TP L6 (1)

6) datos:

$f_{ci} = 1600\ KHz$

$f_{cs} = 2500\ KHz$

max planicidad en Banda de paso → Butter

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

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

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

$\rightarrow f_2 = 3200\ KHz$

6.1) 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

$W_0' = 1$

$W_1' = 0{,}625$

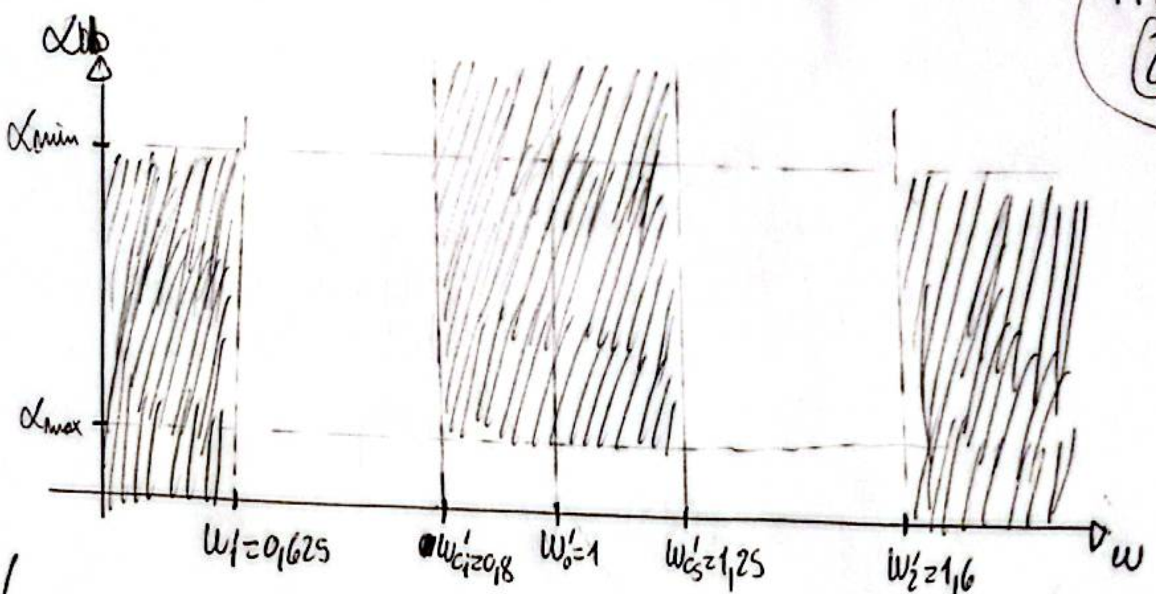
$W_2' = 1{,}6$

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

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

Escaneado con CamScanner

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

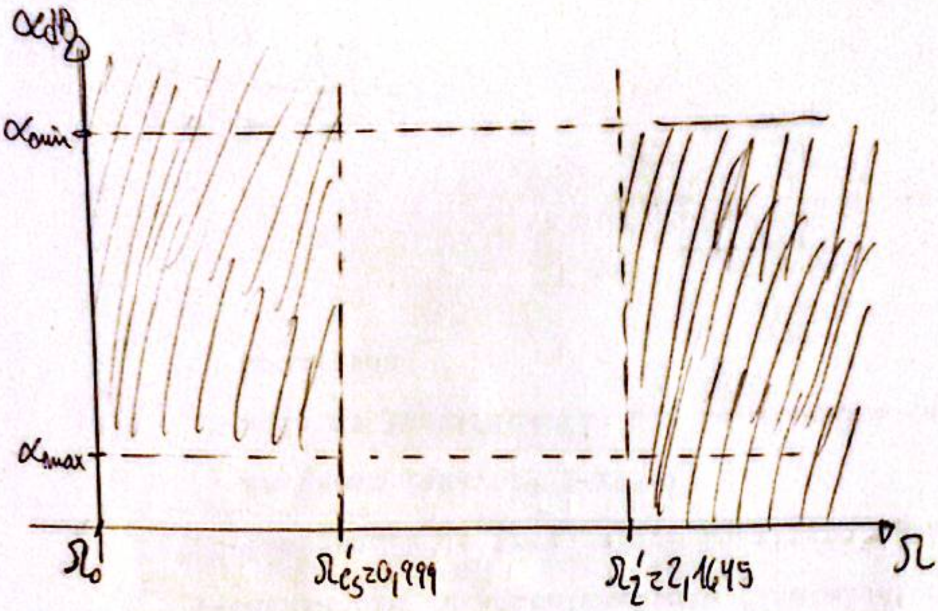
$$\Omega = \frac{W^2 - W_0^2}{W} \cdot \frac{Q}{W_0}$$

lo normalizo en W_0

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

$|\Omega_2'| = 2{,}1645$
$|\Omega_1'| = 2{,}1645$ → elijo cualquiera ya que son iguales
$|\Omega_{ci}'| = 0{,}999$
$|\Omega_{cs}'| = 0{,}999$
$|\Omega_0'| = 0$

TPL6 3



6.2) Calculo el orden del pasabajo en Butter

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

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

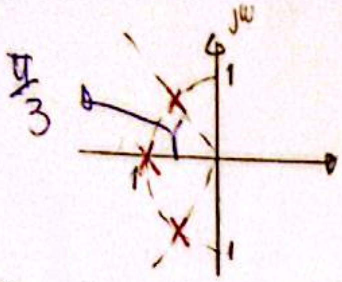
$\alpha_{dB_{n=1}} = 7{,}53\,dB$ X $< \alpha_{min}$

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

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

TPL6 (4)

Si es Butter de orden 3



$$\cancel{Q = 2\cos\left(\frac{\pi}{3}\right) \to Q = 2}$$

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

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

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 $\omega_0 \to s = s\cdot\omega_0$

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

TP26 [redacted]5

veo el resultado de la etapa 1° Orden

$$T_1(s) = \frac{1}{\left(\frac{s^2+1}{s}\right)\cdot\text{[redacted]} + 1} = \frac{1}{\frac{s^2+1+s\cdot\text{[redacted]}}{s\cdot\text{[redacted]}}} \rightarrow T_1(s) = \frac{s\cdot\text{[redacted]}}{s^2+s\cdot\text{[redacted]}+1}$$

[redacted] veo el resultado de la etapa de 2° Orden

$$T_2(s) = \frac{1}{\left(\frac{s^2+1}{s\cdot\text{[redacted]}}\right)^2 + \left(\frac{s^2+1}{s\cdot\text{[redacted]}}\right)\cdot\text{[redacted]} + 1}$$

$$\left(\frac{s^2+1}{s\cdot\text{[redacted]}}\right)\cdot\left(\frac{s^2+1}{s\cdot\text{[redacted]}}\right) = \frac{s^4+s^2+s^2+1}{s^2\cdot\text{[redacted]}} = \frac{s^4+s^2\cdot 2+1}{s^2\cdot\text{[redacted]}}$$

$$T_2(s) = \frac{1}{\frac{s^4+s^2\cdot 2+1}{s^2\cdot\text{[redacted]}} + \frac{s^2+1}{s\cdot\text{[redacted]}} + 1} = \frac{1}{\frac{s^4+s^2\cdot 2+1+(s^2+1)\cdot s\text{[redacted]}+s^2\cdot\text{[redacted]}}{s^2\cdot\text{[redacted]}}}$$

$$T_2(s) = \frac{s^2\cdot\text{[redacted]}}{s^4+s^3\cdot\text{[redacted]}+s^2\,3\text{[redacted]}+s\cdot\text{[redacted]}+1}$$

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

$$T(s) = \frac{s\cdot\text{[redacted]}}{s^2+s\cdot\text{[redacted]}+1}\cdot\frac{s^2\cdot\text{[redacted]}}{s^4+s^3\cdot\text{[redacted]}+s^2\,3\text{[redacted]}+s\cdot\text{[redacted]}+1}\cdot K$$

TPL 6

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

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

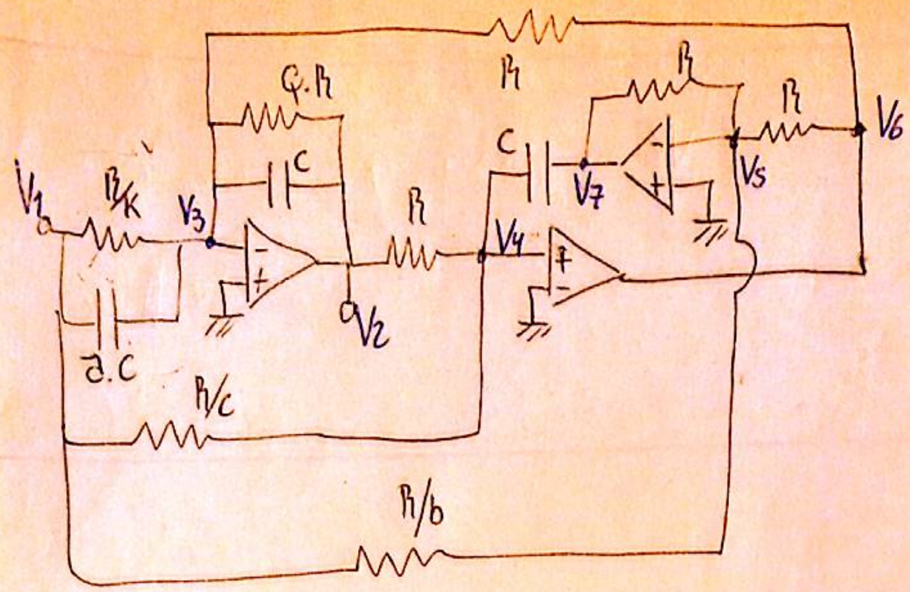
factorizado en python $\longrightarrow K = 3{,}16$

$$T(s) = \left(\frac{K \cdot s \cdot \cancel{0{,}7087}}{s^2 + s + 1}\right) \cdot \left(\frac{(s \cdot \cancel{\ldots})}{s^2 + s \cdot 0{,}7032 + 2{,}369}\right) \cdot \left(\frac{(s \cdot \cancel{\ldots})}{s^2 + s\,0{,}2968 + 0{,}4221}\right)$$

$T_1(s)$ $T_2(s)$ $T_3(s)$

Escaneado con CamScanner

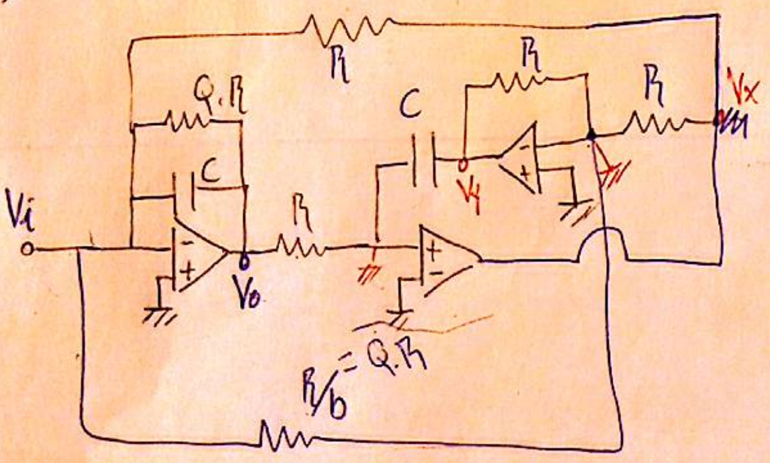
ítem 1



$$T(s) = \frac{V_2}{V_1} = \frac{a \cdot s^2 + s \cdot \omega_0 (K - b) + C \cdot \omega_0^2}{s^2 + s \cdot \frac{\omega_0}{Q} + \omega_0^2}$$

si pasa-banda no inversor → $a = 0$ | $b = b$ | $C = 0$ | $K = 0$

$$T(s) = \frac{- s \cdot \omega_0 \cdot b}{s^2 + s \frac{\omega_0}{Q} + \omega_0^2}$$



Extra 2

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

$$T(s) = \frac{-\underbrace{Q}_{=K} \cdot s \cdot \frac{\omega_0}{Q}}{s^2 + s \cdot \frac{\omega_0}{Q} + \omega_0^2}$$

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

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

$\rightarrow K \overset{?}{=} Q \rightarrow K = 1$

$t_1(s) \Rightarrow \omega_0^2 = 2{,}369 \rightarrow \omega_0 = 1{,}539$

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

$\rightarrow K = Q \rightarrow K = 2{,}182$

$t_2(s) \Rightarrow \omega_0^2 = 0{,}4221 \rightarrow \omega_0 = 0{,}6497$

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

$\rightarrow K = Q \rightarrow K = 2{,}189$

Extra 3

$\cancel{V_i \cdot \left(\frac{1}{Q \cdot R} + SC + \frac{1}{Q \cdot R}\right) - V_x \cdot \left(\frac{1}{R}\right) - V_0 \cdot (\;)}$

$$V_i \cdot \left(\frac{1}{R} + \frac{1}{Q \cdot R} + SC + \frac{1}{Q \cdot R}\right) - V_x \cdot \left(\frac{1}{R}\right) - V_0 \cdot \left(\frac{1}{Q \cdot R} + S.C\right) = 0$$

$$V_0 \cdot \left(\frac{1}{R}\right) = -V_y \cdot (SC) \rightarrow V_y = -V_0 \cdot \frac{1}{SCR}$$

$$-V_y \cdot \left(\frac{1}{R}\right) - V_i \cdot \left(\frac{1}{Q \cdot R}\right) - V_x \cdot \left(\frac{1}{R}\right) = 0$$

$$V_0 \cdot \frac{1}{SCR^2} - V_i \cdot \left(\frac{1}{Q \cdot R}\right) - V_x \left(\frac{1}{R}\right) = 0 \rightarrow V_x = V_0 \cdot \frac{1}{S.CR} - V_i \left(\frac{1}{Q}\right)$$

$$V_i \cdot \left(\frac{1}{R} + \frac{2}{Q \cdot R} + SC\right) - V_0 \cdot \frac{1}{SCR^2} + V_i \frac{1}{Q \cdot R} - V_0 \cdot \left(\frac{1}{QR} + SC\right) = 0$$

$$V_i \cdot \left(\frac{1}{R} + \frac{3}{Q \cdot R} + SC\right) = V_0 \cdot \left(\frac{1}{SCR^2} + \frac{1}{Q \cdot R} + SC\right)$$

$$V_i \left(\frac{Q + 3 + SCQR}{QR}\right) = V_0 \cdot \left(\frac{Q + SCR + S^2C^2R^2Q}{SCR^2Q}\right)$$

$$H(s) = \frac{V_0}{V_i} = \frac{S^2C^2R^3 \cdot Q^2 + SCR^2 \cdot Q \cdot (Q+3)}{S^2C^2R^3Q^2 + SCR^2Q + R^4 \cdot Q^2}$$

Extra 4

$$T(s) = \frac{s^2 + s \cdot \frac{\cancel{C}\cancel{R^2}\cdot\cancel{G}}{C^2 R^3 \cdot G^2} \cdot (G+3)}{s^2 + s \cdot \frac{\cancel{C R^2 G}}{C^3 R^3 \cdot G^2} + \frac{\cancel{R}\cdot\cancel{G^2}}{C^2 R^3 \cancel{G^2}}}$$

$$T(s) = \frac{s^2 + s \cdot \frac{1}{CRG} \cdot (G+3)}{s^2 + s \cdot \frac{1}{CRG} + \frac{1}{C^2 R^2}}$$

No entiendo como seguir