Video 2: Partial Fractions

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

$$= \frac{K_1}{s} + \frac{K_2}{s+1} + \frac{A}{s+2+j2} + \frac{A^*}{s+2-j2}$$

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

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

$$K_2 = \frac{2(-1)^3+8(-1)^2+4(-1)+8}{(-1)[(-1)^2+4(-1)+8]} = \frac{-2+8-4+8}{(-1)(1-4+8)} = \frac{10}{-5} \Rightarrow \boxed{K_2 = -2}$$

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

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

Por partes

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

$$= 2[-8-j24+24+j8] = 2[16-j16]$$

$$= 32-j32$$

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

$$= 8[(-2)^2+2(-2)(-j2)+(j2)^2 = 8[4+8j-4]$$

$$= 64j$$

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

$$= \frac{4+j3}{3+j} = \frac{4+j3}{3+j}\cdot\frac{3-j}{3-j} \Rightarrow \boxed{A = 1{,}5+j\,0{,}5}$$

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