Figure 5.2
Components of a block diagram for a linear, time-invariant system

$R(s)$ $C(s)$

Signals

(a)

$R(s)$ $G(s)$ $C(s)$
Input   Output

System

(b)

$R_1(s)$ $+$

$+$

$C(s) = R_1(s) + R_2(s) - R_3(s)$

$-$

$R_2(s)$

$R_3(s)$

Summing junction

(c)

$R(s)$
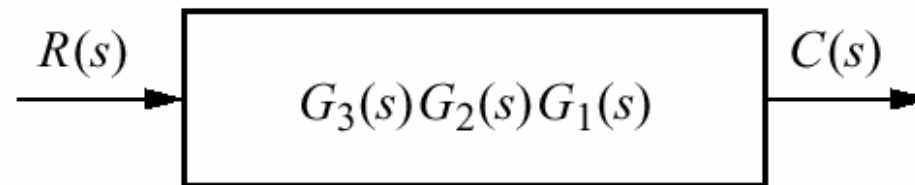
$R(s)$ $R(s)$

$R(s)$

Pickoff point

(d)

Figure 5.3
a. Cascaded subsystems;
b. equivalent transfer function

$R(s)$ → $G_1(s)$ → $X_2(s) = G_1(s)R(s)$ → $G_2(s)$ → $X_1(s) = G_2(s)G_1(s)R(s)$ → $G_3(s)$ → $C(s) = G_3(s)G_2(s)G_1(s)R(s)$

(a)

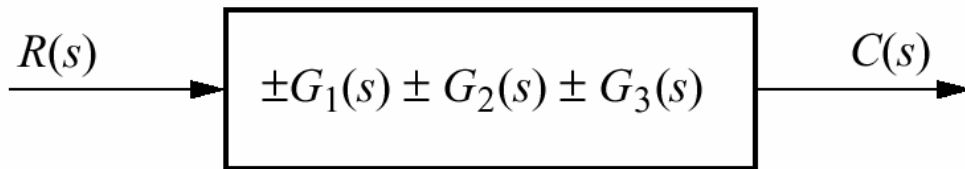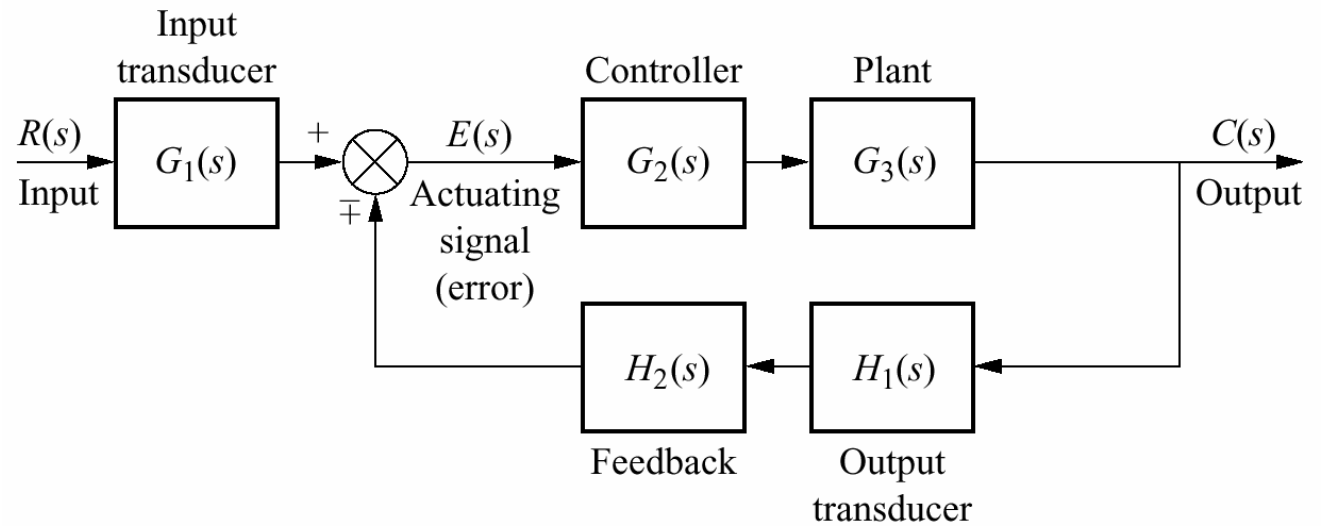$R(s)$ → $G_3(s)G_2(s)G_1(s)$ → $C(s)$
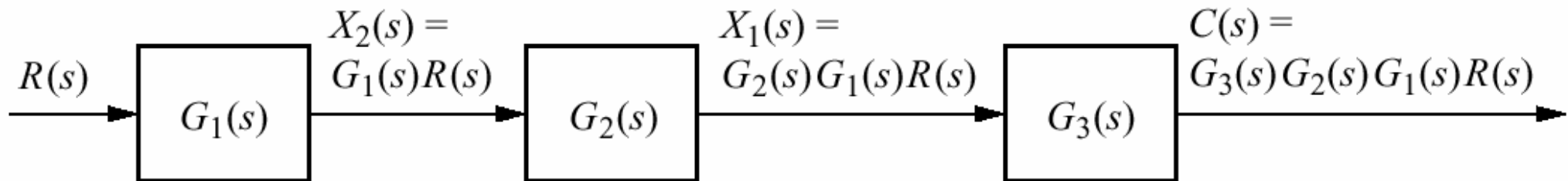
(b)
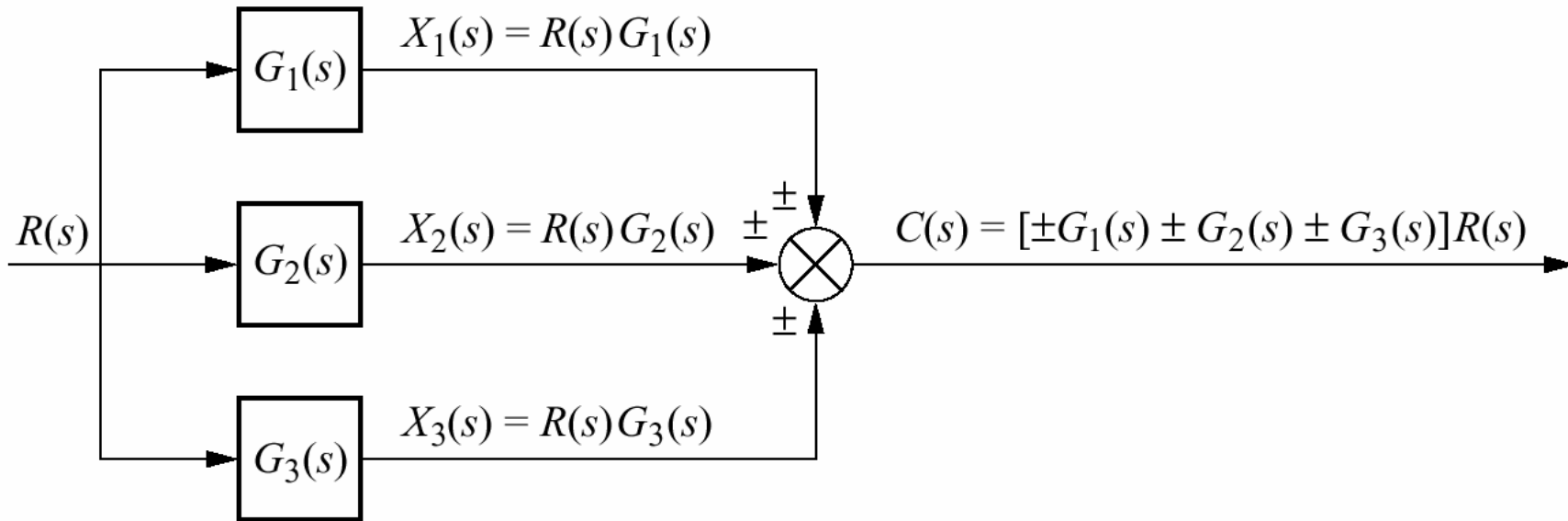
(a)

(b)

Figure 5.5
a. Parallel subsystems; **b.** equivalent transfer function
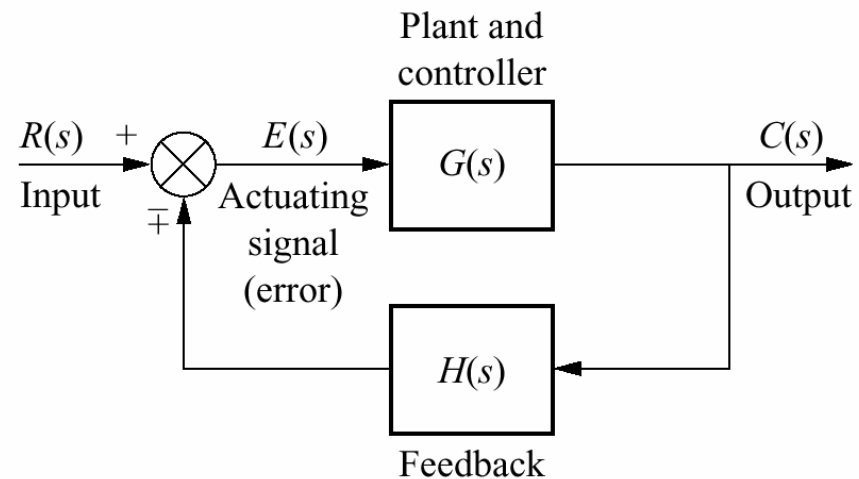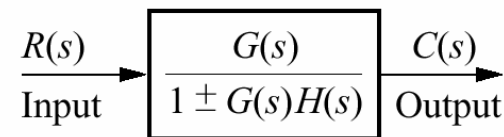
Figure 5.6
a. Feedback control system;
b. simplified model;
c. equivalent transfer function

Figure 5.7
Block diagram algebra for summing junctions— equivalent forms for moving a block **a.** to the left past a summing junction; **b.** to the right past a summing junction
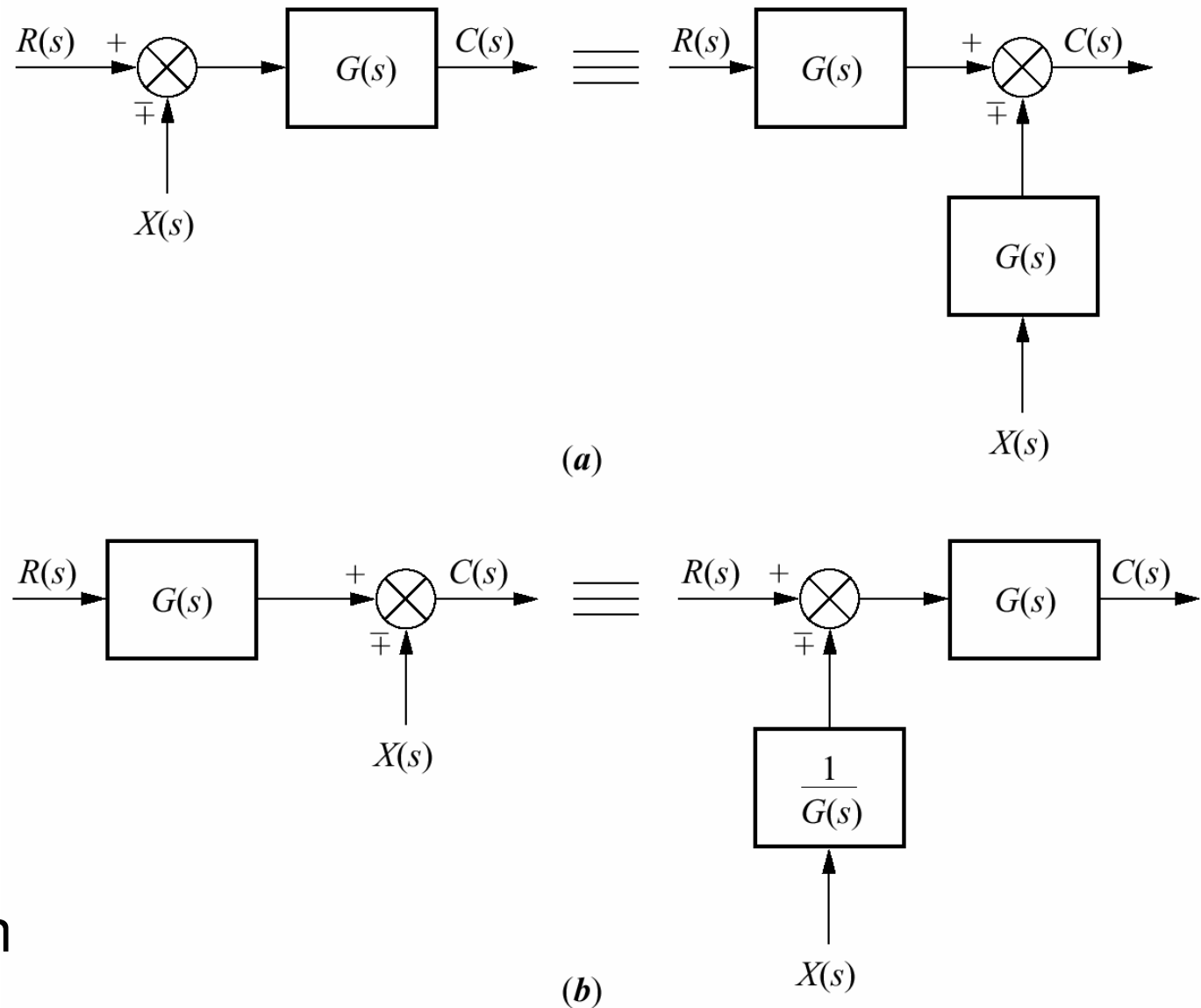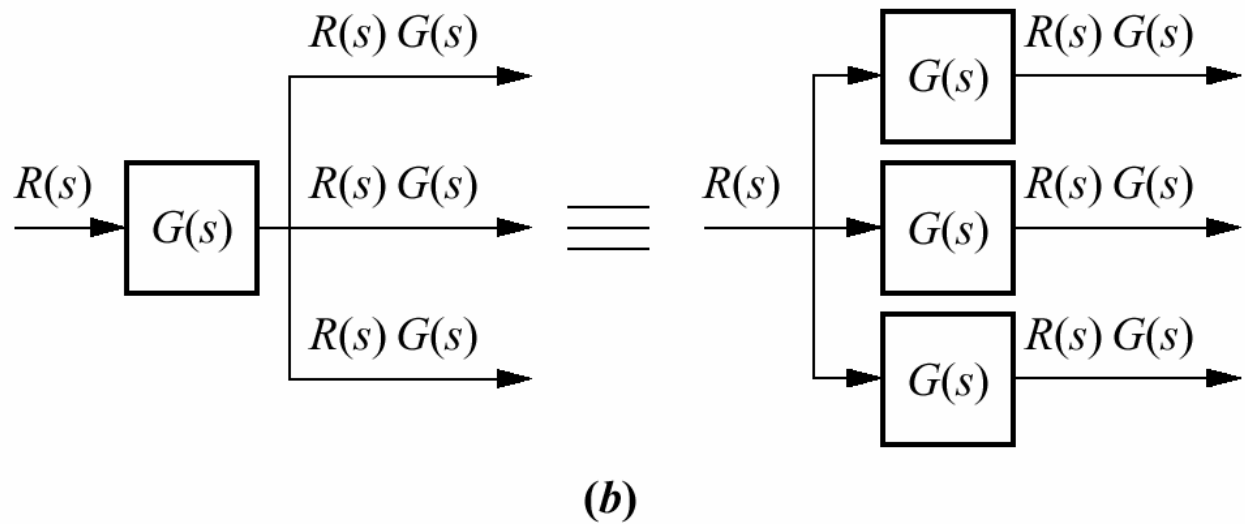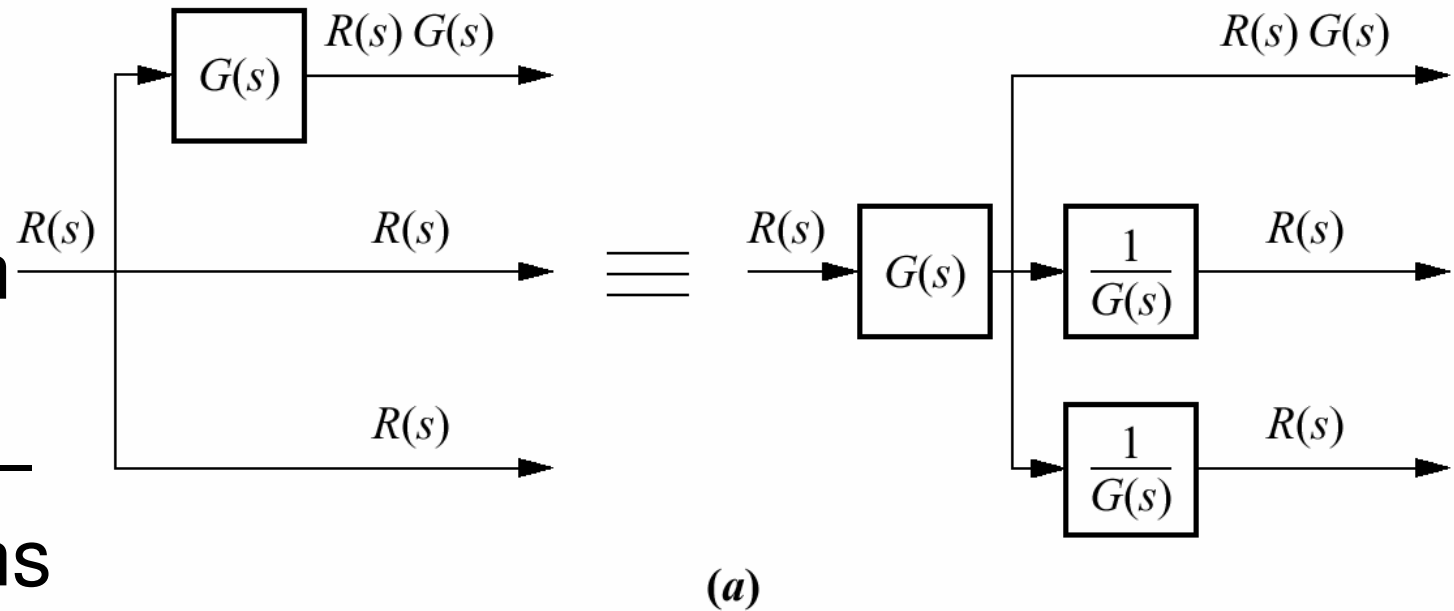
(a)

(b)

Figure 5.8 Block diagram algebra for pickoff points—equivalent forms for moving a block **a.** to the left past a pickoff point; **b.** to the right past a pickoff point
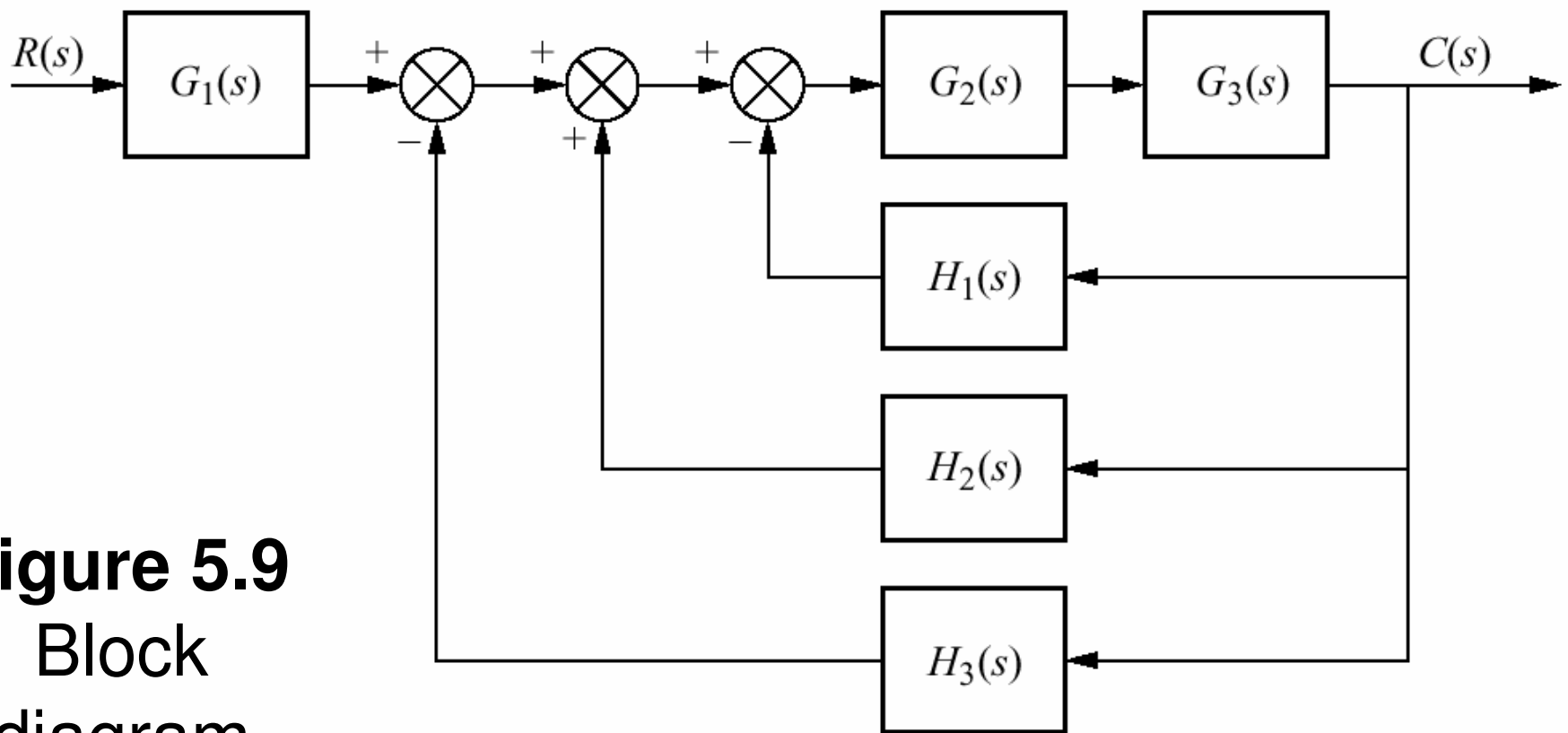
Figure 5.9
Block diagram for Example5.1

Figure 5.10

Steps in solving
Example 5.1:
a. collapse summing
junctions;
b. form equivalent
cascaded system
in the forward path
and equivalent
parallel system in the
feedback path;
c. form equivalent
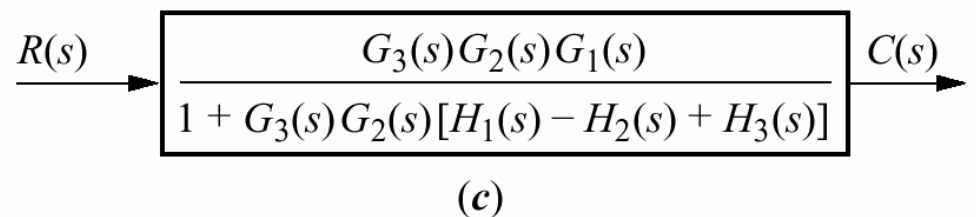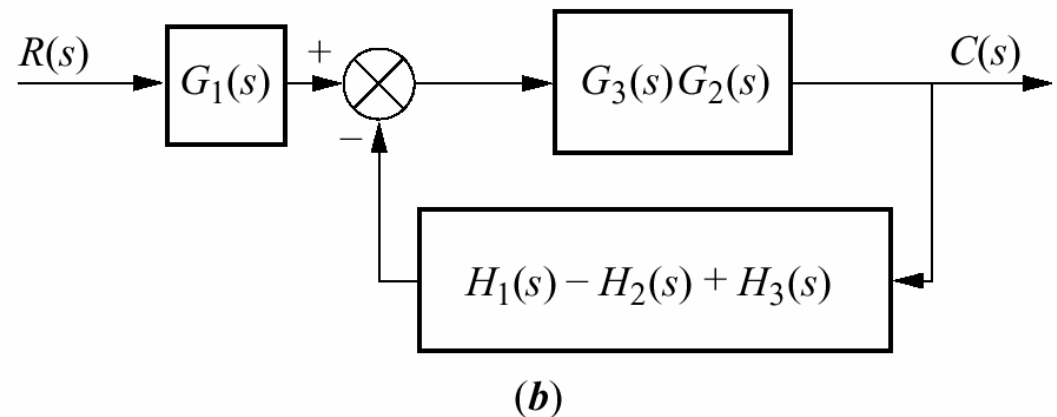feedback system and
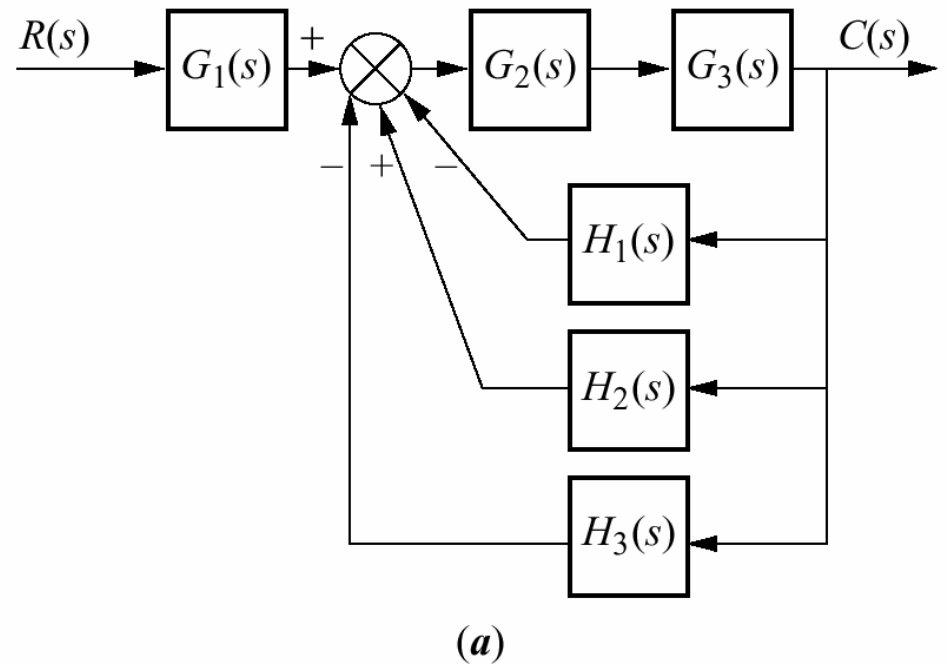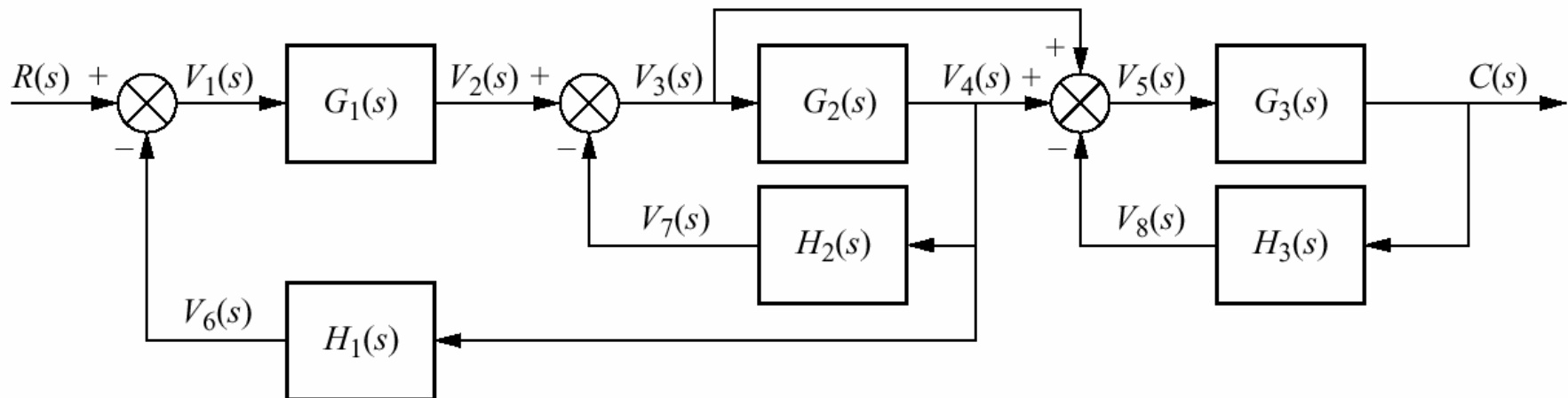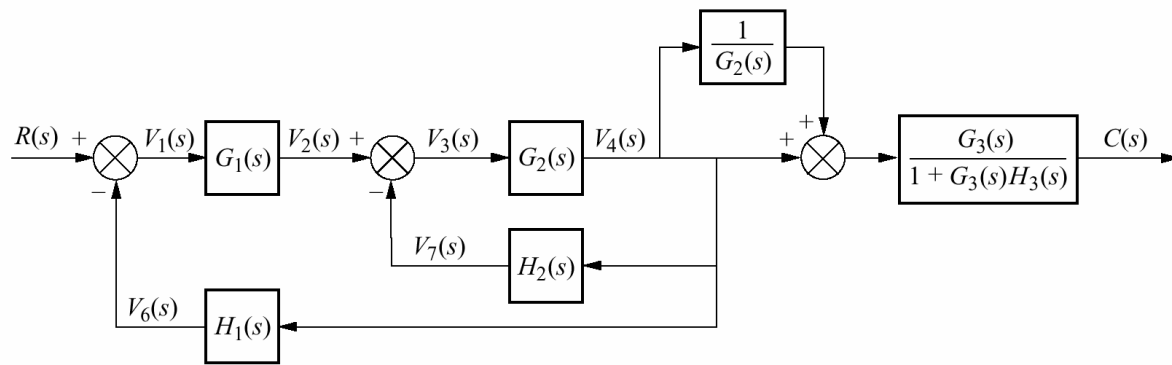multiply by cascaded
$G_1(s)$

(a)

(b)

(c)

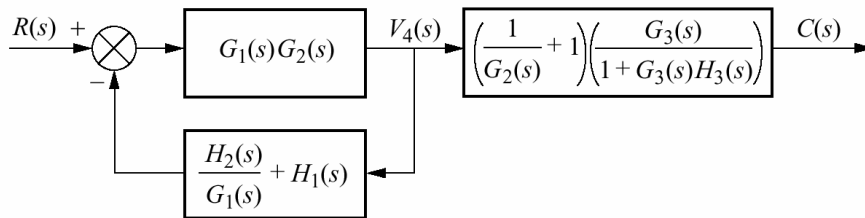# Figure 5.11
Block diagram for
Example 5.2
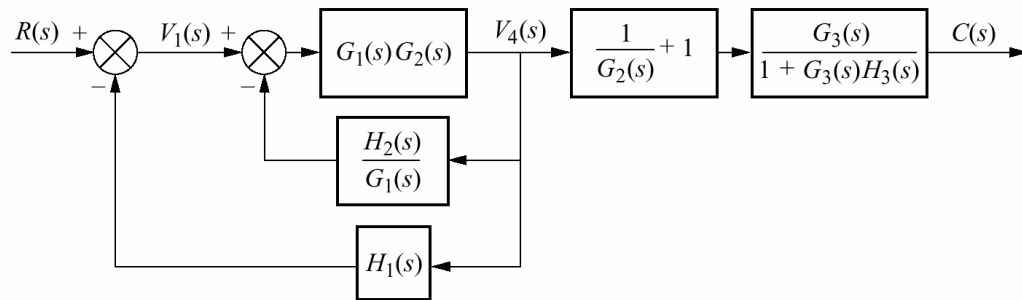
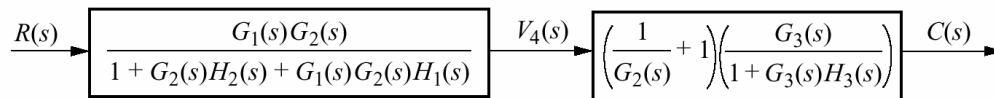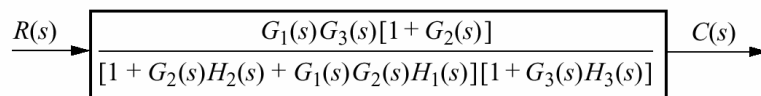**Figure 5.12**
Steps in the block diagram reduction for Example 5.2

(a)

(b)

(c)

(d)

(e)