

Video 2

Fracciones parciales

$$X(s) = \frac{2s^3 + 8s^2 + 4s + 8}{s(s+1)(s^2+4s+8)} = \frac{k_1}{s} + \frac{k_2}{s+1} + k_3$$

$$k_3 = \frac{A}{s+2+j2} + \frac{A^*}{s+2-j2}$$

para cada caso

$$k_1 = s \times (s) \Big|_{s=0} = \frac{2s^3 + 8s^2 + 4s + 8}{(s+1)(s^2+4s+8)} \Big|_{s=0} = \frac{8}{8} = 1$$

$$k_2 = (s+1) \times (s) \Big|_{s=-1} = \frac{(s+1)(2s^3 + 8s^2 + 4s + 8)}{(s+1)(s)(s^2+4s+8)} \Big|_{s=-1}$$

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

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

Por partes

$$\begin{aligned} 2s^3 &= 2(-2-j2)^3 \\ &= 2((-2)^3 + 3(-2)^2(-j2) + 3(-2)(-j2)^2 + (-j2)^3) \\ &= (2((-2)^3 - j24 + 24 + j8)) \\ &= 2(-8 + 24 + j8 - 24j) \\ &= 2(16 - 16j) \end{aligned}$$

$$2s^3 = 32 - 32j$$

$$\begin{aligned} 8s^2 &= 8(-2-j2)^2 \\ &= j64 \end{aligned}$$

$$\text{Numerador} = 32 - j32 + j64 + 4(-2-j2) + 8$$

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

$$= 32 + j24$$

$$\text{Denominador} = s(s+1)(s+2-j2)$$

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

$$= (-2-j2+2+j2)$$

$$= 24 + j8$$

$$A = \frac{32 + j24}{24 + j8} = \frac{8(4 + j3)}{8(3 + j)}$$

$$A = \frac{4 + j3}{3 + j}$$

$$A = \frac{15 - 5j}{10} = 1,5 - 0,5j$$

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