EXAMPLE

Simplify the block diagram shown in Figure 3–44. Obtain the transfer function relating $C(s)$ and $R(s)$.

**Figure 3–44**
Block diagram of a system.

**Solution.** The block diagram of Figure 3–44 can be modified to that shown in Figure 3–45(a). Eliminating the minor feedforward path, we obtain Figure 3–45(b), which can be simplified to that shown in Figure 3–45(c). The transfer function $C(s)/R(s)$ is thus given by

$$
\frac{C(s)}{R(s)} = G_1 G_2 + G_2 + 1
$$

The same result can also be obtained by proceeding as follows: Since signal $X(s)$ is the sum of two signals $G_1 R(s)$ and $R(s)$, we have

$$
X(s) = G_1 R(s) + R(s)
$$

The output signal $C(s)$ is the sum of $G_2 X(s)$ and $R(s)$. Hence

$$
C(s) = G_2 [G_1 R(s) + R(s)] + R(s)
$$

And so we have the same result as before:

$$
\frac{C(s)}{R(s)} = G_1 G_2 + G_2 + 1
$$