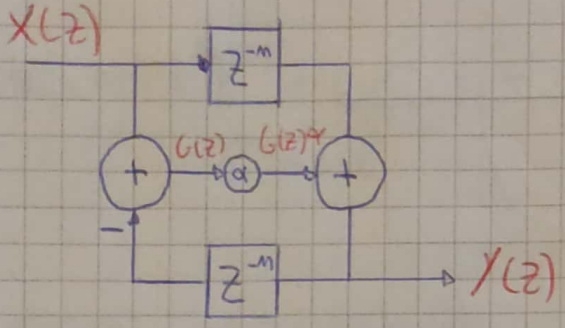
2)



DATOS

$m=2$; $\alpha=0,8$

a)

$X(z) - z^{-m} Y(z) = G(z)$ (1) ; $G(z)\,\alpha + z^{-m} X(z) = Y(z)$ (2)

(1) en (2)

$$Y(z) = \alpha\left(X(z) - z^{-m} Y(z)\right) + z^{-m} X(z)$$

$$Y(z)\left[1 + z^{-m}\alpha\right] = X(z)\left[\alpha + z^{-m}\right] \rightarrow H(z) = \frac{\alpha + z^{-m}}{z^{-m}\alpha + 1}$$

con $m=2$ y $\alpha=0,8$:

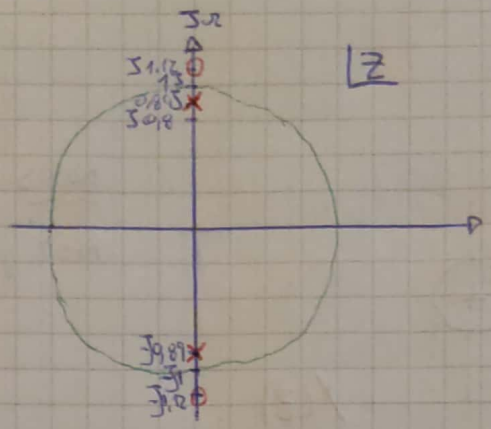
$$H(z) = \frac{z^2\alpha + 1}{z^2 + \alpha} \rightarrow H(z) = \frac{\alpha\,(z^2 + 1/\alpha)}{z^2 + \alpha}$$

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

Polos: $z_{1,2} = \pm j\,0,89$

Ceros: $z_{1,2} = \pm j\,1,12$

DIAGRAMA DE POLOS Y CEROS

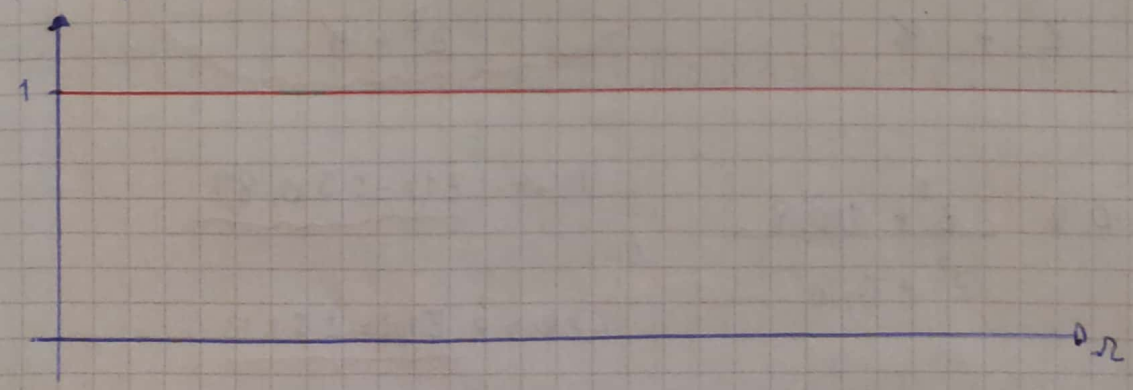


$$H(j\Omega) = H(z)\Big|_{z=1e^{j\Omega}} \Rightarrow H(j\Omega) = \frac{e^{j2\Omega} + 1}{e^{j2\Omega} + 0,8} \cdot 0,8$$

$$|H(j0)| = \frac{e^{j0} + 1}{e^{j0} + 0,8} 0,8 \Rightarrow |H(j0)| = 1 \quad ; \quad |H(j\pi/2)| = \frac{e^{j\pi} + 1}{e^{j\pi} + 0,8} 0,8$$

$$|H(j\pi)| = \frac{e^{j2\pi} + 1}{e^{j2\pi} + 0,8} 0,8 \Rightarrow |H(j\pi)| = 1 \quad ; \quad |H(j\pi/2)| = \left|\frac{0,8 + 1}{0,8 + (-1)}\right|$$

$$|H(j\pi/2)| = \left|\frac{1 + (-0,8)}{-1 + 0,8}\right| = 1$$



NOTA

$\theta(\mathfrak{J}0) = 0 \quad ; \quad \theta(\mathfrak{J}\pi) = 0 \quad , \quad \theta(\mathfrak{J}\pi/2) =$

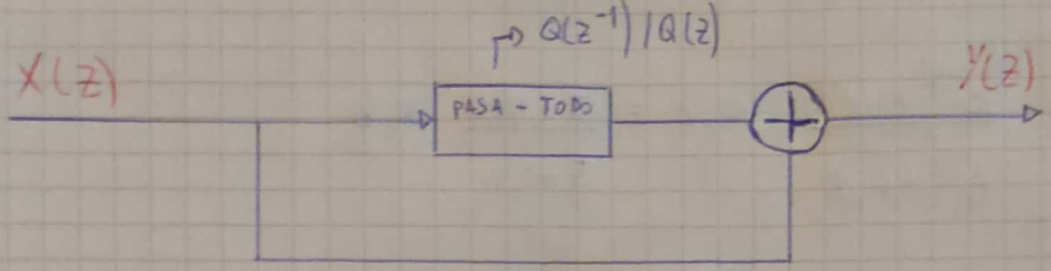
$$H\theta(\mathfrak{J}\pi/4) = \frac{e^{\overset{1}{\cancel{2}}\cdot\pi/\cancel{4}^{2}} + 1/0{,}8}{e^{\pi/2} + 0{,}8} \cdot 0{,}8 = \frac{\mathfrak{J} + 1/0{,}8}{\mathfrak{J} + 0{,}8} \; 0{,}8$$

$$\theta(\mathfrak{J}\pi/4) = \frac{\text{ARCTg}\,(0{,}8/1)}{\text{ARCTg}\,(1/0{,}8)} \quad , \quad H(\mathfrak{J}\pi/4) = \underbrace{\sqrt{\frac{1 + 0{,}8^2}{0{,}8^2 + 1}}}_{1} \; e^{\text{ARCTg}(0{,}8) - \text{ARCTg}(1/0{,}8)}$$

$\hookrightarrow < 0$

b) SENOIDAL EN 125 Hz Y SU SEGUNDA ARMONICA. TENEMOS UN (+)

Y EL MISMO FILTRO CON M = 4



$$T(z) = 1 + \frac{Q(z^{-1})}{Q(z)} = \frac{Q(z) + Q(z^{-1})}{Q(z)}$$

$$T(z) = \frac{z^{m} + \alpha + \alpha z^{m} + 1}{\alpha z^{m} + 1} = \frac{z^{m}(1+\alpha) + (1+\alpha)}{\alpha z^{m} + 1} \rightarrow T(z) = \frac{(1+\alpha)(z^{m}+1)}{\alpha\left(z^{m} + 1/\alpha\right)}$$

PARA $M = 4$

$$T(z) = \frac{(1+\alpha)}{\alpha} \frac{z^{4} + 1}{z^{4} + 1/\alpha}$$

CEROS: $z_{1,2} = \pm\frac{\sqrt{2}}{2} \pm j\frac{\sqrt{2}}{2}$; $z_{3,4} = \pm\frac{\sqrt{2}}{2} \pm \frac{\sqrt{2}}{2}$

POLOS: $z_{1,2} = \pm$; $z_{3,4} = \pm$

PARA ELIMINAR LOS 125 Hz, $FS = 8 \cdot 125\,Hz = 1000\,Hz = 1\,KHz$

↳ $\theta = \frac{M}{4}$; si $M \rightarrow FS/2$

$M/4 \rightarrow FS/8$

PARA ELIMINAR LA SEGUNDA ARMONICA, $FS = \frac{8}{3} \cdot 800\,Hz = \frac{8000}{3}\,Hz$

$\theta = \frac{3M}{4}$