TAREA SEMANAL 7

Ej 2 - Guía TP5

- Butter orden 2 con $f_c = 1\,kHz$ } enventanado digitalmente

a) $f_s = 100\,kHz$

$$H(s) = \frac{1}{s^2 + \sqrt{2}\,s + 1} = \frac{\omega_0^2}{s^2 + \frac{\omega_0}{Q}\cdot s + \omega_0^2}$$

$$H(z) = H(s)\Big|_{s = k\cdot\frac{z-1}{z+1}} = \frac{1\cdot\omega_0^2}{k^2\frac{(z-1)^2}{(z+1)^2} + \frac{\omega_0}{Q}\cdot k\frac{(z-1)}{(z+1)} + \frac{(z-1)^2}{(z+1)^2}\}\,\omega_0^2}$$

$\frac{\omega_0}{Q} \to \sqrt{2}$

$$H(z) = (z+1)^2 \cdot \frac{1}{k^2(z^2 - 2z + 1) + \sqrt{2}k(z-1)(z+1) + (z^2 + 2z + 1)\cdot\omega_0^2}$$

$(z^2 - 1)$

$$H(z) = \frac{(z+1)^2\cdot\omega_0^2}{z^2(k^2 + \sqrt{2}k + 1) + z(2 - 2k) + k - \sqrt{2} + 1}$$

$\frac{\omega_0}{Q}$ $\quad\omega_0^2$ $\quad 2\omega_0^2$ $\quad\frac{\omega_0}{Q}\cdot k$ $\quad\omega_0^2$

$$H(z) = \frac{\omega_0^2 z^2 + 2z\omega_0^2 + \omega_0^2}{z^2\cdot\left(k^2 + k\frac{\omega_0}{Q} + \omega_0^2\right) + z\left(2\omega_0^2 - 2k^2\right) + \left(k^2 - \frac{\omega_0}{Q}k + \omega_0^2\right)}$$

Ej ② c) $H(s) = \dfrac{s^2}{s^2 + \sqrt{2}\,s + 1} = \dfrac{s^2}{s^2 + \frac{w_0}{Q}\cdot s + w_0^2}$

$$H(z) = H(s)\Big|_{s = \kappa \cdot \frac{z-1}{z+1}} = \frac{\cancel{(z+1)^2} \cdot \kappa^2 \frac{(z-1)^2}{\cancel{(z+1)^2}}}{z^2 \cdot \left(\kappa^2 + \frac{\kappa w_0}{Q} + w_0^2\right) + z\,(2w_0^2 - 2\kappa^2) + \left(\kappa^2 - \frac{w_0}{Q}\kappa + w_0\right.}$$

$$H(z) = \frac{z^2 \cdot \kappa^2 - 2\kappa^2 z + \kappa^2}{z^2\left(\kappa^2 + \frac{\kappa w_0}{Q} + w_0^2\right) + z\left(2w_0^2 - 2\kappa^2\right) + \left(\kappa^2 - w_0\frac{\kappa}{Q} + w_0^2\right)}$$