

Task 6

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

$$= \frac{k_1}{s} + \frac{k_2}{s+1} + \frac{A}{s+2+j2} + \frac{A^*}{s+2-j2}$$

$$k_1 = s X(s) \Big|_{s=0}$$

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

$$= \frac{8}{8} = 1$$

$$k_2 = (s+1) X(s) \Big|_{s=-1}$$

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

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

$$= \frac{10}{-5} = -2$$

$$(s+2+j2) X(s) \Big|_{s=-2-j2}$$

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

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

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

Partes

$$2s^3 = 2[(-2)^3 + 3(-2)^1(-j2) + 3(-2)(-j2)^2 + (-j2)^3]$$

$$= 2[-8 - j24 + 24 + j8]$$

$$= 2[16 - j16]$$

$$= 32 - j32$$

$$8s^2 = 8[-2-j2]^2$$

$$= 8[(-2)^2 + 2(-2)(-j2) + (j2)^2]$$

$$= 8[4 + 0j - 4]$$

$$= 64j$$

$$A = \frac{32 - j32 + 4(-2-j2) + 8 + 64j}{(2-j2)(-1-2j)(-2/j)} = \frac{32 + j24}{24 + j8}$$

$$= \frac{8(4+j3)}{8(3+j)} = \frac{4+j3}{3+j} \cdot \frac{3-j}{3-j}$$

$$A = 1.5 + j0.5$$

$$X(s) = \frac{1}{s} + \frac{-2}{s+1} + \frac{1.5+j0.5}{s+2+j2} + \frac{1.5-j0.5}{s+2-j2}$$