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Fracciones Parciales

Considere la siguiente ecuación de transferencia

$$X(s) = \frac{2s^3 + 8s^2 + 4s + 8}{s(s+1)(s^2+4s+8)} = \frac{K_1}{s} + \frac{K_2}{s+1} + K_3$$

$$K_3 \rightarrow \frac{A}{s+2+j2} + \frac{A^*}{s+2-j2}$$

✓ Considerando cada caso

$$K_1 = sX(s)\Big|_{s=0} = \frac{2s^3+8s^2+4s+8}{(s+1)(s^2+4s+8)}\Big|_{s=0} = \frac{8}{8} = 1$$

$$K_2 = (s+1)X(s)\Big|_{s=-1} = \frac{(s+1)(2s^3+8s^2+4s+8)}{(s+1)(s)(s^2+4s+8)}\Big|_{s=-1}$$

$$= \frac{2(-1)^3+8(-1)^2+4(-1)+8}{(-1)((-1)^2+4(-1)+8)} = \frac{-2+8-4+8}{-(1-4+8)} = -\frac{10}{5} = -2$$

$$A = (s+2+j2)X(s)\Big|_{s=-2-j2} = \frac{(s+2+j2)(2s^3+8s^2+4s+8)}{(s+1)(s^2+4s+8)(s)}\Big|_{s=-2-j2}$$

$$\frac{(s+2+j2)(2s^3+8s^2+4s+8)}{(s+2+j2)(s+2-j2)(s+1)(s)} = \frac{2s^3+8s^2+4s+8}{(s+2-j2)(s+1)(s)}\Big|_{s=-2-j2}$$

✓ Por partes

- $2s^3 = 2(-2-j2)^3 = 2\left((-2)^3+3(-2)^2(-j2)+3(-2)(-j2)^2+(-j2)^3\right)$

$= 2\left((-2)^3 - j24 + 24 + j8\right)) = 2(-8+24+8j-24j)$

$2s^3 = 2(16-16j) = 32-32j$

- $8s^2 = 8(-2-j2)^2 \rightarrow 8s^2 = j64$

Numerador $32 - j32 + j64 + 4(-2-j2) + 8$

$= 32 - j32 + j64 - j8 = 32 + j24$

Denominador $s(s+1)(s+2-j2) = (-2-j2)(-2-j2+1)(-2-j2+2+j2)$

$= 24 + j8$

$$A = \frac{32+j24}{24+j8} = \frac{8(4+j3)}{8(3+j)} \rightarrow A = \frac{4+j3}{3+j} = \frac{15-5j}{10} = 1,5-0,5j$$

$$X(s) = \frac{1}{s} - \frac{2}{s+1} + \frac{1,5-0,5j}{s+2+j2} + \frac{1,5+0,5j}{s+2-j2}$$