TP3 - Ejercicio 4

Hallar $E(s)$ a partir de su reactancia $X(j\omega) = \frac{-\omega^3 + \omega}{\omega^4 - \omega^2 + 1}$

$$X(j\omega)\Big|_{\omega = s/j} = j\left(\frac{\frac{s^3}{j} + \frac{s}{j}}{s^4 + s^2 + 1}\right) = \frac{s^3 + s}{s^4 + s^2 + 1} = X(s)$$

Cg
$(s^2+1)^2 = s^4 + 2s^2 + 1$

$$\boxed{X(s) = \frac{s^3 + s}{s^4 + s^2 + 1} = \frac{s(s^2+1)}{s^4 + s^2 + 1} = \frac{n_1 \cdot m_2 - m_1 n_2}{m_2^2 - n_2^2}}$$

Del numerador:

$$s^3 + s = n_1 m_2 - m_1 n_2 \implies \underline{n_2 = s} \wedge \underline{m_1 = 0}$$

$$\underline{n_1 = s} \wedge \underline{m_2 = s^2 + 1}$$

Verificamos el denominador: $(s^2+1)^2 - s^2 = s^4 + 2s^2 + 1 - s^2 = s^4 + s^2 + 1$

Ahora armamos $\boxed{F(s) = \frac{m_1 + n_1}{m_2 + n_2} = \frac{s}{s^2 + s + 1}}$

Corroboramos:

$$F(s)\Big|_{s=j\omega} = \frac{j\omega}{(1 - \omega^2 + j\omega)} \cdot \frac{(1 - \omega^2 - j\omega)}{(1 - \omega^2 - j\omega)} = \frac{j\omega - j\omega^3 + \omega^2}{(1 - \omega^2)^2 + \omega^2}$$

$$\boxed{F(\omega) = R(\omega) + j\,X(\omega) = \frac{\omega^2}{\omega^4 - \omega^2 + 1} + j\,\frac{-\omega^3 + \omega}{\omega^4 - \omega^2 + 1}}$$