

13.21 Given the following functions $F(s)$, find $f(t)$. **PSV**

$$(a) F(s) = \frac{(s+1)(s+3)}{(s+2)(s^2+2s+2)}$$

$$(b) F(s) = \frac{(s+2)^2}{s^2+4s+5}$$

SOLUTION:

$$a) F(s) = \frac{(s+1)(s+3)}{(s+2)(s+1-j1)(s+1+j1)} = \frac{k_1}{s+2} + \frac{k_2}{s+1-j1} + \frac{k_2^*}{s+1+j1}$$

$$k_1 = \frac{(-1)(1)}{-4+4+2} = -1/2 \quad k_2 = \frac{j1(2+j1)}{(1+j1)(j2)} = 0.79 \angle -18.4^\circ$$

$$f(t) = \left[\frac{1}{2} e^{-2t} + 1.58 e^{-t} \cos(t - 18.4^\circ) \right] u(t)$$

b)

$$F(s) = \frac{s^2+4s+4}{s^2+4s+5} = 1 - \frac{1}{s^2+4s+5} = 1 - \left[\frac{k_1}{s+2-j1} + \frac{k_1^*}{s+2+j1} \right]$$

$$k_1 = \frac{1}{j2} = j1/2 = 1/2 \angle 90^\circ$$

$$F(s) = 1 - \frac{1/2 \angle -90^\circ}{s+2-j1} - \frac{1/2 \angle +90^\circ}{s+2+j1}$$

$$f(t) = \left[\delta(t) - e^{-2t} \cos(t - 90^\circ) \right] u(t)$$