Sheet (4)

2.1. Verify Eqs. (2.7) and (2.8), that is,

(a) $x(t) * h(t) = h(t) * x(t)$

(b) $\{x(t) * h_1(t)\} * h_2(t) = x(t) * \{h_1(t) * h_2(t)\}$

2.2. Show that

(a) $x(t) * \delta(t) = x(t)$

(b) $x(t) * \delta(t - t_0) = x(t - t_0)$

(c) $x(t) * u(t) = \int_{-\infty}^{t} x(\tau)\, d\tau$

(d) $x(t) * u(t - t_0) = \int_{-\infty}^{t - t_0} x(\tau)\, d\tau$

2.5. Compute the output $y(t)$ for a continuous-time LTI system whose impulse response $h(t)$ and the input $x(t)$ are given by

$$h(t) = e^{-\alpha t}u(t) \qquad x(t) = e^{\alpha t}u(-t) \qquad \alpha > 0$$

2.6. Evaluate $y(t) = x(t) * h(t)$, where $x(t)$ and $h(t)$ are shown in Fig. 2-6, (a) by an analytical technique, and (b) by a graphical method.

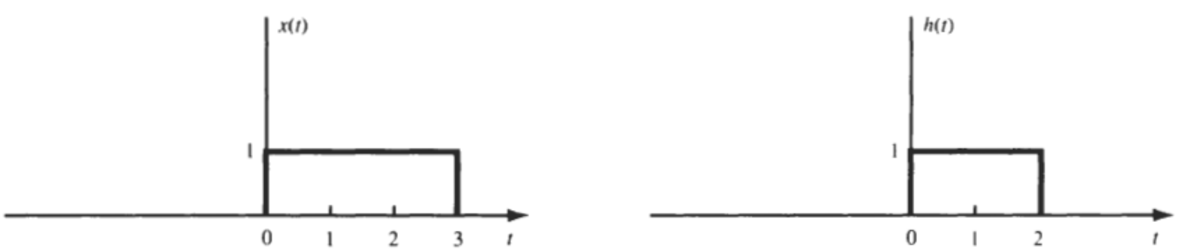


Fig. 2-6

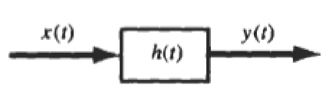
2.14. The system shown in Fig. 2-17(a) is formed by connecting two systems *in cascade*. The impulse responses of the systems are given by $h_1(t)$ and $h_2(t)$, respectively, and

$$h_1(t) = e^{-2t}u(t) \qquad h_2(t) = 2e^{-t}u(t)$$

(a) Find the impulse response $h(t)$ of the overall system shown in Fig. 2-17(b).

(b) Determine if the overall system is BIBO stable.

(a)



(b)

Fig. 2-17

Sheet (4)

2.27. Show that

(a) $x[n] * \delta[n] = x[n]$ (2.130)

(b) $x[n] * \delta[n - n_0] = x[n - n_0]$ (2.131)

(c) $x[n] * u[n] = \sum_{k=-\infty}^{n} x[k]$ (2.132)

(d) $x[n] * u[n - n_0] = \sum_{k=-\infty}^{n-n_0} x[k]$ (2.133)

2.30. Evaluate $y[n] = x[n] * h[n]$, where $x[n]$ and $h[n]$ are shown in Fig. 2-23, (a) by an analytical technique, and (b) by a graphical method.

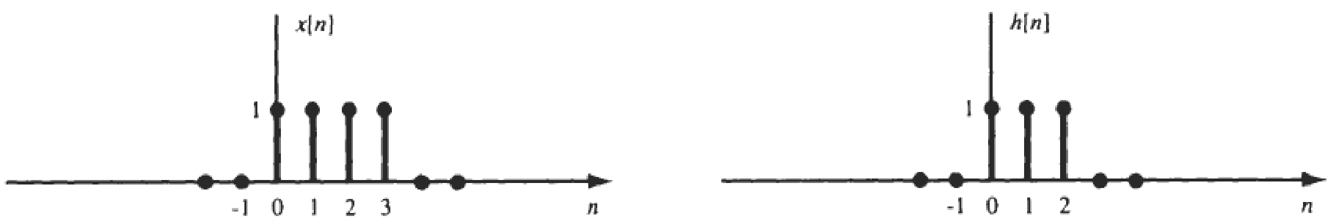


Fig. 2-23