HOJA Nº 1

FECHA

T57: Filtros digitales

EJ 2 - Guía

Q- Butter de 2do orden f_c (corte) = 1KHz y f_s (sampling) = 100KHz ; Normalizo $\Omega_w = 2\pi 1KHz$

$\Rightarrow \omega_c = 1$

$$H(s) = \frac{1}{s^2 + s\sqrt{2} + 1}$$

$$H(z) = H(s)\Big|_{s=f_{B(z)}} \quad ; f_{B(z)} = K\frac{z-1}{z+1} \quad \text{siendo } K = 2f_s$$

$$H(z) = \frac{1}{K^2\frac{(z-1)^2}{(z+1)^2} + K\frac{(z-1)}{z+1}\sqrt{2} + 1}$$

$$H(z) = \frac{(z+1)^2}{K^2(z-1)^2 + \sqrt{2}K(z-1)(z+1) + (z+1)^2}$$

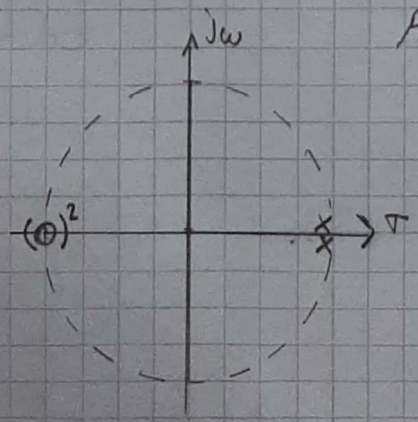
$$H(z) = \frac{z^2+2z+1}{K^2(z^2-2z+1) + \sqrt{2}K(z^2-1) + (z^2+2z+1)}$$

$$H(z) = \frac{z^2+2z+1}{z^2(K^2+\sqrt{2}K+1) + z(2-2K^2) + (K^2-\sqrt{2}K+1)}$$

$K = 2f_s \rightarrow$ como normalicé por $\omega_c \Rightarrow K = 2 \cdot 100 = 200$

$$H(z) = \frac{(z+1)^2}{z^2\,40284 - z\,79998 + 39718} = \frac{1}{40284}\,\frac{(z+1)^2}{z^2 - z1{,}986 + 0{,}986}$$

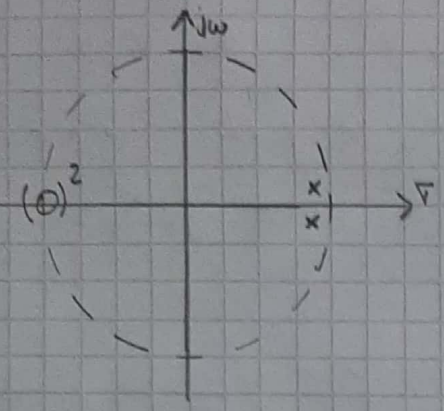
Polos = $(0{,}99 \pm j\,0{,}007)$



NOTA 13:40 → 15:20

b) Ahora $K = 2 f_s = 2 \cdot 10 = 20$

$$\Rightarrow H(z) = \frac{(z-1)^2}{429{,}3\, z^2 - 798 z + 372{,}7} = \frac{1}{429{,}3} \frac{(z-1)^2}{z^2 - 1{,}859 z + 0{,}868}$$



Polos = $(0{,}93 + j0{,}06)$; $(0{,}93 - j0{,}06)$

c) Si $f_c = 6\,KHz$ $\Rightarrow$ a - $K = 2 f_s = 2 \cdot 16{,}67 = 33{,}33$ → normalizada por f_c

b - $K = 2 f_s = 2 \cdot 1{,}667 = 3{,}33$

NOTA