HOJA Nº

FECHA

TRABAJO SEMANAL Nº13 (ROLANDO TOMÁS)

1) Nos piden un filtro bessel de orden 3. Para obtener la forma del filtro bessel nos basamos en los formatos provistos por la tabla:

Para $n=3 \Rightarrow B_{en}(s) = 15 + 15s + 6s^2 + s^3$

$k_0 = 15$

Si recordamos, podemos definir la función transferencia como:

$$T(s) = \frac{k_0}{B_{en}(s)} \Rightarrow T(s) = \frac{15}{s^3 + 6s^2 + 15s + 15}$$

Debemos hallar $|T(s)|^2$:

$$|T(s)|^2 = T(s) \cdot T(-s)$$

$$T(s) = \frac{15}{s^3 + 6s^2 + 15s + 15} \quad \wedge \quad T(-s) = \frac{15}{-s^3 + 6s^2 - 15s + 15}$$

Entonces:

$$|T(s)|^2 = \frac{15}{s^3 + 6s^2 + 15s + 15} \cdot \frac{15}{-s^3 + 6s^2 - 15s + 15}$$

$$|T(s)|^2 = \frac{225}{\left(-s^6 + 6s^5 - 15s^4 + 15s^3 - 6s^5 + 36s^4 - 90s^3 + 90s^2 - 15s^4 + 90s^3 - 225s^2 + 225s - 15s^3 + 90s^2 - 225s + 225\right)}$$

$$|T(s)|^2 = \frac{225}{-s^6 + 6s^4 - 45s^2 + 225}$$

NOTA

De los parámetros S:

$$|T(s)|^2 = |S_{21}|^2$$

$$T(s) = S_{21} = \frac{15}{s^3 + 6s^2 + 15s + 15}$$

$$|S_{11}|^2 + |S_{21}|^2 = 1$$

$$|S_{11}|^2 = 1 - |S_{21}|^2 = 1 - \frac{225}{-s^6 + 6s^4 - 45s^2 + 225}$$

$$|S_{11}|^2 = \frac{-s^6 + 6s^4 - 45s^2 + 225 - 225}{-s^6 + 6s^4 - 45s^2 + 225}$$

$$|S_{11}|^2 = \frac{(-1)}{(-1)} \cdot \frac{s^6 - 6s^4 + 45s^2}{s^6 - 6s^4 + 45s^2 - 225} = S_{11}(s) \cdot S_{11}(-s)$$

Extraemos:

$$|S_{11}|^2 \Rightarrow S_{11} = \frac{s^3 + 4{,}44s^2 + 6{,}69s}{s^3 + 6s^2 + 15s + 15}$$

$$S_{11} = \frac{Z_1 - R_0}{Z_1 + R_0}$$

Se despeja Z_1:

$$Z_1 = R_0 \cdot \frac{S_{11} + 1}{1 - S_{11}}$$

Como: $R_0 = 1$ y $S_{11} = \frac{s^3 + 4{,}44s^2 + 6{,}69s}{s^3 + 6s^2 + 15s + 15}$

NOTA

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$$Z_1 = 1 \cdot \frac{5^3 + 4,445^2 + 6,695 + 1}{5^3 + 6s^2 + 5s + 5}$$

$$1 - \frac{5^3 + 4,445^2 + 6,695}{5^3 + 6s^2 + 5s + 5}$$

→ CÁLCULO NUMÉRICO

$$Z_1 = \frac{2s^3 + 10,4s^2 + 21,69s + 15}{1,6s^2 + 8,31s + 15}$$