. Trabajo semanal Nº4.

→ $\omega_0 = 2\pi\ 22\,kHz$.

→ $Q = 5$.

→ Aproximación de Cheby ⇒ 0,5 dB (rizado).

Filtro Cheby:

$$|T(\omega)|^2 = \frac{1}{1+\epsilon^2 C_n^2(\omega)}.$$

$$\alpha_{MAX} = 10 \log(1+\epsilon^2) = 0,5dB.$$

$$\longrightarrow \epsilon = 0,349.$$

→ Condición de la banda de stop.

$$T(f_{s1}) = -16dB \rightarrow f_{s1} = 17\,kHz$$
$$T(f_{s2}) = -24dB \rightarrow f_{s2} = 36\,kHz.$$

① $\Omega_{s1} = -0,521.5 \longrightarrow \alpha = 16dB$.

② $\Omega_{s2} = 5.1,025 \longrightarrow \alpha = 24dB$

$$\alpha = 10 \log\left(1+\epsilon^2 . \cosh^2(n \cosh^{-1}(\Omega))\right)$$

Para cumplir con ① → $N=3$

Para cumplir con ② → $N=2$.

} $N=3$ cumple los dos condiciones.

$$\therefore |T(j\omega)|^2 = \frac{1}{1+\epsilon^2 . C_3^2(\Omega)}$$

$C_0(\omega) = 1$

$C_1(\omega) = \omega$.

$C_2(\omega) = 2\omega^2 - 1$

$C_3(\omega) = 4\omega^3 - 2\omega - \omega = 4\omega^3 - 3\omega$.

$$\therefore |T(\omega)|^2 = \frac{1}{1+\epsilon^2(4\omega^3-3\omega)^2} = \frac{1}{1+\epsilon^2(4^2\omega^6 - 4.2.3\omega^4 + 3^2\omega^2)}$$

$$|T(s)|^2 = \frac{1}{\epsilon^2 A^2 \omega^6 - 24\epsilon^2 s^4 + 9\cdot\epsilon^2 s^2 + 1}$$

$$a^2 = \epsilon^2 A^2 \rightarrow \boxed{a = \epsilon \cdot A}$$

$$d^2 = 1 \rightarrow \boxed{d = 1}$$

$$c = \sqrt{2bd + 9\epsilon^2}$$

$$b^2 = -24\epsilon^2 + 22c = -24\epsilon^2 + 22\sqrt{2b + 9\epsilon^2}$$

$$b^2 + 24\epsilon^2 = 22\sqrt{2b + 9\epsilon^2}$$

$$b^4 + 48b^2\epsilon^2 + 24^2\epsilon^4 = 64(2b + 9\epsilon^2)$$

$$b^3 + 48\epsilon^2 b - 128\epsilon^2 = 0 \rightarrow b = 1{,}75.$$

$$\rightarrow c = 2{,}144$$

NOTA

$$H(s) = \frac{1}{s^3 \ldots + s^2 \cdot 1{,}75 + s\,2{,}144 + 1}$$

1,397.

$$H(s) = \frac{2{,}053}{s^3 + 3{,}593\,s^2 + 4{,}402\,s + 2{,}053}$$

$s_1 = -1{,}7437$

$s_{2-3} = -0{,}924 \pm 0{,}567j$

$$H(s) = \frac{0{,}7158 \cdot}{s^3 + s^2(1{,}25) + s(1{,}534) + 0{,}7158}$$

→ Simulación ✓

Transformación

$$P = H(s) = \left(\frac{1+s^2}{s}\right) Q$$

$$\rightarrow H(s) = \frac{0{,}7158 \cdot}{Q^3\left(\frac{1+s^2}{s}\right)^3 + 1{,}25Q^2\left(\frac{1+s^2}{s}\right)^2 + 1{,}534 \cdot Q\left(\frac{1+s^2}{s}\right) + 0{,}715}$$

→ Resolución numérica.