6) datos:

$f_{ci} = 1600\,KHz$

$f_{cs} = 2500\,KHz$

max planicidad en Banda de paso → Butter

$K_{real} = 10\,dB = 3{,}16$ veces

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

$\alpha_{min} = 20\,dB \rightarrow f_1 = 1250\,KHz$

$\rightarrow f_2 = 3200\,KHz$

7, PL6 (1)

6.1) ~~[illegible]~~ si $W_0^2 = W_{cs} \cdot W_{ci}$

$f_0^2 = f_{cs} \cdot f_{ci} \rightarrow f_0 = 2000\,KHz$

si normalizo respecto f_0

$W_0' = 1$

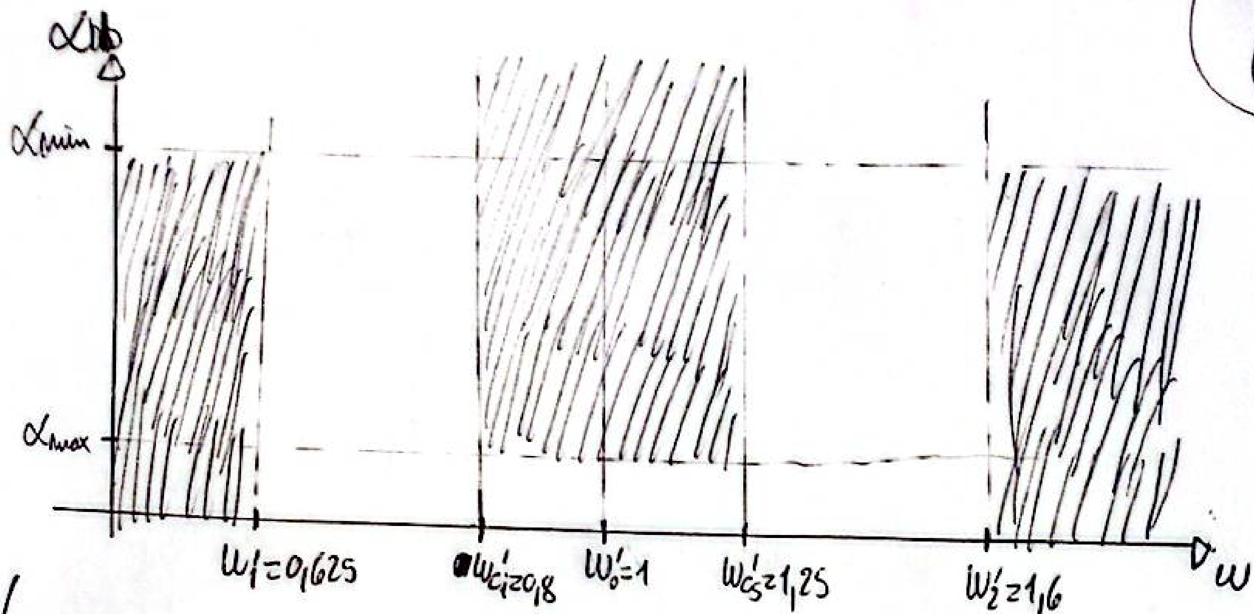
$W_1' = 0{,}625$

$W_2' = 1{,}6$

$W_{ci}' = 0{,}8$

$W_{cs}' = 1{,}25$

TP26
2



si $B = f_{cs} - f_{ci} \rightarrow B = 900\ KHz$

si $Q = \dfrac{f_0}{B} \rightarrow Q = 2,22$ → medido en Hz

si el nucleo de transformación

$$\Omega = \frac{\omega^2 - \omega_0^2}{\omega} \cdot \frac{Q}{\omega_0}$$

lo normalizo en ω_0

$$\Omega' = \frac{\omega^2 - 1}{\omega^2} \cdot \frac{Q}{1}$$

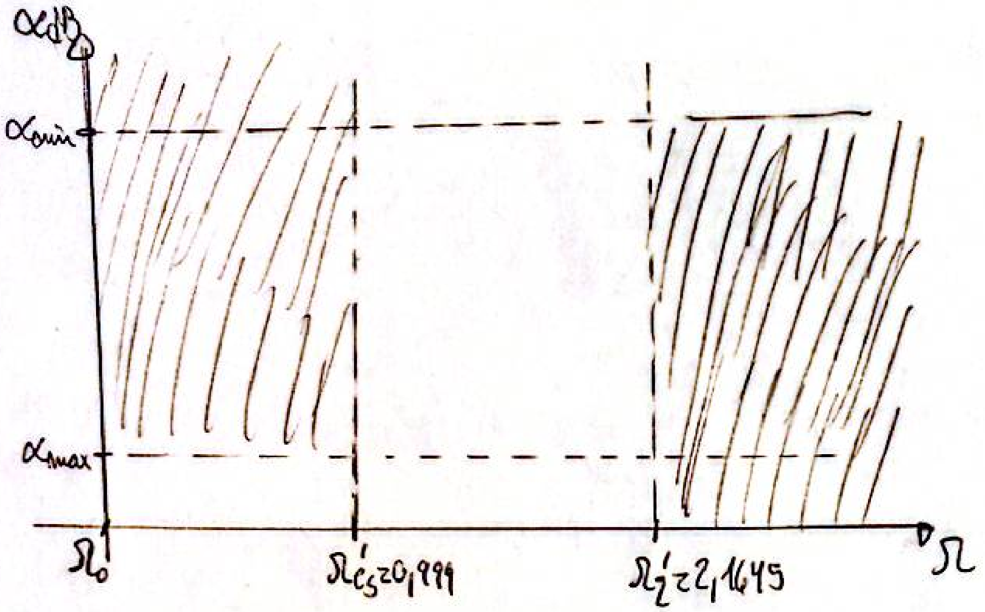
$|\Omega_2'| = 2,1645$ → elijo cualquiera ya que son iguales

$|\Omega_1'| = 2,1645$

$|\Omega_{ci}'| = 0,999$

$|\Omega_{cs}'| = 0,999$

$|\Omega_0'| = 0$



6.2) Calculo el orden del pasabajo en Butter

si $\alpha_{max} = 3dB \rightarrow \varepsilon^2 = 10^{\frac{\alpha_{max}}{10}} - 1 \rightarrow \varepsilon^2 = 0,995$

si $\alpha_{dB} = 10 . \log\left(1 + \varepsilon^2 . \Omega_2'^{\,2.n}\right)$

$\alpha dB_{n=1} = 7,53 \, dB$ X $< \alpha_{min}$

$\alpha dB_{n=2} = 13,586 \, dB$ X $< \alpha_{min}$

$\alpha dB_{n=3} = 20,14 \, dB$ ✓ $> \alpha_{min}$ → es de orden $n=3$

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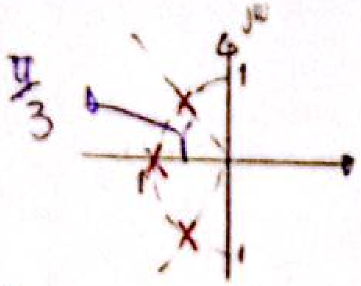
(4)

si es Butter de orden 3



~~$Q = 2\cos\left(\frac{\pi}{3}\right) \rightarrow Q = 2$~~

$$Q = \frac{1}{2\cdot\underbrace{\cos\left(\frac{\pi}{3}\right)}_{=\frac{1}{2}}} \rightarrow Q_{PB} \simeq 1 \rightarrow \frac{1}{Q_{PB}} = 1$$

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

si $\Omega = \frac{\omega^2-\omega_0^2}{\omega^2}\cdot\frac{Q}{\omega_0}$

si $\omega = \frac{s}{j}$

$$\$ = \frac{-s^2-\omega_0^2}{-s}\cdot\frac{Q}{\omega_0}$$

normalizo medio de transformación en $\omega_0 \rightarrow S = s\cdot\omega_0$

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

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veo el resultado de la etapa ~~del paralelo~~ 1° Orden

$$T_1(s) = \frac{1}{\left(\frac{s^2+1}{s}\right)\cdot 1 + 1} = \frac{1}{\frac{s^2+1+s.1}{s.1}} \rightarrow T_1(s) = \frac{s.1}{s^2+s.1+1}$$

veo el resultado de la etapa de 2° Orden

$$T_2(s) = \frac{1}{\left(\frac{s^2+1}{s.1}\right)^2 + \left(\frac{s^2+1}{s.1}\right).1 + 1}$$

$$\left(\frac{s^2+1}{s.1}\right)\left(\frac{s^2+1}{s.1}\right) = \frac{s^4+s^2+s^2+1}{s^2.1} = \frac{s^4+s^2.2+1}{s^2.1}$$

$$T_2(s) = \frac{1}{\frac{s^4+s^2.2+1}{s^2.1} + \frac{s^2+1}{s.1} + 1} = \frac{1}{\frac{s^4+s^2.2+1+(s^2+1).s.1+s^2.1}{s^2.1}}$$

$$T_2(s) = \frac{s^2.1}{s^4+s^3.1+s^2.3+s.1+1}$$

$$T(s) = T_1(s) \cdot T_2(s)$$

$$T(s) = \frac{s.1}{s^2+s.1+1} \cdot \frac{s^2.1}{s^4+s^3.1+s^2.3+s.1+1} . K$$

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$$T(s) = \frac{s^3 \cdot K}{s^6 + s^5 + s^4 \cdot 3 + s^3 + s^2 + s^5 + s^4 + s^3 \cdot 3 + s^2 + s + s^4 + s^3 + s^2 \cdot 3 + s + 1}$$

$$T(s) = \frac{s^3 \cdot K}{s^6 + s^5 \cdot 2 + s^4 \cdot 5 + s^3 \cdot 5 + s^2 \cdot 5 + s \cdot 2 + 1}$$

factorizado en python $\rightarrow K = 3{,}16$

$$T(s) = \left(\frac{K \cdot s}{s^2 + s + 1}\right) \cdot \left(\frac{(s \cdot \ldots)}{s^2 + s \cdot 0{,}7032 + 2{,}369}\right) \cdot \left(\frac{(s \cdot \ldots)}{s^2 + s \cdot 0{,}2968 + 0{,}4221}\right)$$

$T_1(s)$ $\qquad T_2(s)$ $\qquad T_3(s)$

$T_1(s) \Rightarrow \omega_0^2 = 1 \rightarrow \omega_0 = 1$

$\frac{\omega_0}{Q} = 1 \rightarrow Q = 1$

$K = 1$

$T_1(s) \Rightarrow \omega_0^2 = 2{,}369 \rightarrow \omega_0 = 1{,}539$

$\frac{\omega_0}{Q} = 0{,}7032 \rightarrow Q = 2{,}182$

$\cancel{K = Q \rightarrow K = 2{,}182}$ $K = \sqrt{3{,}16} \simeq 1{,}7776$

$T_2(s) \Rightarrow \omega_0^2 = 0{,}4221 \rightarrow \omega_0 = 0{,}6497$

$\frac{\omega_0}{Q} = 0{,}2968 \rightarrow Q = 2{,}189$

$\cancel{K = Q \rightarrow K = 2{,}189}$ $K = \sqrt{3{,}16} \simeq 1{,}7776$

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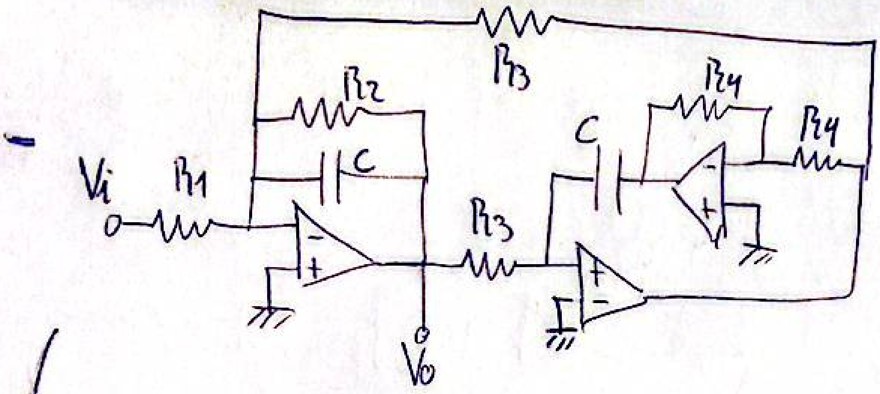

$$T(S) = \frac{V_o}{V_i} = \frac{-\frac{1}{R_1 \cdot C} \cdot S}{S^2 + S \cdot \frac{1}{R_2 \cdot C} + \frac{1}{R_3^2 C^2}}$$

$$W_o^2 = \frac{1}{R_3^2 \cdot C^2} \rightarrow W_o = \frac{1}{R_3 C}$$

$$K \cdot W_o = \frac{1}{R_1 \cdot C} \rightarrow K \cdot \frac{1}{R_3 \cdot \cancel{C}} = \frac{1}{R_1 \cancel{C}} \rightarrow K = \frac{R_3}{R_1}$$

$$\frac{W_o}{Q} = \frac{1}{R_2 C} \rightarrow Q = W_o \cdot R_2 \cdot C \rightarrow Q = \frac{1}{R_3 \cancel{C}} \cdot R_2 \cancel{C} \rightarrow Q = \frac{R_2}{R_3}$$

$$C = \frac{1}{R_3 \cdot W_o} \quad ; \quad R_1 = \frac{R_3}{K} \quad ; \quad R_2 = Q \cdot R_3$$

normalizo con $\Omega_z = R_3 \rightarrow R_3' = 1 = R_4'$

$$R_1' = \frac{1}{K} \qquad R_2' = Q \qquad C' = \frac{1}{W_o}$$

Facundo

$$\begin{cases} -V_i.(G_1) - V_0.(G_2+SC) - V_x.(G_3) = 0 \\ -V_0.(G_3) - V_x.(SC) = 0 \\ -V_x.(\cancel{G_4}\,1) - V_y.(\cancel{G_4}) = 0 \end{cases}$$

$-V_0.(G_3) - V_x.(SC) = 0 \rightarrow -V_0.G_3 + V_x.(SC) = 0 \rightarrow V_x = \frac{V_0.G_3}{SC}$

$-V_x.(\cancel{G_4}\,1) - V_y.(\cancel{G_4}) = 0 \rightarrow V_y = -V_x$

$$-V_0.(G_2+SC) - V_0\,\frac{G_3^2}{SC} = V_i.G_1 \rightarrow -V_0.\left(\frac{SCG_2 + S^2C^2 + G_3^2}{SC}\right) = V_i.G_1$$

$$T(S) = \frac{-SC.G_1}{SC^2 + SCG_2 + G_3^2} \rightarrow T(S) = \frac{-\frac{S.\cancel{C}.G_1}{C^{\cancel{2}}}}{S + S.\frac{\cancel{C}.G_2}{C^{\cancel{2}}} + \frac{G_3^2}{C^2}} \rightarrow T(S) = \frac{-S.\frac{1}{R_1.C}}{S + S.\frac{1}{R_2.C} + \frac{1}{R_3^2.C^2}}$$