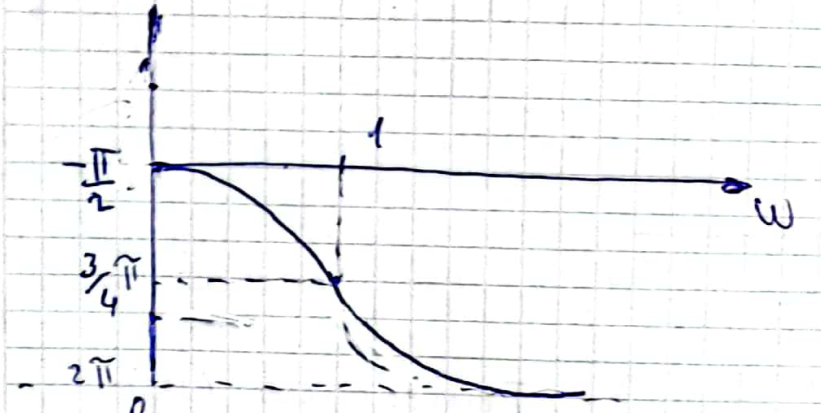
Transferencia filtro pasa-altos Normalizado

(2) Diagrama de polos y ceros



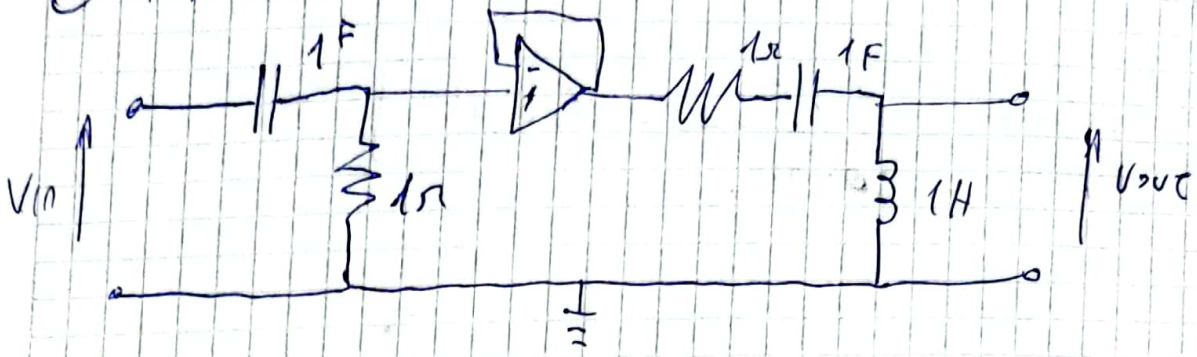
Borrejo de respuesta en Frecuencia





$$\varphi = \alpha_{zi,w} - \alpha_{pi,w}$$

③ Implementación del circuito:

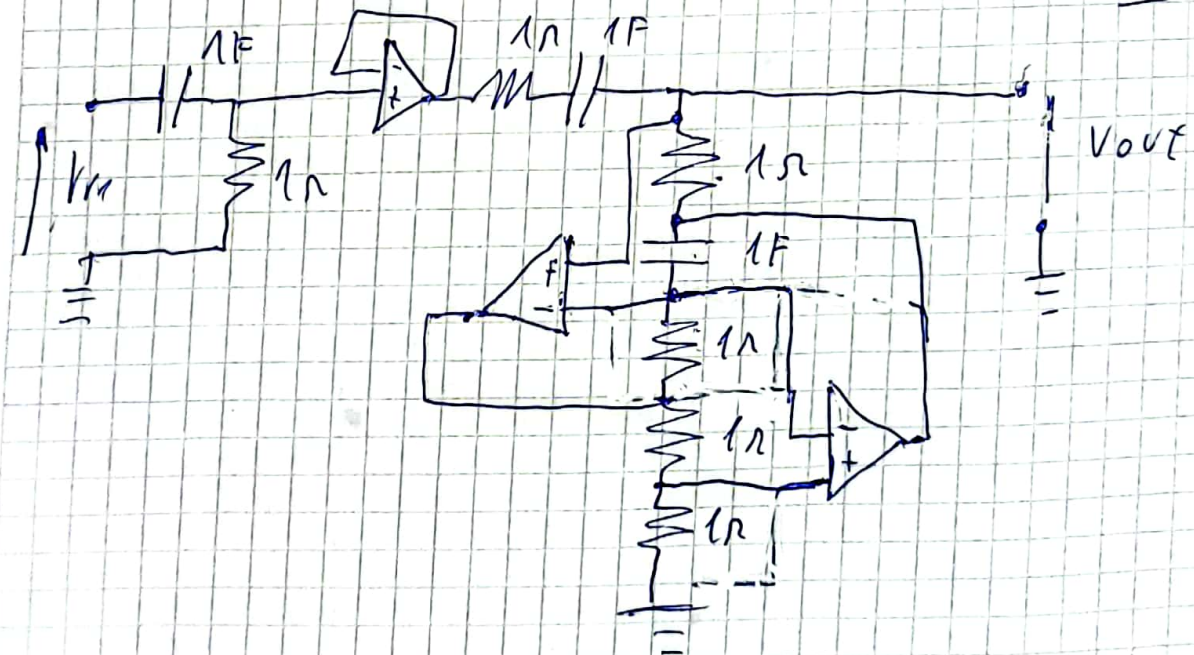


$$T(s) = \frac{1}{\frac{1}{s}+1} \cdot \frac{s}{1+\frac{1}{s}+s}$$

④ Activación de inductores

Inductor en derivación:

Gic de Antoniou configurado como GIRADOR



$$Z_{Gic} = \frac{1}{\frac{1}{sC}\,1} = s$$

Desnormalización en frecuencia

$R = 1\Omega$

$$C = \tau \frac{1}{\Omega_w \Omega_z} \simeq \frac{1F}{200799} = 5\,\mu F$$