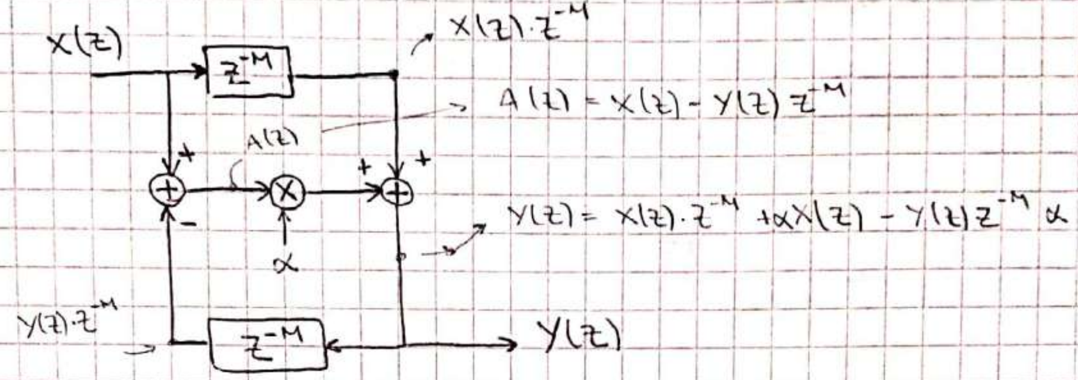
Ej ② TS7



$$Y(z)\left[1 + \alpha z^{-M}\right] = X(z)\left[\alpha + z^{-M}\right]$$

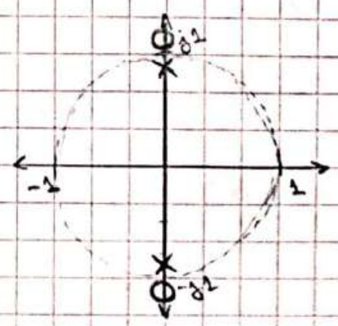
$$\frac{Y(z)}{X(z)} = H(z) = \frac{\alpha + z^{-M}}{1 + \alpha z^{-M}} = \frac{\cancel{z^{-M}}\,(\alpha z^{M} + 1)}{\cancel{z^{-M}}\,(z^{M} + \alpha)}$$

$$H(z) = \frac{\alpha z^{M} + 1}{z^{M} + \alpha} = \alpha\left(\frac{z^{M} + 1/\alpha}{z^{M} + \alpha}\right) //$$

a) $M = 2 \;\wedge\; \alpha = 0{,}8$

$$H(z) = 0{,}8\;\frac{z^2 + 1/0{,}8}{z^2 + 0{,}8}$$

polos $\nearrow j0{,}89$ $\searrow -j0{,}89$ ceros $\nearrow 1{,}11\,j$ $\searrow -1{,}11\,j$

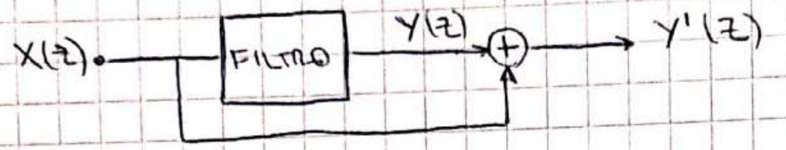


$$H(\Omega) = 0{,}8\;\frac{e^{j\Omega 2} + 1{,}25}{e^{j\Omega 2} + 0{,}8} =$$

$$0{,}8\;\frac{\cos(2\Omega) + j\,\mathrm{sen}(\Omega 2) + 1{,}25}{\cos(2\Omega) + j\,\mathrm{sen}(2\Omega) + 0{,}8} = 0{,}8\cdot\frac{1{,}25 + \cos(2\Omega) + j\,\mathrm{sen}(2\Omega)}{0{,}8 + \cos(2\Omega) + j\,\mathrm{sen}(2\Omega)}$$

$$H(z) = 0{,}8\cdot\sqrt{\frac{\left[1{,}25 + \cos(2\Omega)\right]^2 + \mathrm{sen}(2\Omega)^2}{\left[0{,}8 + \cos(2\Omega)\right]^2 + \mathrm{sen}(2\Omega)^2}}\cdot e^{j\left[\mathrm{arctg}\left(\frac{\mathrm{sen}\,2\Omega}{1{,}25+\cos 2\Omega}\right) - \mathrm{arctg}\left(\frac{\mathrm{sen}\,2\Omega}{0{,}8+\cos 2\Omega}\right)\right]}$$

b) Eliminación de 125 Hz y su 2do armónica



$$Y(Z) = H(z) \cdot X(Z) \rightarrow Y'(Z) = X(Z) \cdot (H(Z) + 1)$$

$$\frac{Y'(Z)}{X(Z)} = H'(Z) = H(Z) + 1$$

• Si $M = 4 \wedge \alpha = 0,8$

$$H'(Z) = \frac{0,8\, Z^4 + 1}{Z^4 + 0,8} + 1 = \frac{0,8\, Z^4 + Z^4 + 1 + 0,8}{Z^4 + 0,8}$$

$$H'(Z) = \frac{1,8\, Z^4 + 1,8}{Z^4 + 0,8} = 1,8 \; \frac{Z^4 + 1}{Z^4 + 0,8}$$

ceros: siendo $Z = 1 \cdot e^{j\Omega}$, $Z_1 = 1\, e^{j\pi/4}$ $\quad Z_3 = 1\, e^{j\,-\pi/4}$

$Z_2 = 1\, e^{j\frac{3\pi}{4}}$ $\quad Z_4 = 1\, e^{j\,-3\pi/4}$

polos: $\quad p_1 = 0,95\; e^{j\pi/4}$ $\quad p_2 = 0,95\; e^{j\,-\pi/4}$

$p_3 = 0,95\; e^{j\,3\pi/4}$ $\quad p_4 = 0,95\; e^{j\,\frac{-3\pi}{4}}$

$$\Omega = \pi \rightarrow fs/2$$

Entonces: $\frac{\pi}{4} = \frac{fs}{8}$ y $\frac{3\pi}{4} = fs \cdot \frac{3}{8}$ } Ceros

• Si $fs = 8 \cdot 125$ Hz $\rightarrow$ $ceros_1 = \frac{8 \cdot 125}{8} = 125$ Hz

$ceros_2 = 3 \cdot 125$ Hz } 2do armónica