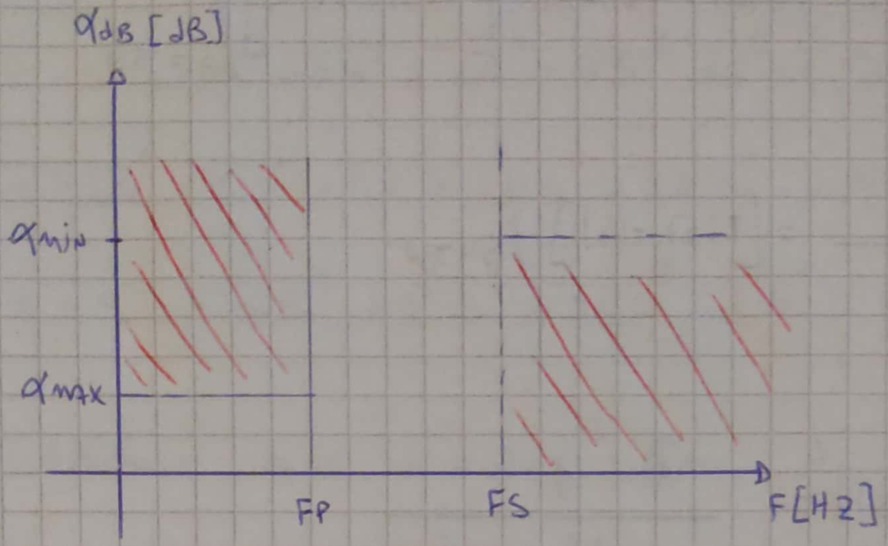
HOJA Nº

FECHA

TRABAJO SEMANAL 3



$\alpha_{MAX} = 1 dB$

$\alpha_{min} = 12 dB$

$FP = 1500 HZ$

$FS = 3000 HZ$

$$\varepsilon^2 = 10^{\alpha_{max}/10} - 1 \rightarrow \varepsilon^2 = 10^{1/10} - 1 \rightarrow \boxed{\varepsilon^2 \cong 0,2589}$$

$$\boxed{\varepsilon \cong 0,5088}$$

$$\alpha_{min}(n) = 10 \log\left(1 + \underbrace{\varepsilon^2}_{0,2589} \cdot \omega_s^{2n}\right) \; ; \; \Omega_\omega = 2\pi FP \; ; \; \omega_s = \frac{2\pi FS}{\Omega_\omega}$$

$\omega_s = 3KHz / 1,5KHz$

$\boxed{\omega_s = 2}$ → NORMALIZADO

$$\alpha_{min}(1) = 10 \log\left(1 + 0,2589 \cdot \omega_s^2\right)$$

$$\alpha_{min1} = 10 \log\left(1 + 0,2589 \cdot 2^2\right) \rightarrow \boxed{\alpha_{min1} \cong 3,087 \text{ dB}}$$

$$\alpha_{min2} = 10 \log\left(1 + 0,2589 \cdot 2^4\right) \rightarrow \boxed{\alpha_{min2} \cong 7,1116 \text{ dB}}$$

$$\alpha_{min3} = 10 \log\left(1 + 0,2589 \cdot 2^6\right) \rightarrow \boxed{\alpha_{min3} \cong 12,4476 \text{ dB}}$$

→ $> \alpha_{min} = 12 dB$ → ORDEN 3

NOTA

TRANFERENCIA PARA MAXIMA PLANICIDAD DE ORDEN 3

PARTIMOS DE: $|T(jw)|^2 = T(jw) \cdot T(-jw) = \left[T(s) \cdot T(-s) \right] \Big/_{s=jw}$

$$|T(w)|^2 = \frac{1}{1+\xi^2 w^{2n}} = \left[T(s)\, T(-s) \right] \Big/_{s=jw}$$

Si $w = s/j$ $\rightarrow |T(s/j)|^2 = \dfrac{1}{1+\xi^2 \left(\frac{s}{j}\right)^6}$
y $n=3$

$$|T(s/j)|^2 = \frac{1}{1+\xi^2 \dfrac{s^6}{\underbrace{j^2 \cdot j^2 \cdot j^2}_{(-1)}}}$$

$$|T(s/j)|^2 = \frac{1}{1-\xi^2 s^6} = \frac{1/\xi^2}{\frac{1}{\xi^2} - s^6} = T(s) \cdot T(-s) =$$

$$= \frac{c}{s^3+as^2+bs+c} \cdot \frac{c}{-s^3+as^2-sb+c}$$

$$c^2 = 1/\xi^2 \Rightarrow c = 1/\xi$$

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DENOMINADOR: $(s^3+as^2+bs+c)(-s^3+as^2-bs+c) =$

$= -s^6 + \cancel{as^5} - bs^4 + \cancel{cs^3} - \cancel{as^5} + a^2s^4 - \cancel{abs^3} + acs^2 - bs^4 +$

$+ \cancel{abs^3} - b^2s^2 + \cancel{bcs} - \cancel{cs^3} + acs^2 - \cancel{bcs} + c^2 =$

$= -s^6 - bs^4 + a^2s^4 + acs^2 - bs^4 - b^2s^2 + acs^2 + c^2$

SABEMOS QUE $c = 1/\xi$ ①

$0 = \cancel{s^4}(-2b + a^2) \Rightarrow a^2 = 2b$ ②

$0 = \cancel{s^2}(2ac - b^2) \Rightarrow b^2 = 2ac$ ③

③ en ② $\Rightarrow a^2 = 2\left(\sqrt{2 \cdot a \cdot c}\right)$ ②'

① en ②' $\Rightarrow a^2 = 2\sqrt{2}\sqrt{\frac{1}{\xi}}\sqrt{a}$

$\frac{a^2}{a^{1/2}} = 2\sqrt{2}\sqrt{\frac{1}{\xi}} \rightarrow a^{3/2} = 2\sqrt{2}\sqrt{\frac{1}{\xi}} \Rightarrow$

$\Rightarrow (\sqrt{a})^3 = 2\sqrt{2}\sqrt{\frac{1}{\xi}} \rightarrow a^3 = 4 \cdot 2 \cdot \frac{1}{\xi} = \frac{8}{\xi} \cong 15,7233$

$a \cong 2,5052$; $b = \frac{a^2}{2} \rightarrow b = 3,14$; $c = 1/\xi = 1,98 \cong 2$

NOTA

VERIFICO:

$b^2 = 2A.C \Rightarrow C = \frac{b^2}{2A} \rightarrow C = 1,98 \simeq (3,14)^2/(2 \cdot 2,5052)$

$$T(S) = \frac{2}{S^3 + 2,5052S^2 + 3,14S + 2}$$

ó

$$T(S) = \frac{(\sqrt{2})^2}{S^3 + 2,5052S^2 + 3,14S + (\sqrt{2})^2}$$

ESTE DENOMINADOR SE PUEDE ESCRIBIR COMO:

$$(S+1,27)\underbrace{(S^2 + a'S + b')}_{\text{RAICES CON CALCULADORA}}$$

$$\left(S - (-0,6162 \pm j1,1)\right)$$

$$\left(S - (-0,62 + j1,1)\right) \cdot \left(S - (-0,62 - j1,1)\right)$$

$$S^2 + (0,62^2 + j\cancel{0,68} - j\cancel{0,68} + 1,1^2) - S(-1,24)$$

$$s^2 + 1,24s + 1,59 \Rightarrow T(s) = \frac{2}{(s+1,27)(s^2+1,24s+1,59)}$$

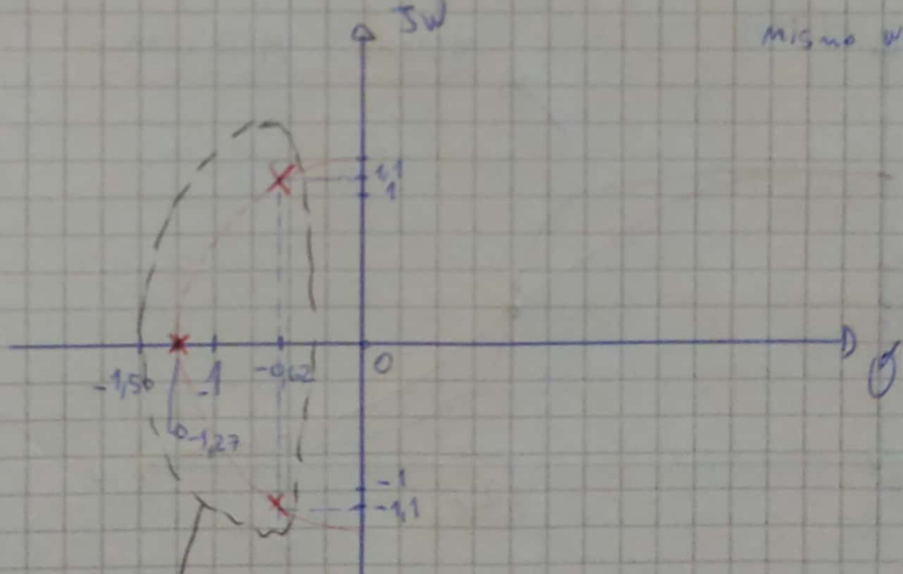
SABIENDO QUE: $1,59 \cdot 1,27 \cong 2$

LA TRANFERENCIA QUEDA: $T(s) = \frac{1,59}{s^2+1,24s+1,59} \cdot \frac{1,27}{s+1,27}$

$\sqrt{1,59} \cong 1,26 \cong 1,27$

↳ ASI SE FORMA LA CIRCUNSFERENCIA MISMO ω_0

b) DIAGRAMA DE POLOS Y CEROS



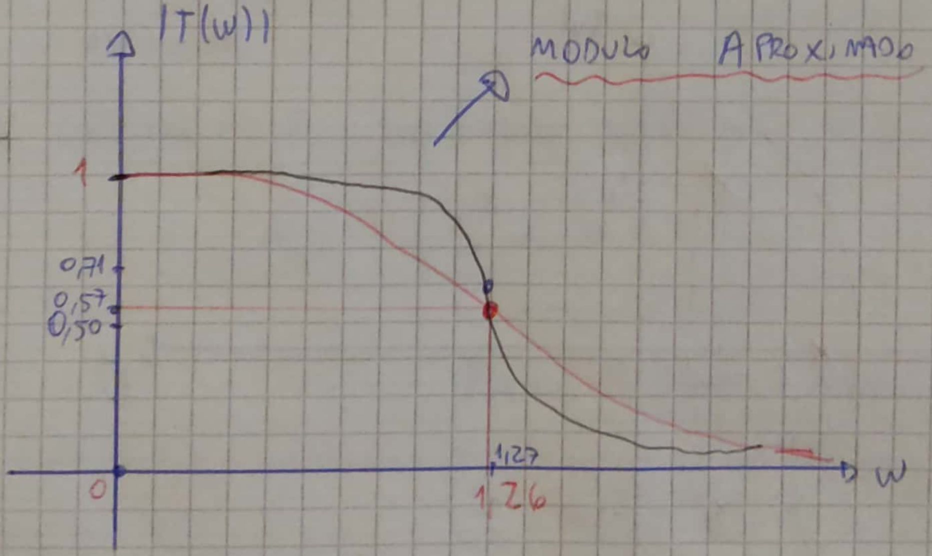
↳ FILTRO DE MAXIMA PLANICIDAD DE ORDEN 3

$$|T(w)| = T(s)\Big|_{s=jw} \Rightarrow T(w) = \frac{1,59}{(1,59-w^2)+jw \cdot 1,24} \cdot \frac{1,27}{1,27+jw}$$

$$|T(w)| = \frac{1,59}{\sqrt{(1,59-w^2)^2 + 1,24^2 w^2}} \cdot \frac{1,27}{\sqrt{1,27^2+w^2}}$$

$|T(w=0)| = 1 \rightarrow 0\,dB$; $|T(w=\sqrt{1,59})| = 1/1,24 \cdot 0,71$

$|T(w \Rightarrow \infty)| = 0$; $|T(w=(\sqrt{1,27})^2)| = 1/\sqrt{2} = \sqrt{2}/2 \cdot 1$



$\frac{w_{01}}{Q} = 1,24$; $Q = ?$ $\rightarrow$ NO ESTA NORMALIZADO