3.23a

Monday, October 2, 2023 8:38 PM

$h(t) = e^{-2t}u(t)$ $\quad x(t) = u(t) - u(t-3)$

$\mathcal{L}\{x(t) * h(t)\} = X(s) \cdot H(s)$

$$H(s) = \frac{Y(s)}{X(s)} = \frac{\mathcal{L}\, y(t)}{\mathcal{L}\, x(t)}$$

$$Y(s) = X(s) \cdot H(s)$$

Check Matlab Code for the rest

$$\boxed{\frac{\left[e^{-3s} \cdot \left[e^{3s} - 1\right]\right]}{s(s+2)}} = \frac{e^{-3s+3s} - e^{-3s}}{s(s+2)} = \boxed{\frac{1 - e^{-3s}}{s(s+2)}}$$

Matlab answer $=$ text Book's answer

3.20a

Monday, October 2, 2023 9:23 PM

$$y(t) = \alpha x(t-T) + \alpha^3 x(t-3T)$$

Input is $x(t)$.

$$\mathcal{L}\, h(t) = \frac{\mathcal{L}\, y(t)}{\mathcal{L}\, X(t)} = \frac{Y(s)}{X(s)}$$

$$\mathcal{L}\, x(t) = X(s)$$

$$\mathcal{L}\, y(t) = \left[\alpha e^{Ts} + \alpha^3 e^{3Ts}\right] X(s) = Y(s)$$

$$\frac{Y(s)}{X(s)} = \alpha\left[e^{Ts} + \alpha^2 e^{3Ts}\right]$$

$$H(s) = \alpha\left[e^{Ts} + \alpha^2 e^{3Ts}\right]$$

$$h(t) = \alpha\left[\delta(t-T) + \alpha^2 \delta(t-3T)\right]$$

b) $H(s) = \alpha\left[e^{Ts} + \alpha^2 e^{3Ts}\right]$

The system has no poles

The system is BIBO Stable

3.35c

Tuesday, October 3, 2023 9:55 PM

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

$$(s^2+2s+3)\,Y(s) = X(s) + (s+1)$$

$$\frac{(s+2)\cancel{(s+1)}}{\cancel{(s+1)}}\,Y(s) = \frac{X(s)}{(s+1)} + \frac{\cancel{(s+1)}}{\cancel{(s+1)}}$$

$$(s+2)\,Y(s) = \frac{X(s)}{(s+1)} + 1$$

$$(s+2)(s+1)\,Y(s) - (s+1)$$

$$[s^2+2s+3]\,Y(s) - (s+1) = X(s)$$

$$s^n F(s) = \frac{d^n}{dt^n} f(t)$$

$$\frac{d^2}{dt^2} y(t) + 2\frac{d}{dt} y(t) + 3y(t) - \text{Initial Condition} = x(t)$$

$$x(t) = \frac{d^2}{dt^2} y(t) + 2\frac{d}{dt} y(t) + 3y(t)$$