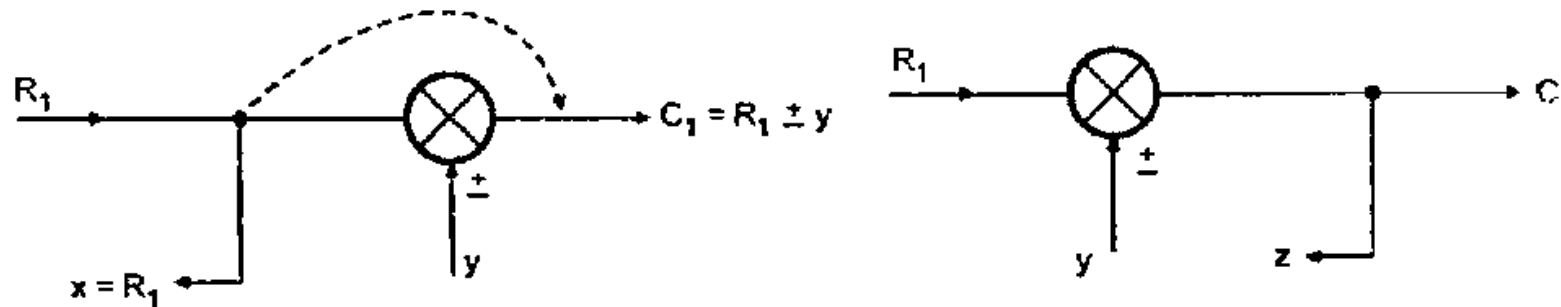# ECE305

Dr.Anuj jain

Rule 10 : Shifting takeoff point after a summing point. Consider a situation as show in Fig.
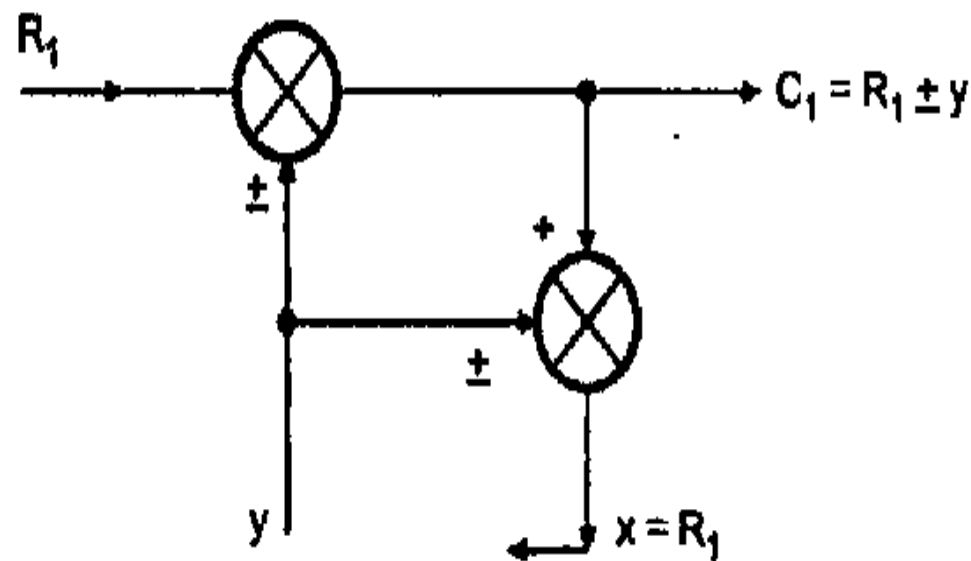

Now after shifting the takeoff point, let signal takingoff be 'z' as shown in the Fig.

Now $$z = R_1 \pm y$$

But we want feedback signal as $x = R_1$ only.

So signal 'y' must be inverted and added to C_1 to keep feedback signal value same. And to add the signal, summing point must be introduced in series with takeoff signal. So modified configuration becomes as shown in the Fig.
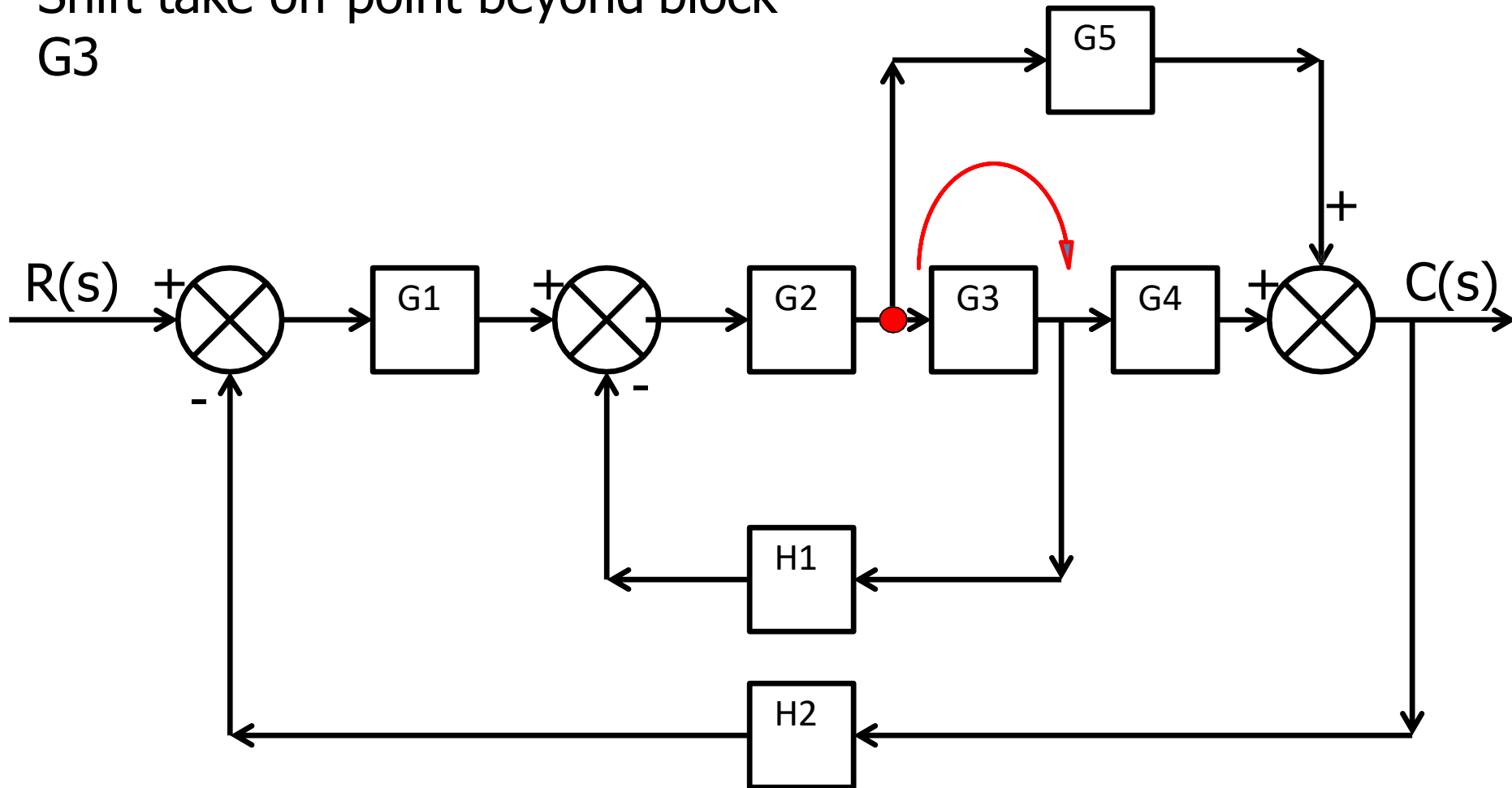
Rule 11 : Shifting takeoff point before a summing point :

Consider a situation as shown in the Fig.

$$C = R_1 \pm y$$

$$x = R_1 \pm y$$

$$C = R_1 \pm y$$

$$x = R_1 \pm y$$
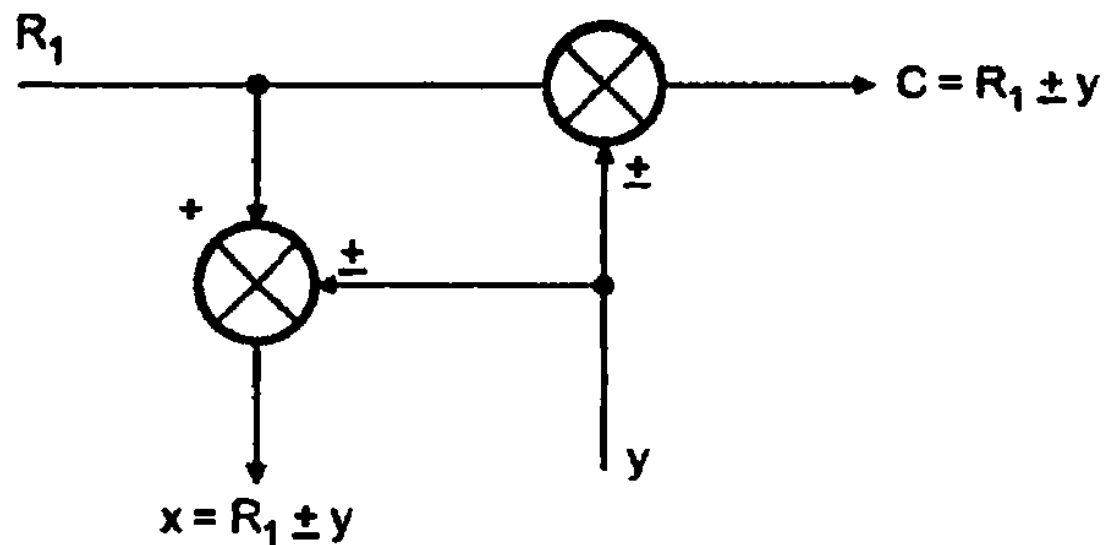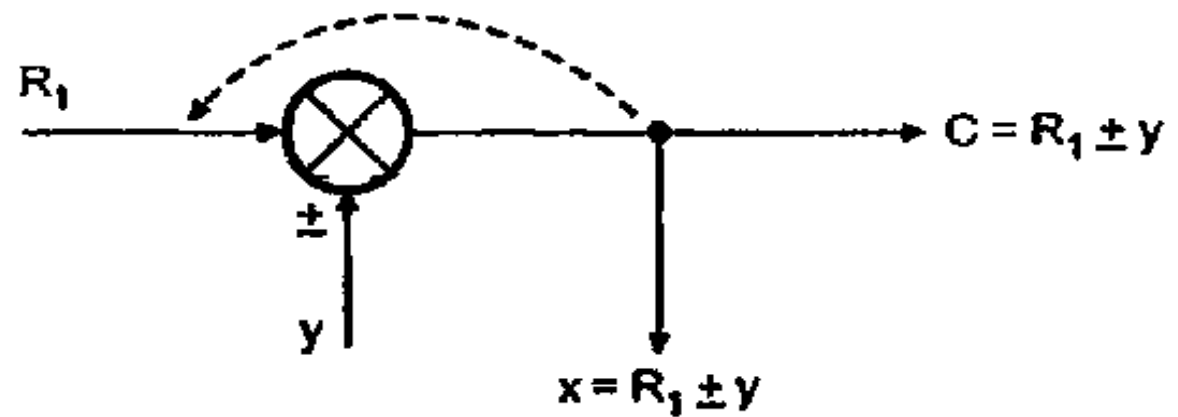
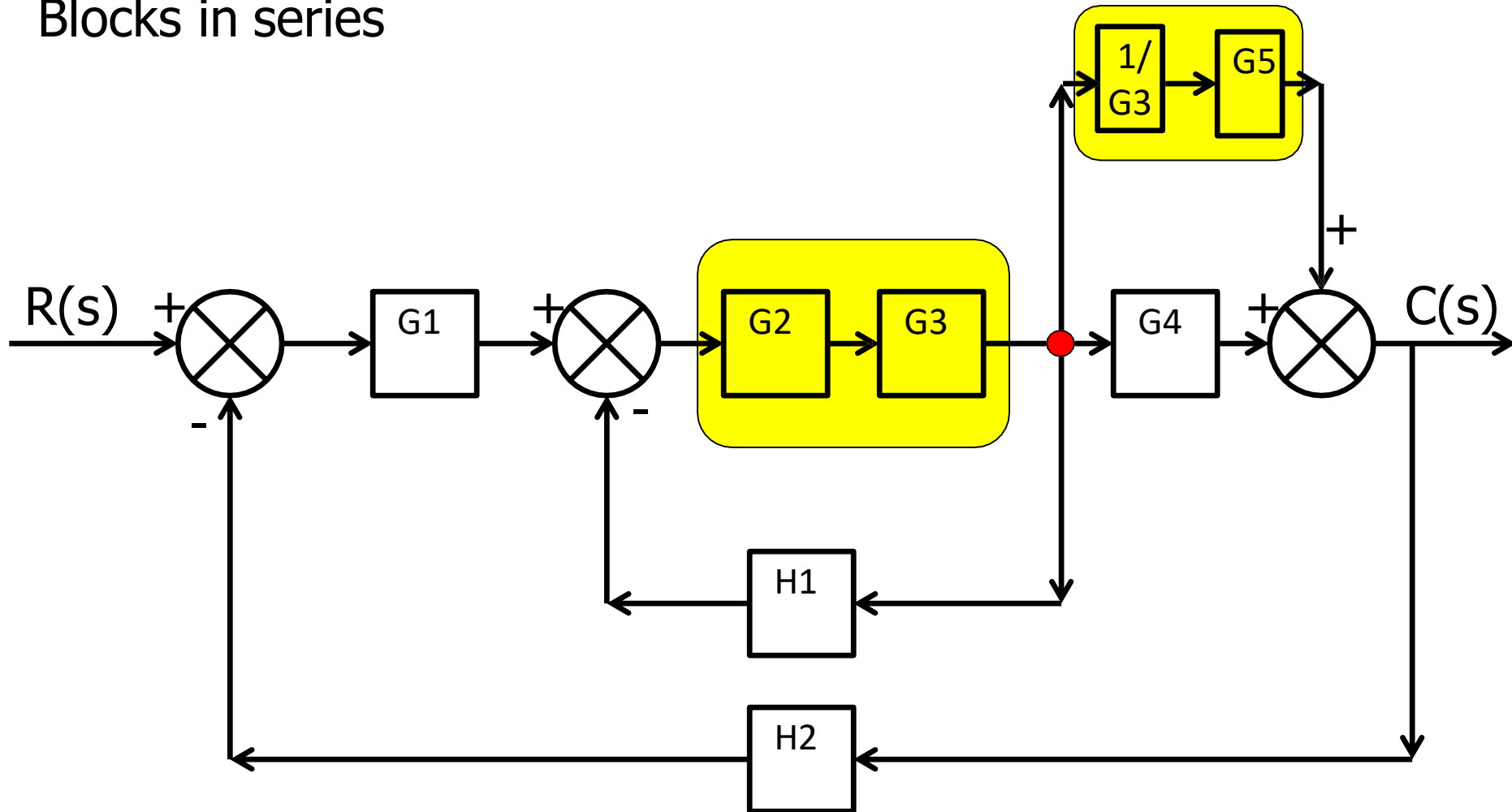# Example 6

Apply rule 8
Shift take off point beyond block
G3

Example 6   cont....

Apply rule 1
Blocks in series

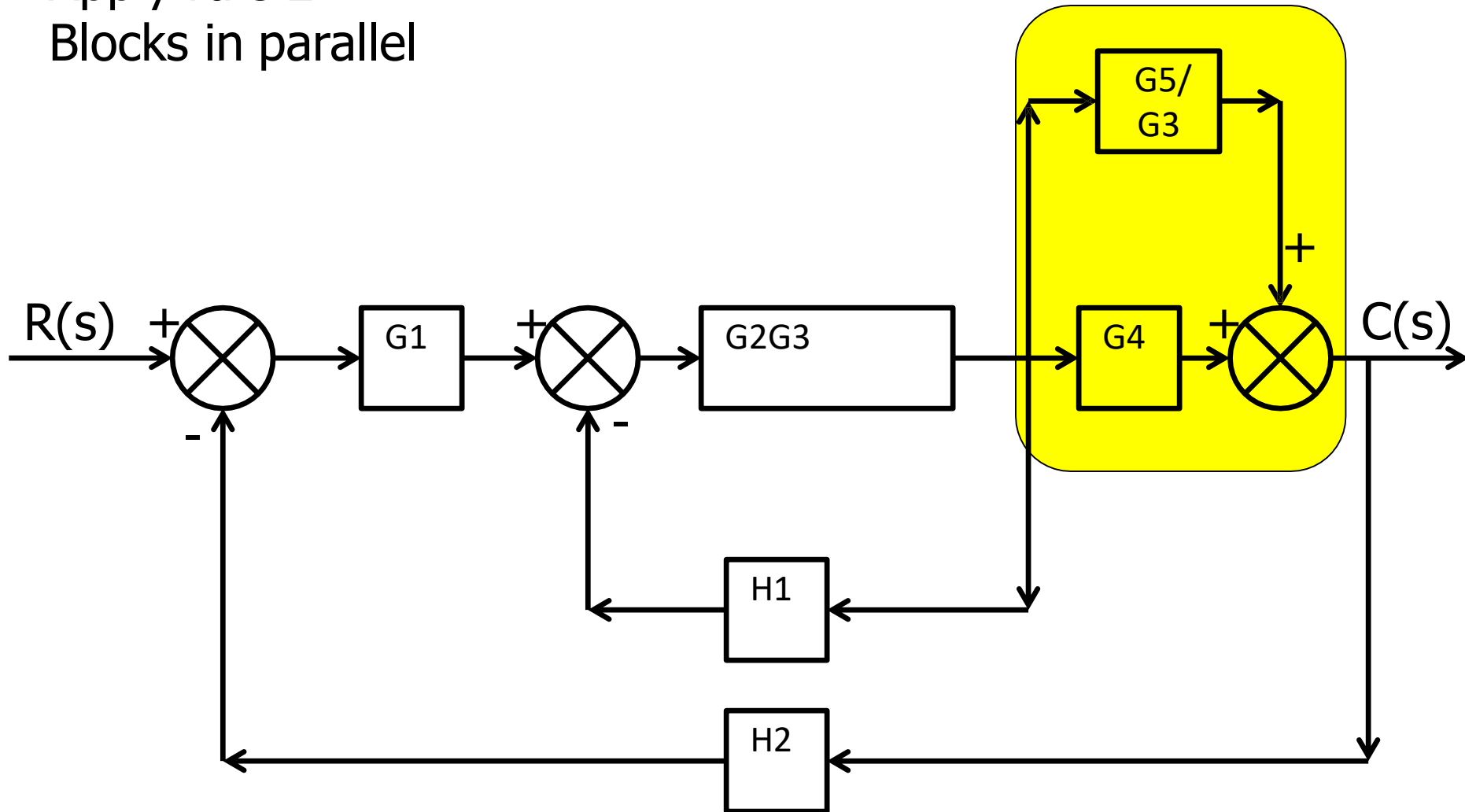# Example 6   cont....

Apply rule 2
Blocks in parallel

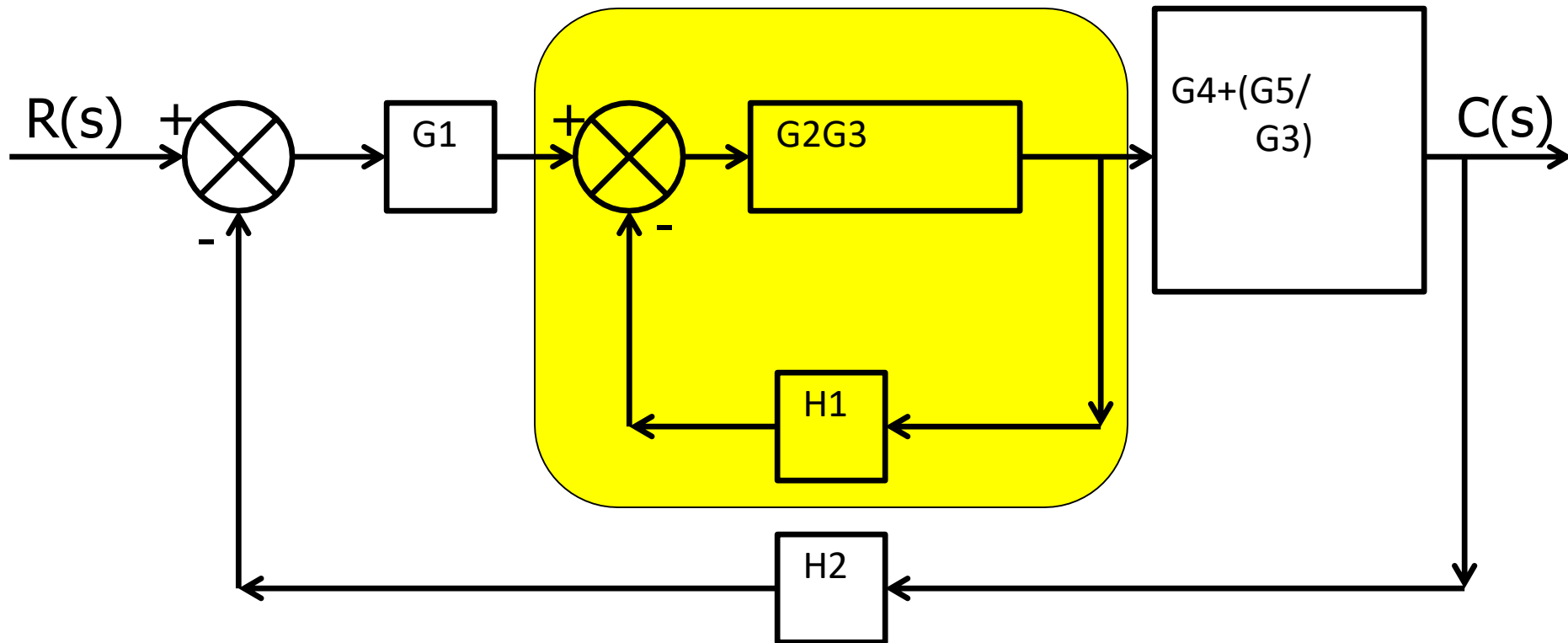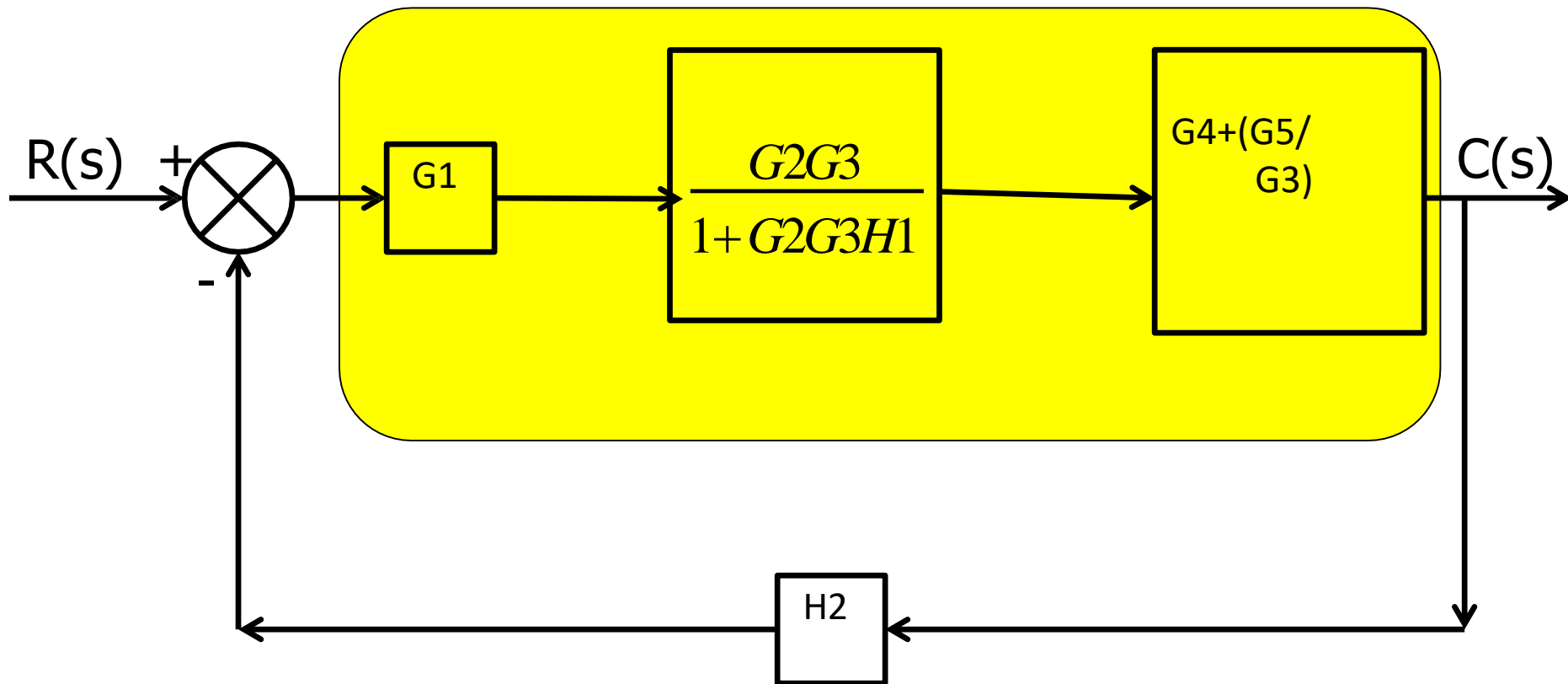# Example 6   cont....
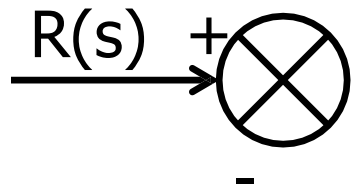
Apply rule 3
Feedback loop

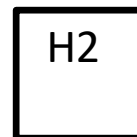# Example 6   cont....

Apply rule 1
Blocks in series

R(s)   **+**

$$(G1)(\frac{G2G3}{1+G2G3H1})(G4+\frac{G5}{G3})$$

-

C(s)

H2

Example 6   cont….

$$= (\text{G1})(\frac{G2G3}{1+G2G3H1})(\text{G}4 + \frac{G5}{G3})$$

$$= (\text{G1})(\frac{G2G3}{1+G2G3H1})(\frac{\text{G}4G3+G5}{G3})$$

$$= \frac{G1G2(\text{G}4\,\text{G}3 + \text{G}5)}{1+G2G3H1}$$

Example 6   cont....

Apply rule 3   Feedback loop

R(s)   + $$\frac{G1\,G2(G4\,G3 + G5)}{1 + G2G3H1}$$ C(s)

-

H2

R(s)

$$\frac{G1G2(G4G3 + G5)}{1 + G2G3H1 + G1G2H2(G3G4 + G5)}$$

C(s)

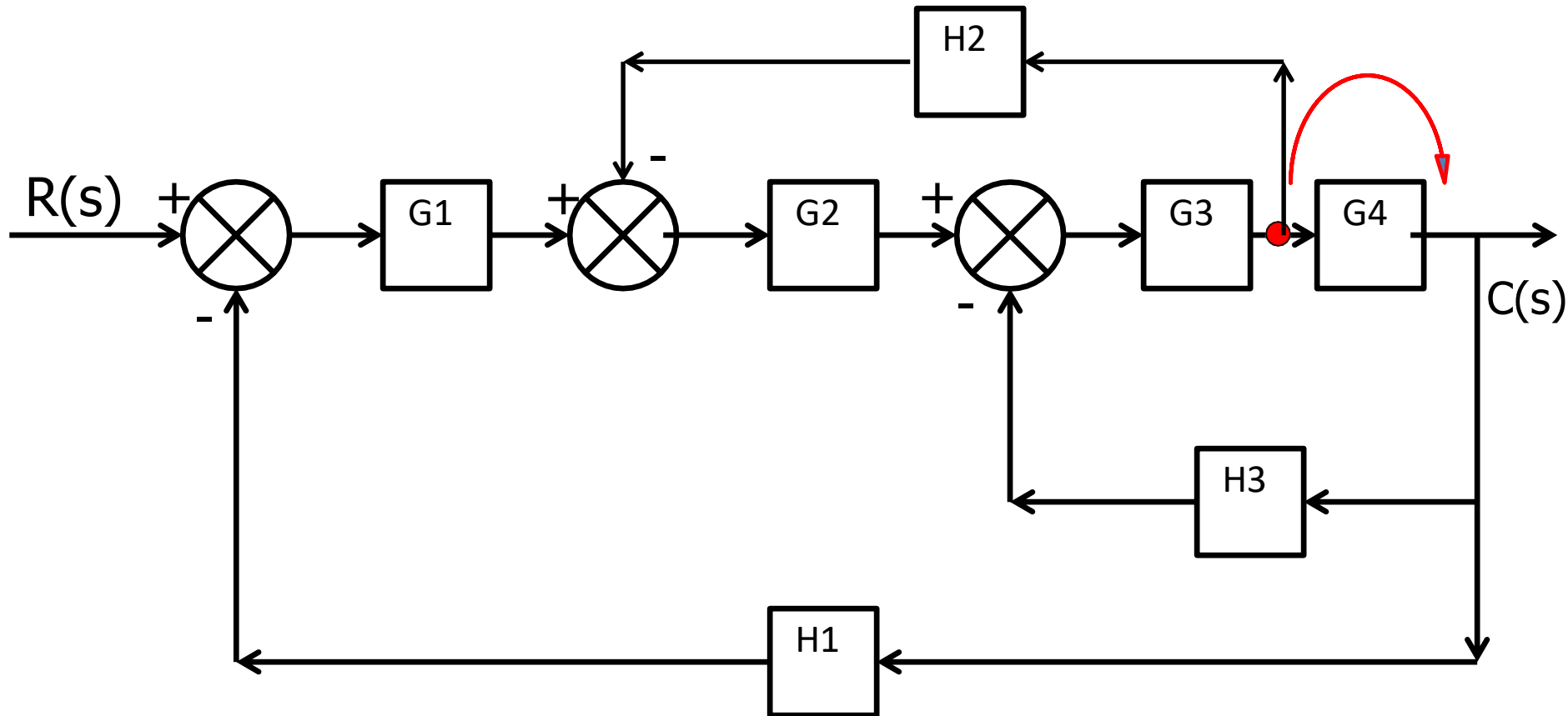# Example 6   cont....
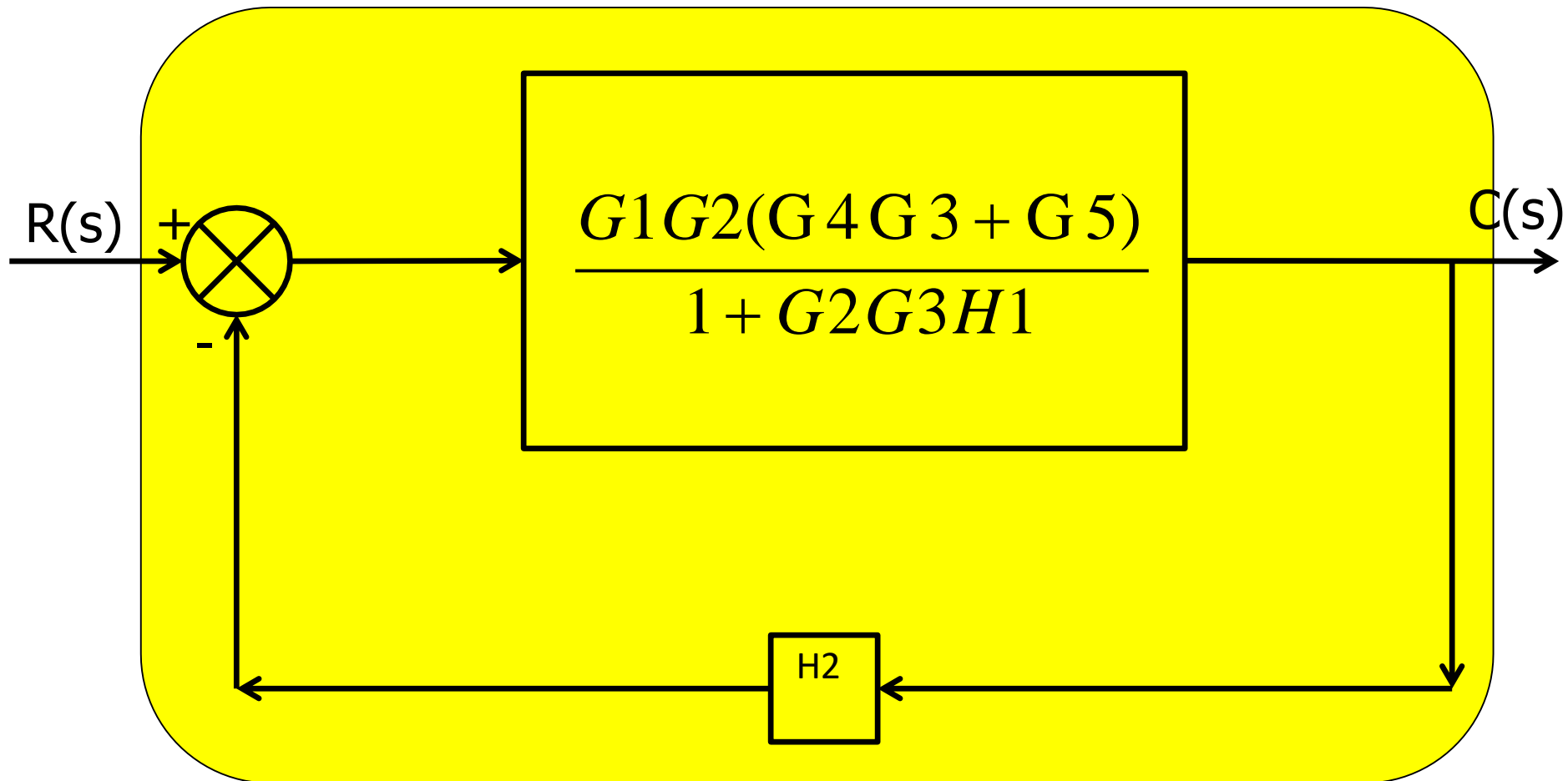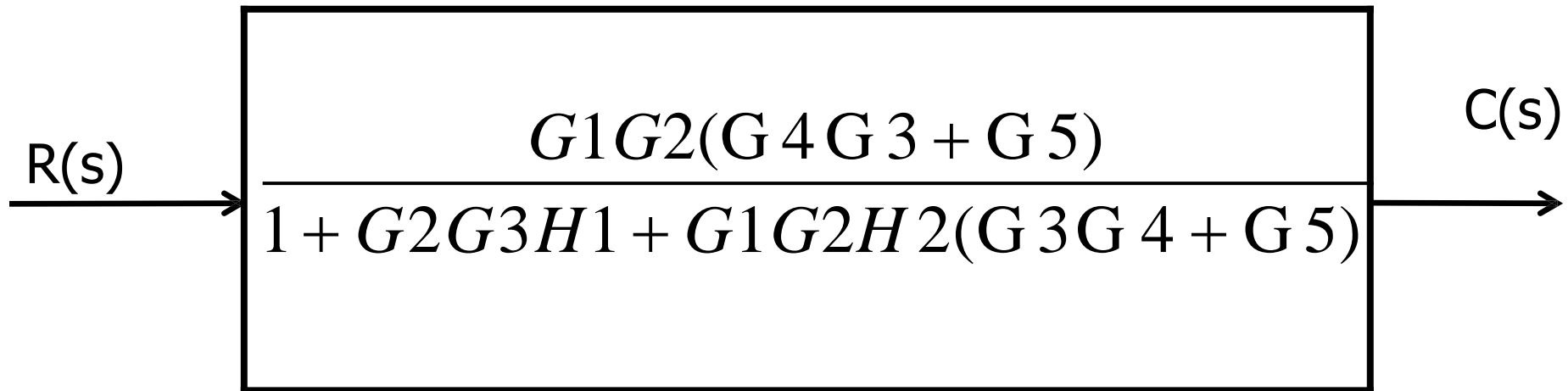
$$\frac{C(S)}{R(S)} = \frac{G1G2(G4G3 + G5)}{1 + G2G3H1 + G1G2H2(G3G4 + G5)}$$

Example 7

Apply rule 8   Shift take off point after block G4

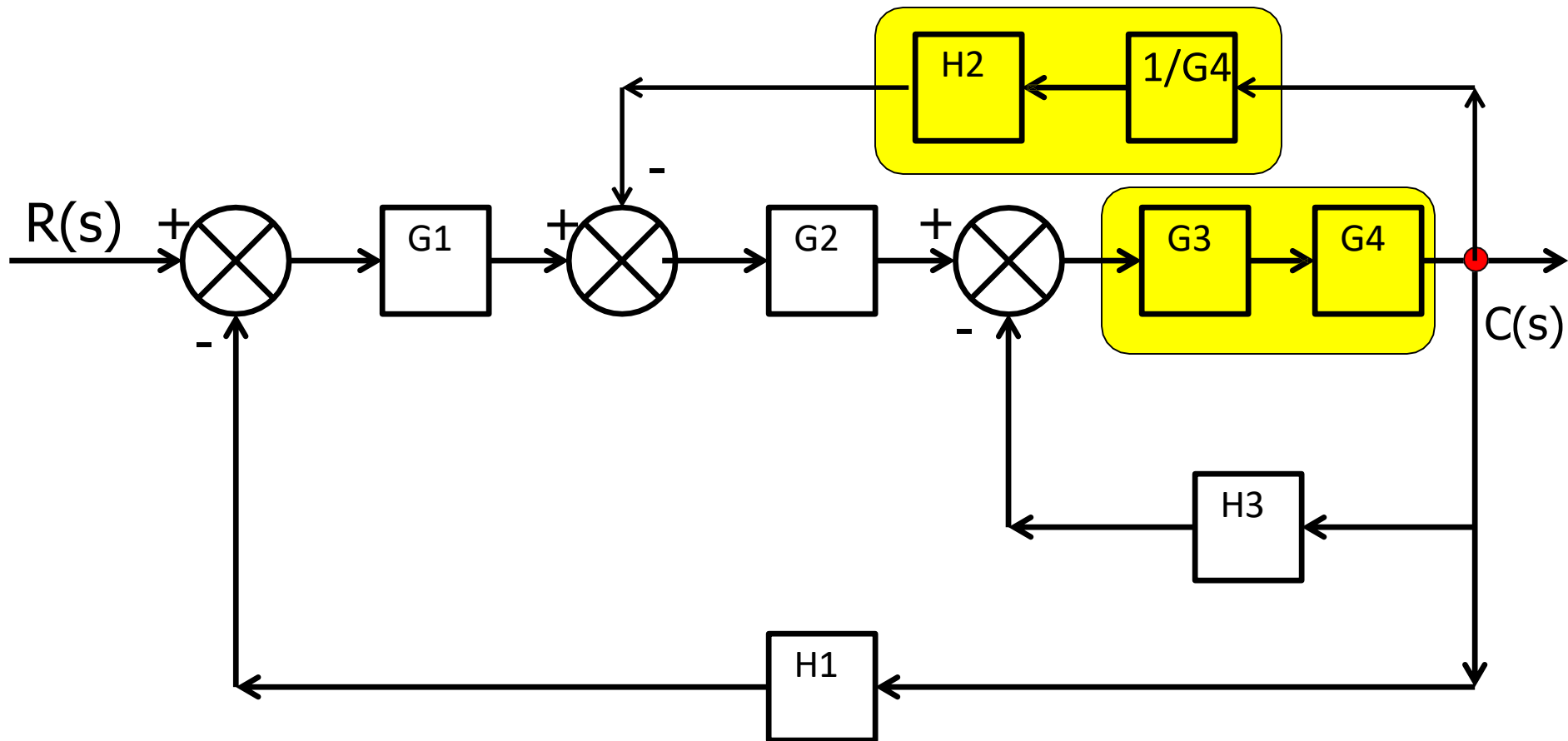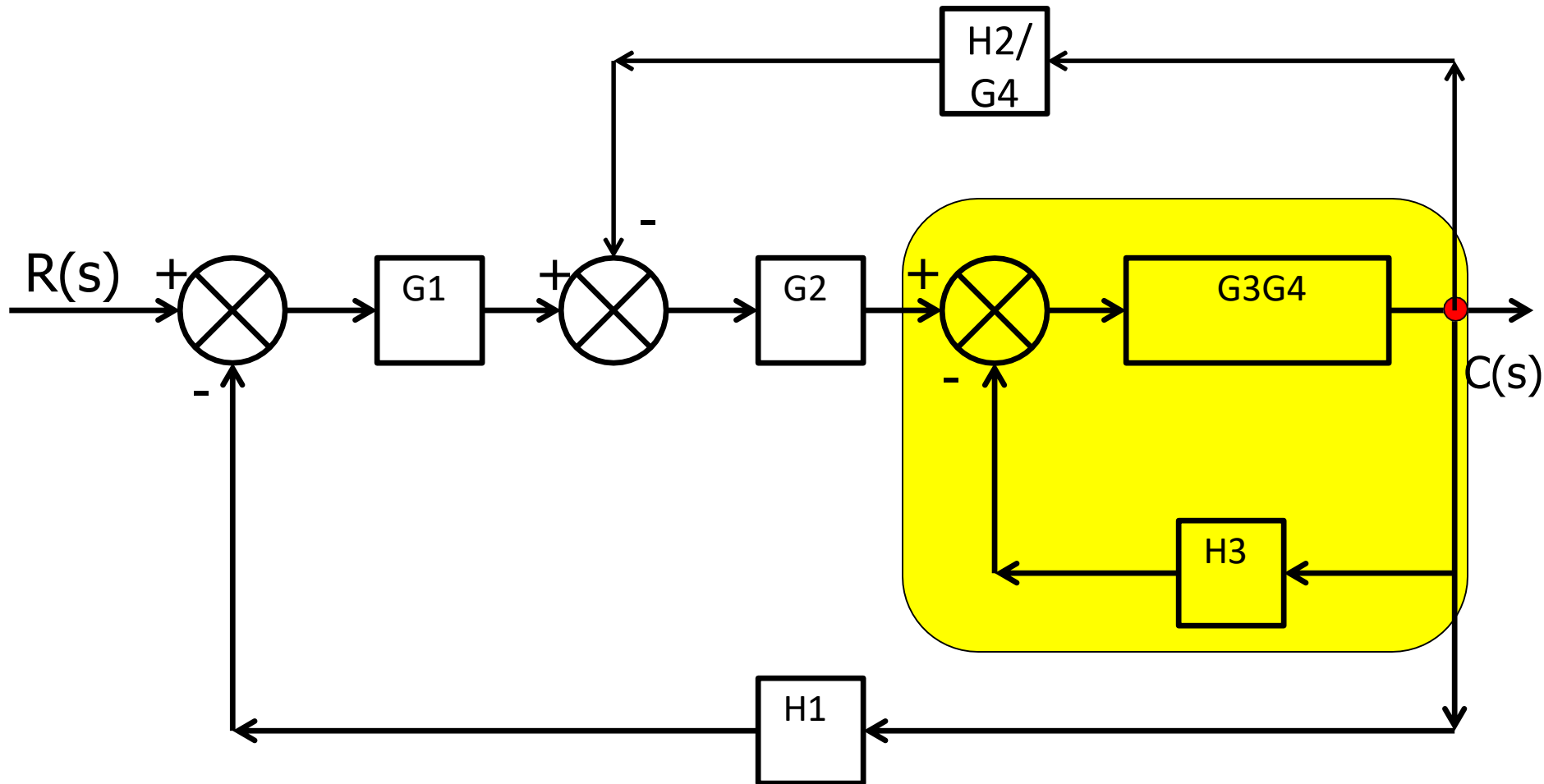# Example 7 cont....

Apply rule 1   Blocks in series

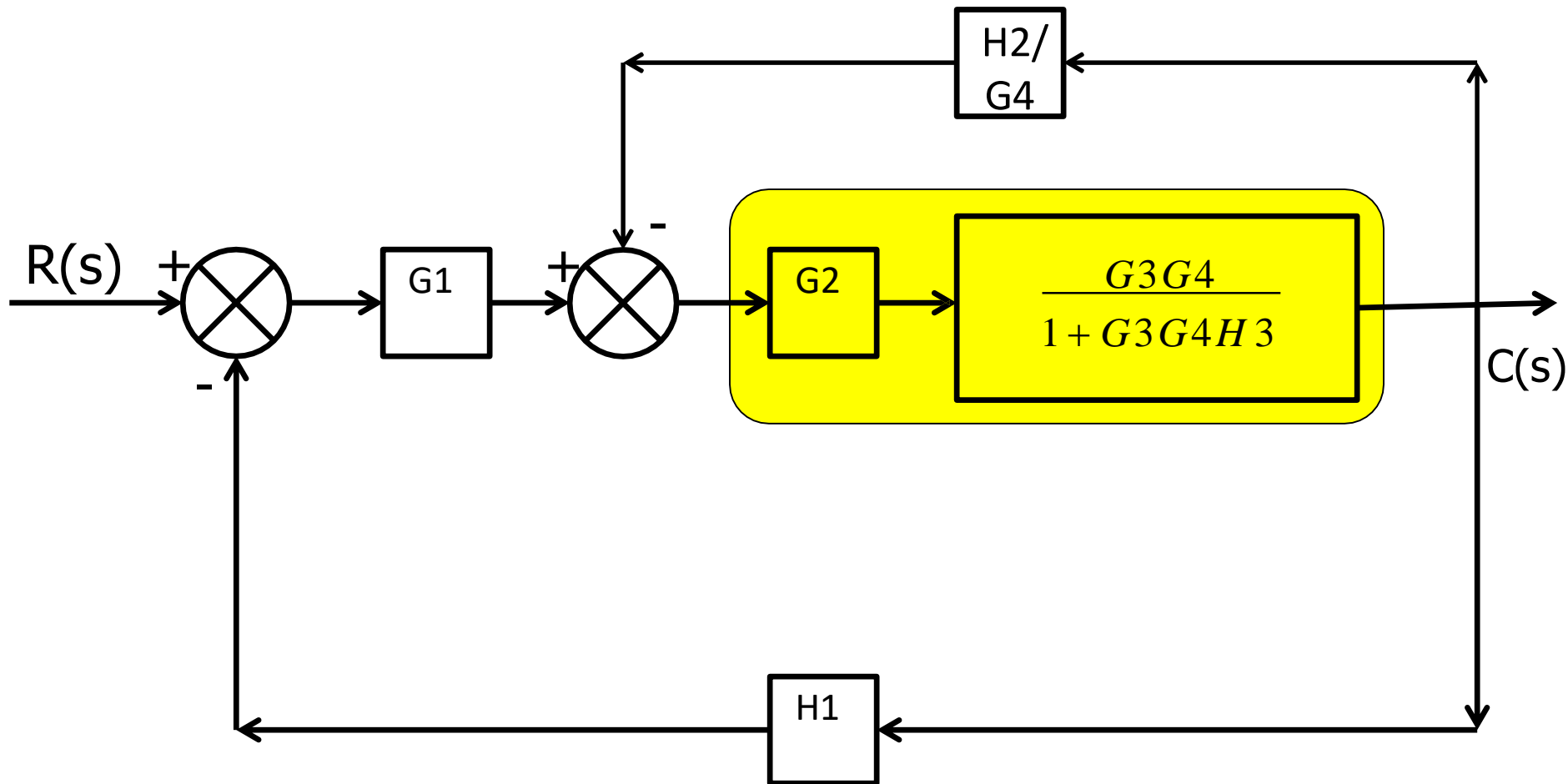**Example 7   cont….**

Apply rule 3   Feedback loop

Example 7   **cont….**

Apply rule 1   Blocks in series

Apply rule 3   Feedback loop

Example 7   cont….

Apply rule 1   Blocks in series

$$\frac{G2G3G4}{1+G3G4H3+G2G3H2}$$

R(s) +   C(s)

\-

G1

H1

Apply rule 3   Feedback loop

R(s) + − C(s)

$$\frac{G1G2G3G4}{1+G3G4H3+G2G3H2}$$

H1

Example 7   cont....
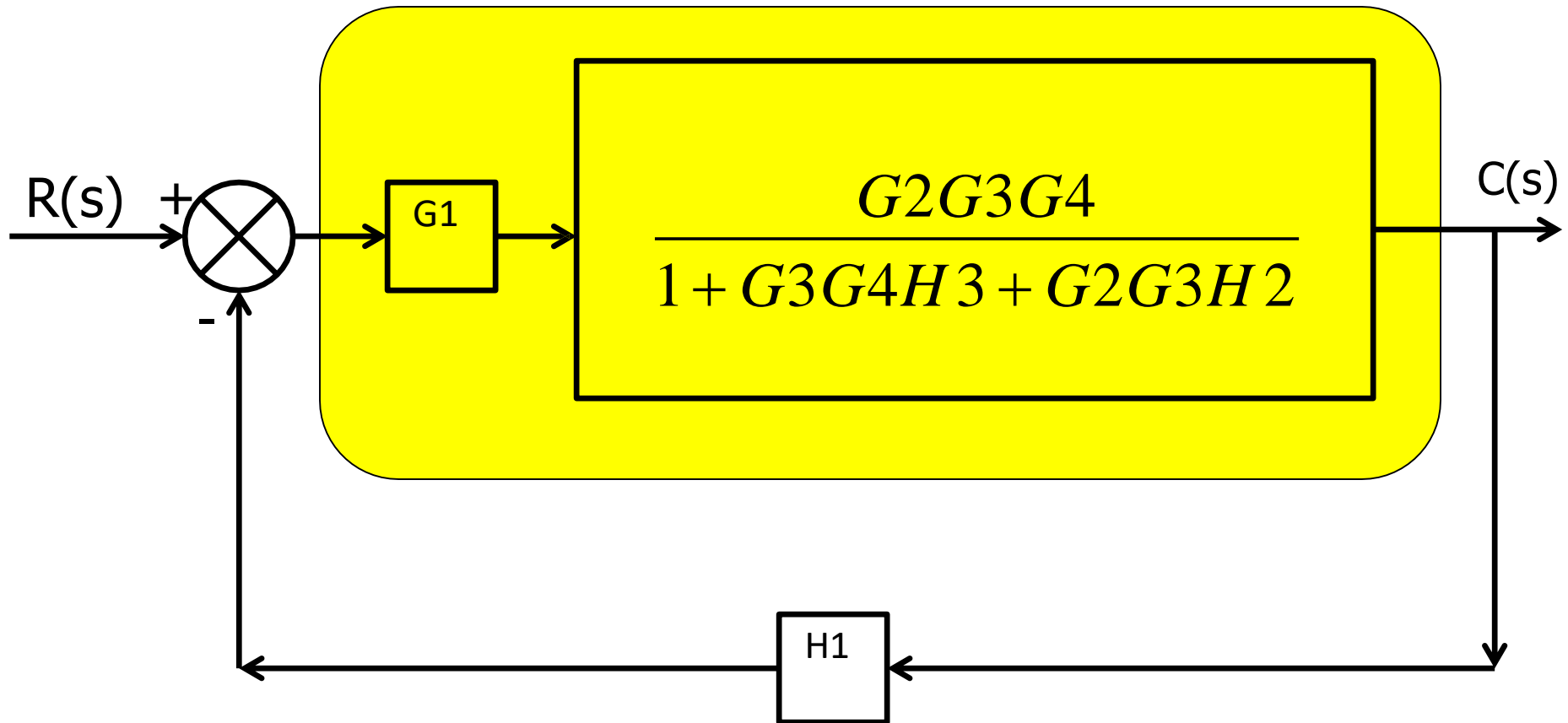
$$R(s) \longrightarrow \boxed{\dfrac{G1\,G2\,G3\,G4}{1 + G3\,G4\,H3 + G2\,G3\,H2 + G1\,G2\,G3\,G4\,H1}} \longrightarrow C(s)$$

Example 7   cont....
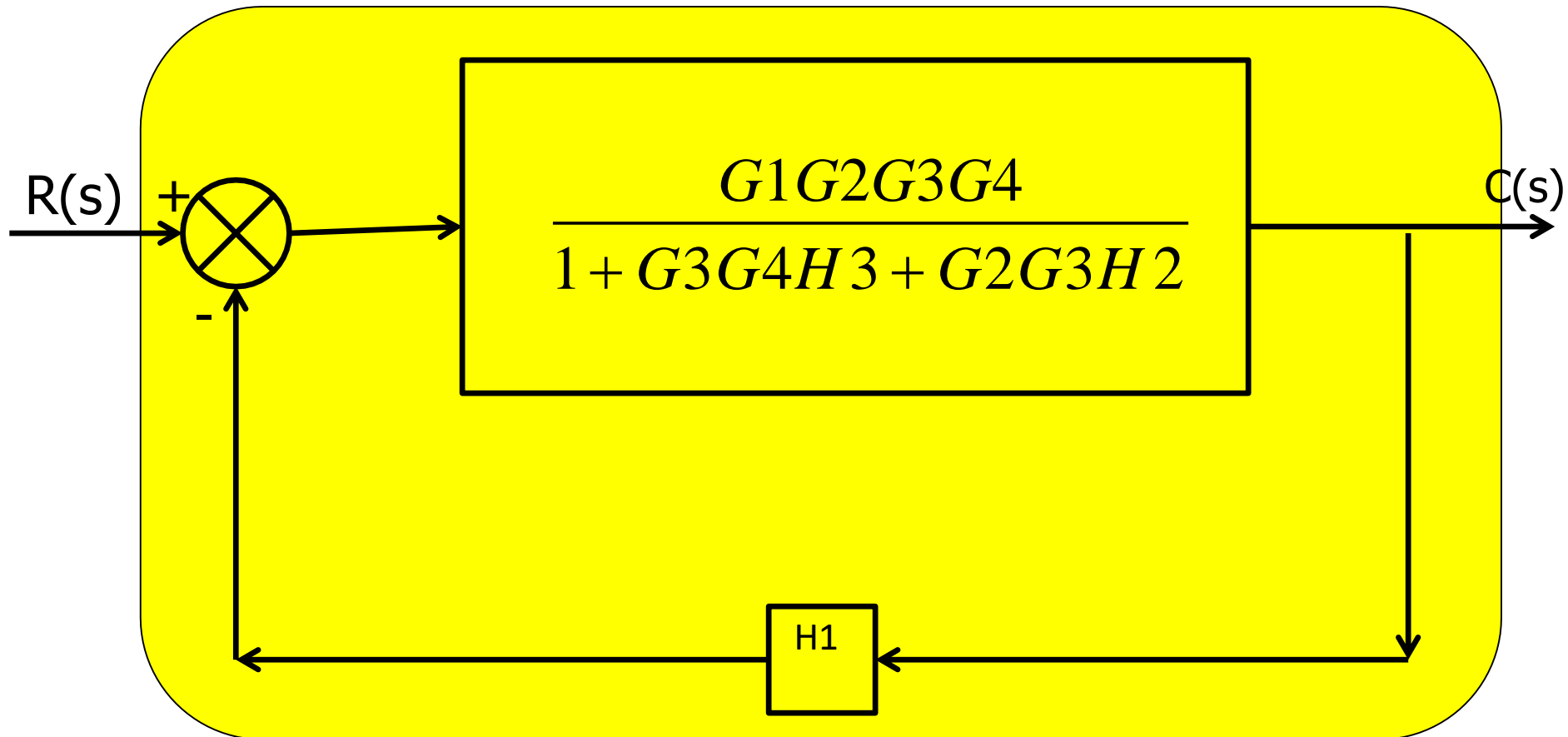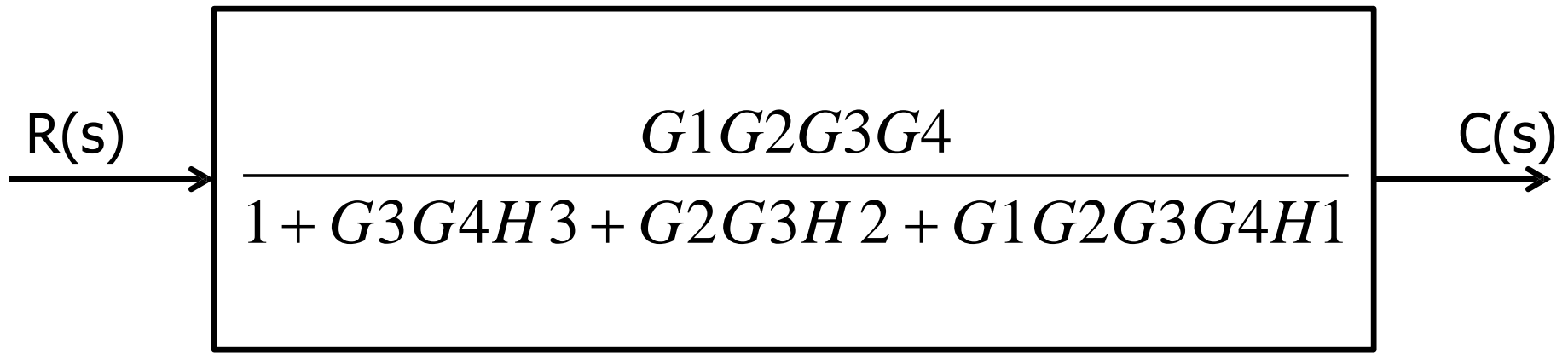
$$\frac{C(S)}{R(S)} = \frac{G1G2G3G4}{1 + G3G4H3 + G2G3H2 + G1G2G3G4H1}$$

Example 8

Simplify, by splitting 3rd summing point as given in Note 1

Apply Rule 3   Elimination of Feedback loop

Example 8   cont....

Apply Rule 8   Shift take off point after block

Example 8   cont....
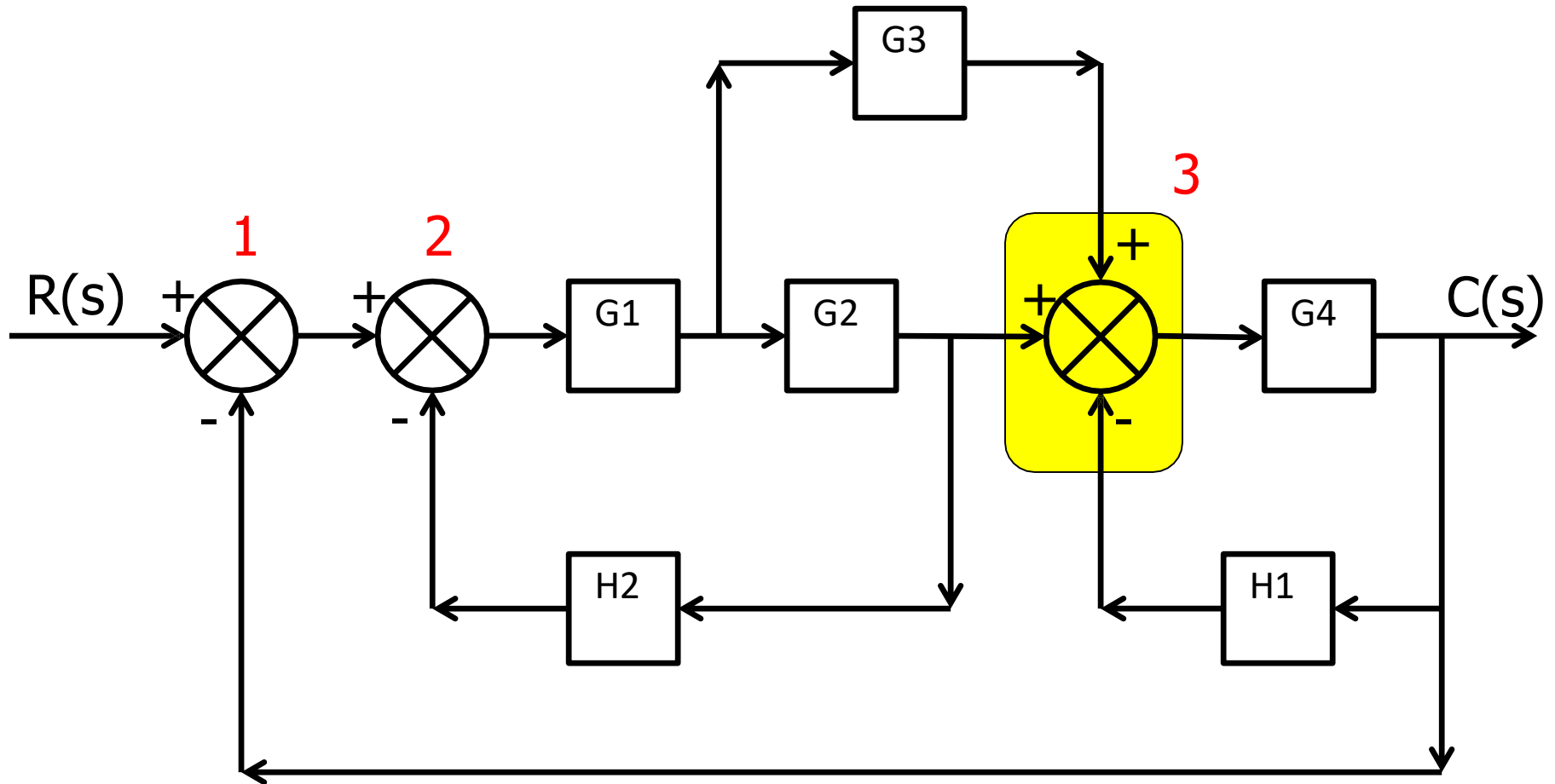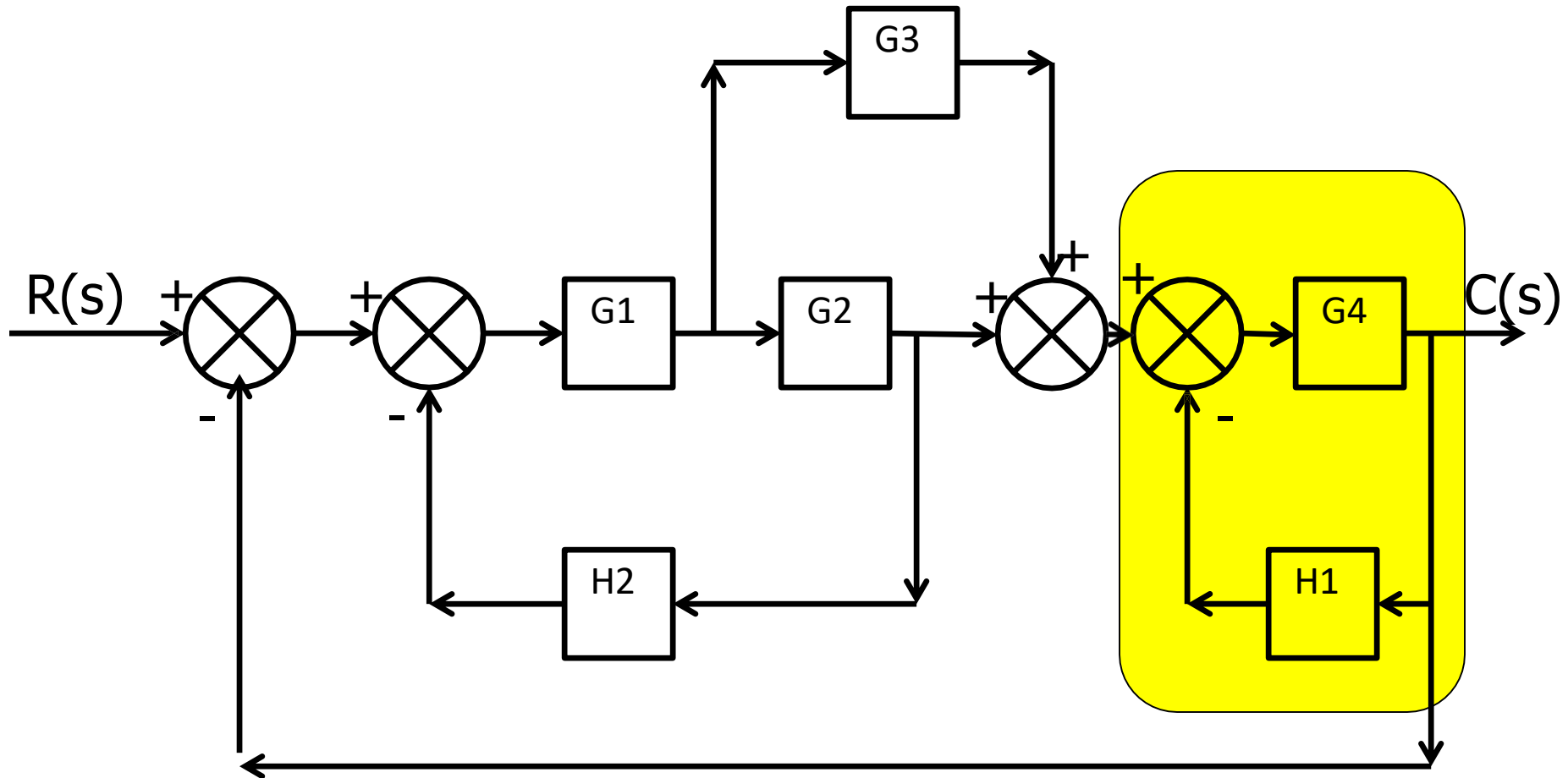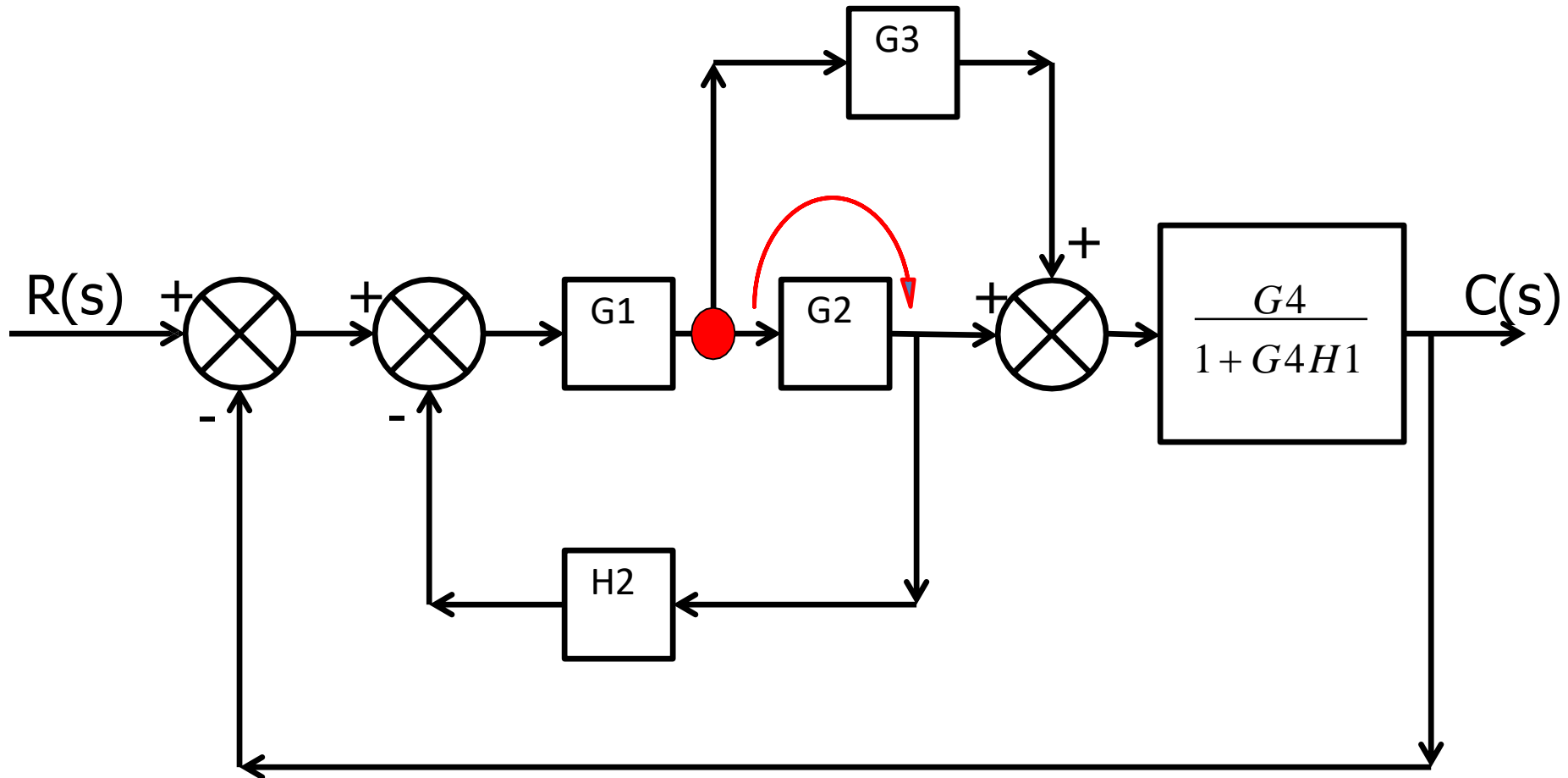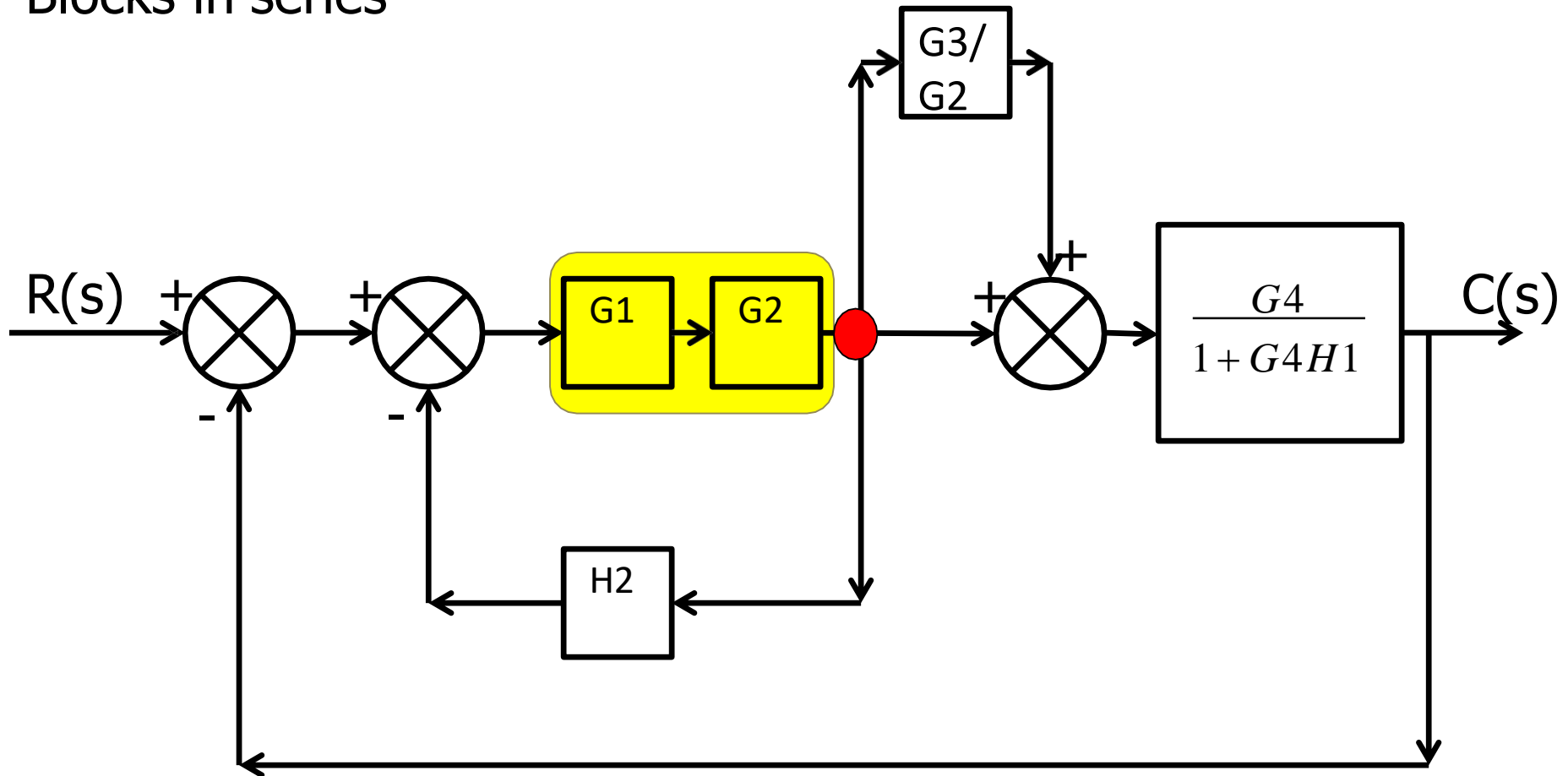
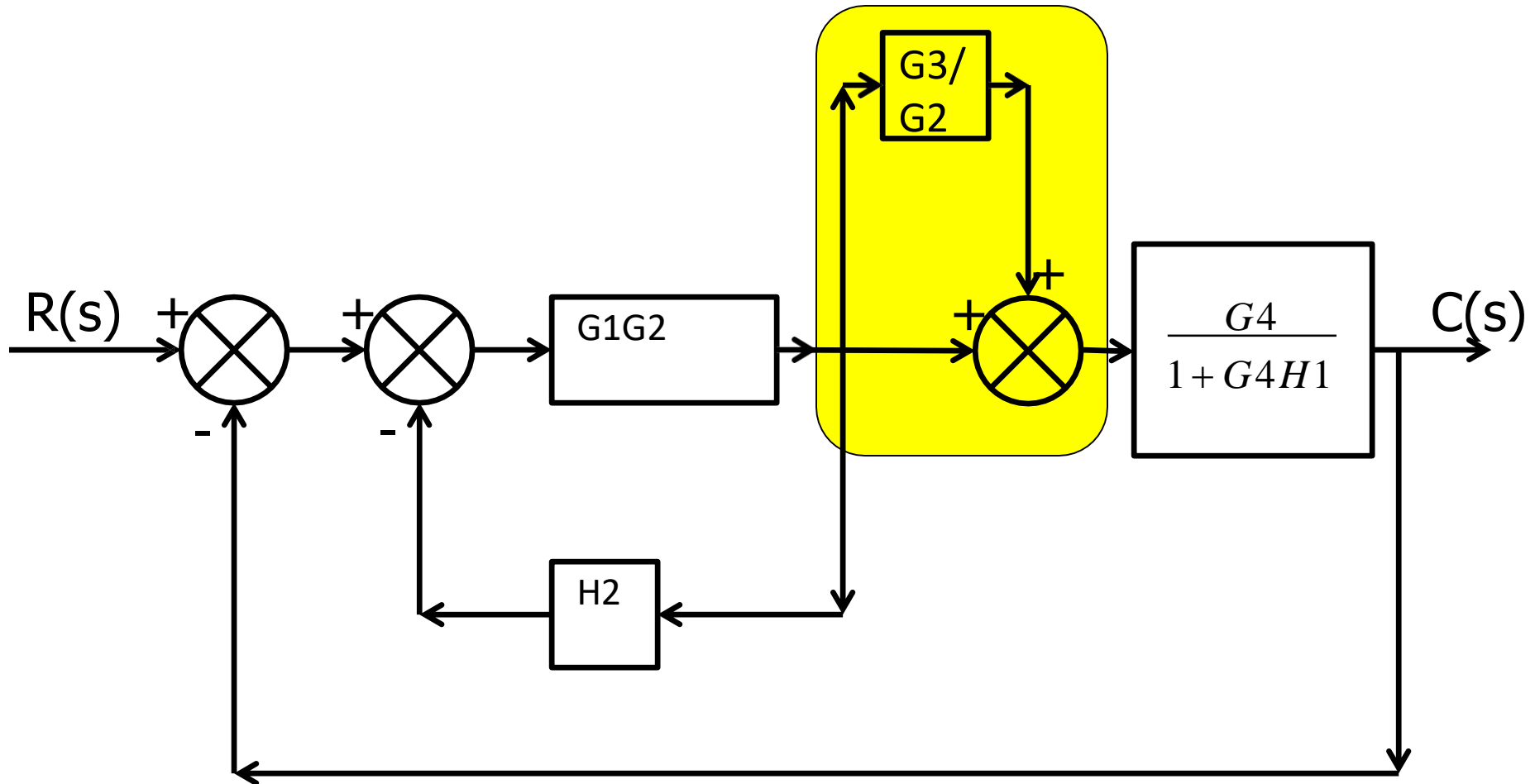Apply Rule 1
Blocks in series

Example 8   cont….

Now which rule we have to use?

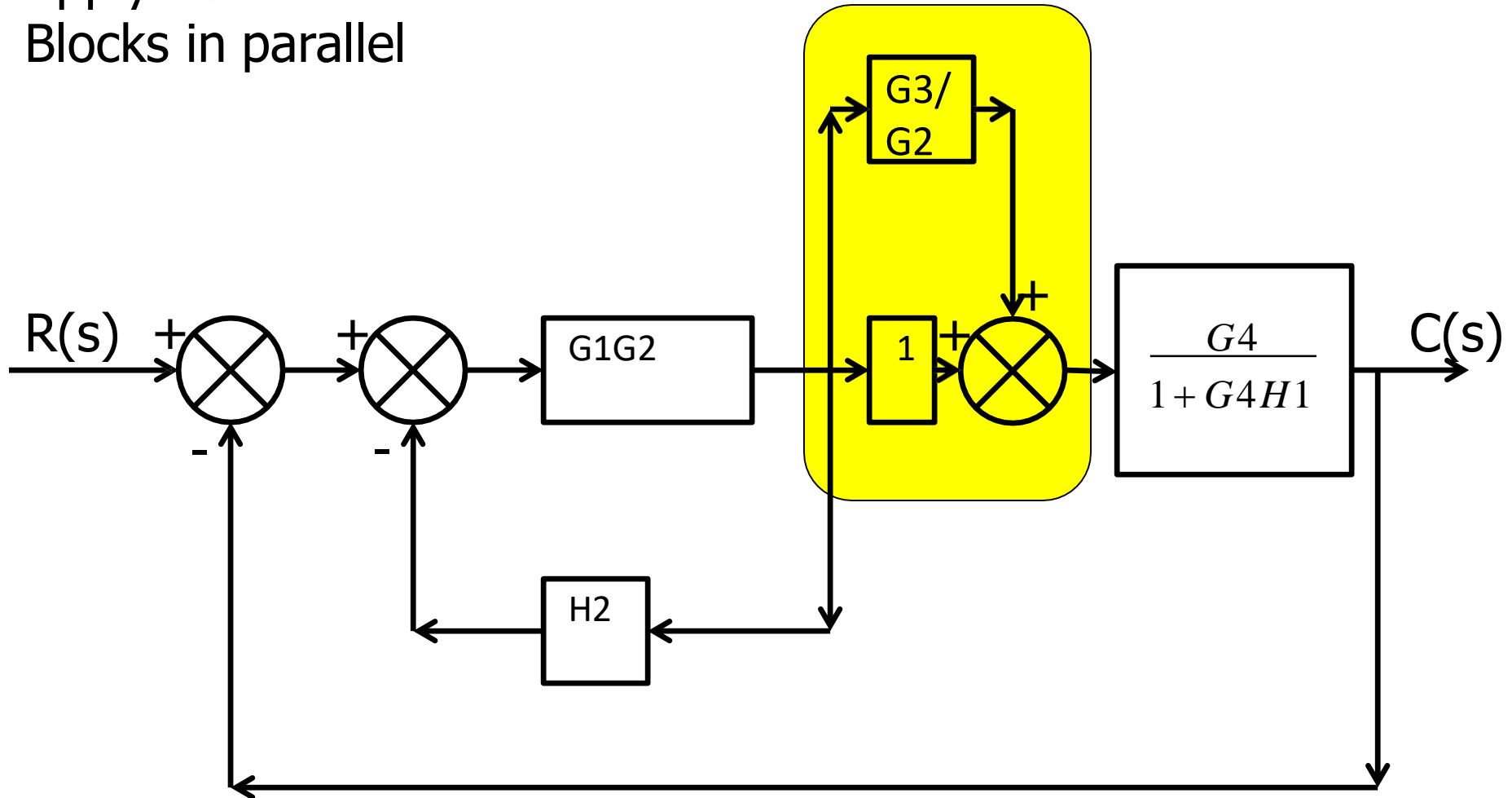# Example 8   cont….

Apply Rule 2
Blocks in parallel

Example 8   cont….

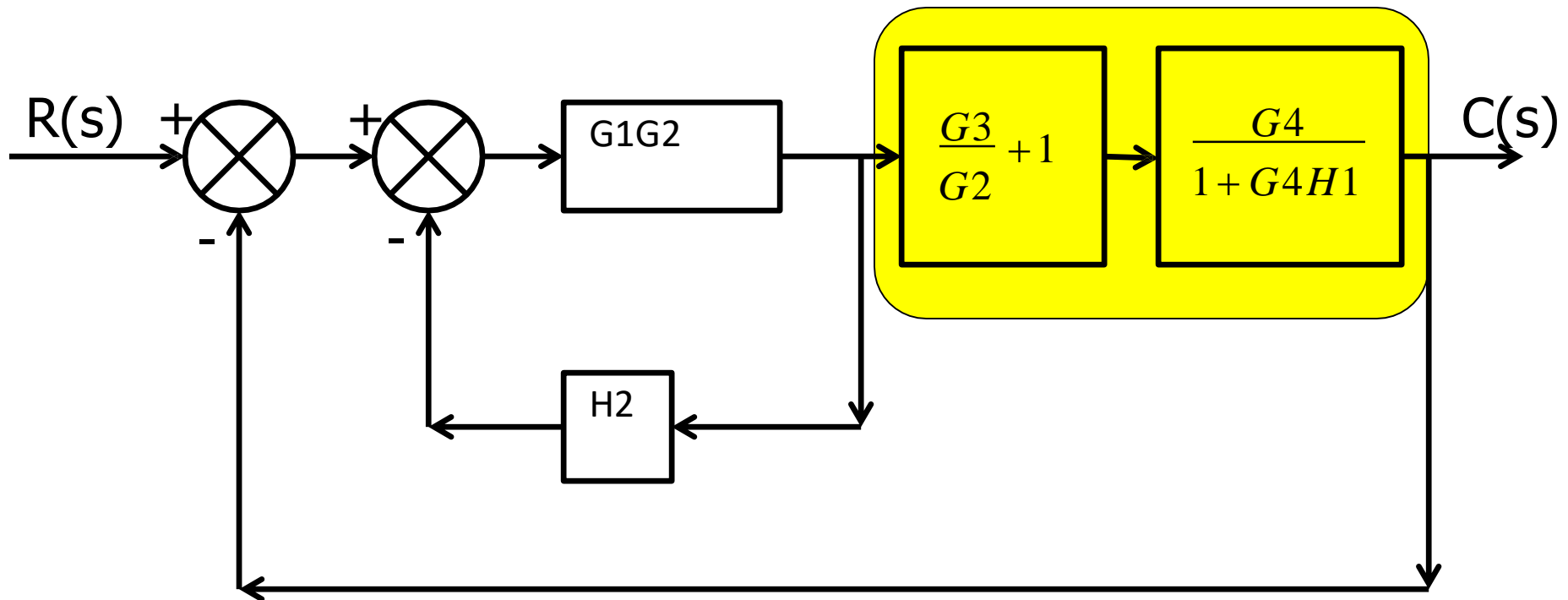Apply Rule 1   Blocks in series

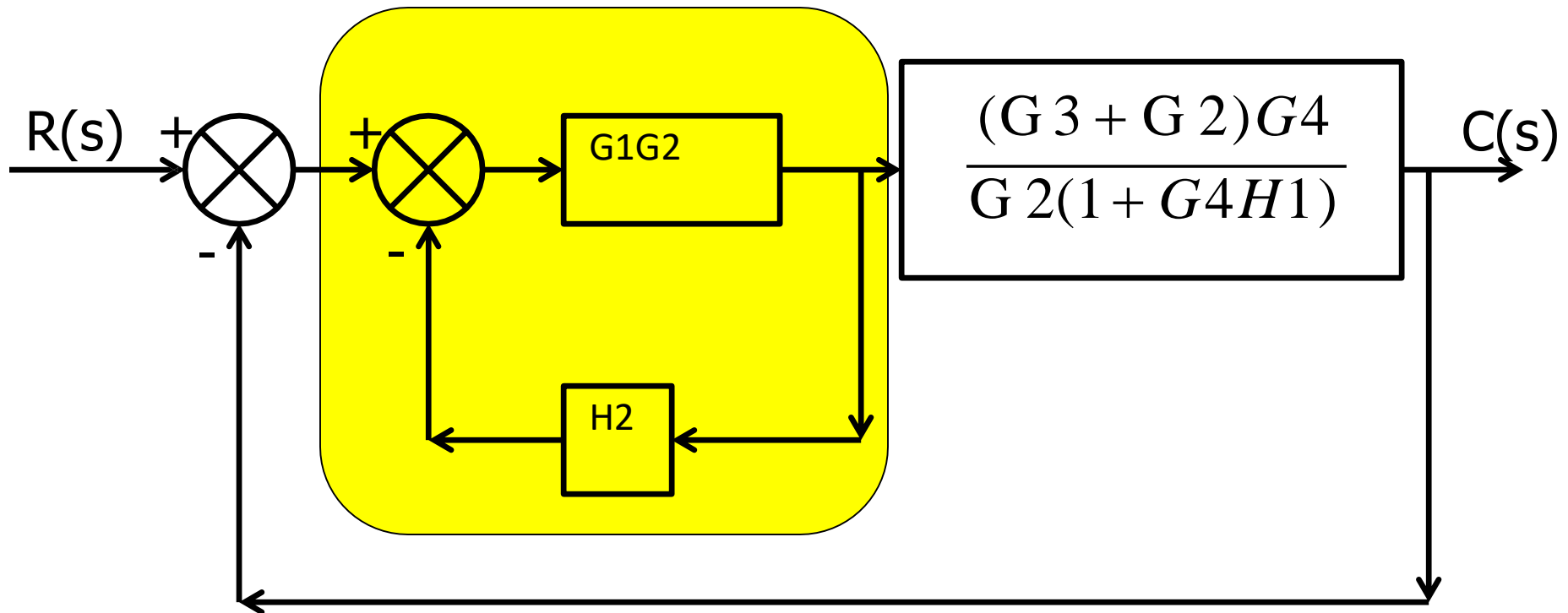# Example 8   cont....

Apply Rule 3   Elimination of Feedback Loop

Example 8   cont....

Apply Rule 1   Blocks in series

R(s)   + $\bigotimes$ $\dfrac{G1G2}{1+G1G2H2}$ $\dfrac{(G3+G2)G4}{G2(1+G4H1)}$ C(s)

-

Apply Rule 3   Elimination of Feedback loop

R(s)   + $$\frac{G1\,G4\,(G3+G2)}{(1+G1\,G2\,H2)(1+G4\,H1)}$$ C(s)

\-
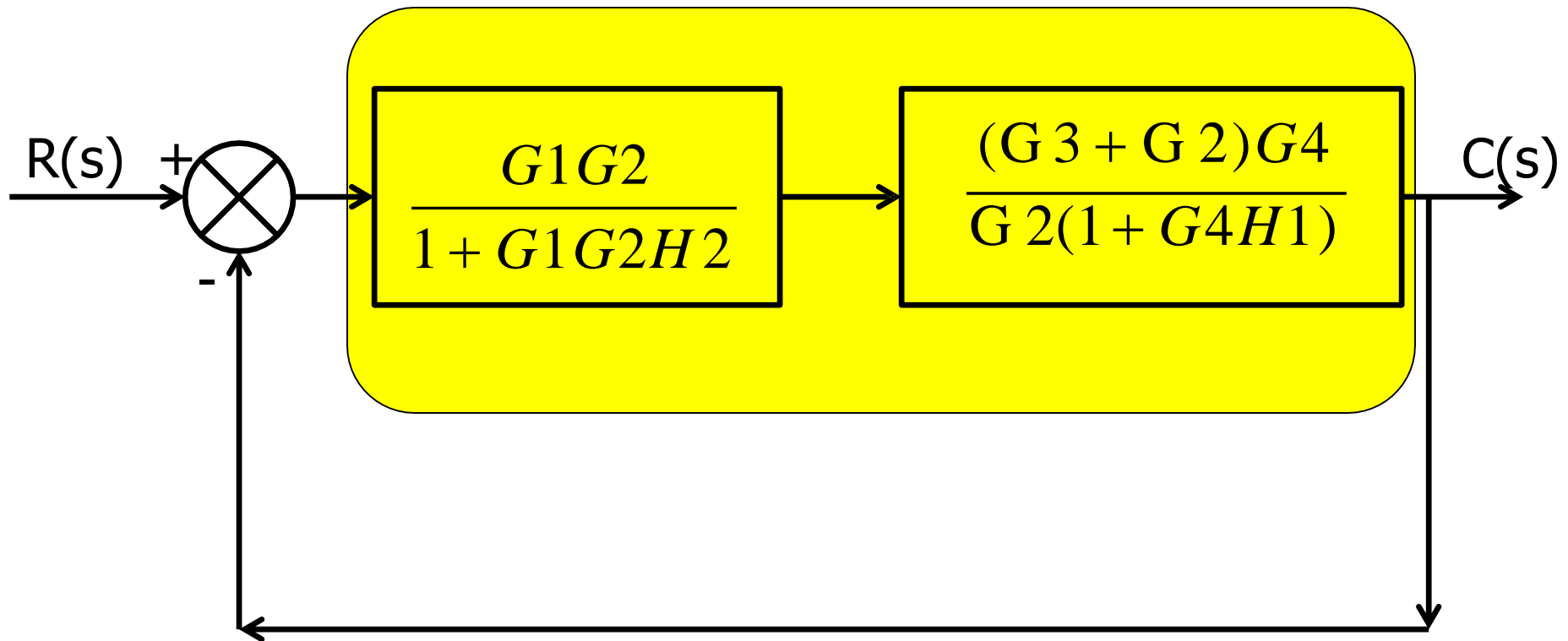
Example 8   cont….

$$R(s) \rightarrow \boxed{\dfrac{G1G4(G3+G2)}{1+G4H1+G1G2H2+G1G2G4H1H2+G1G4(G2+G3)}} \rightarrow C(s)$$
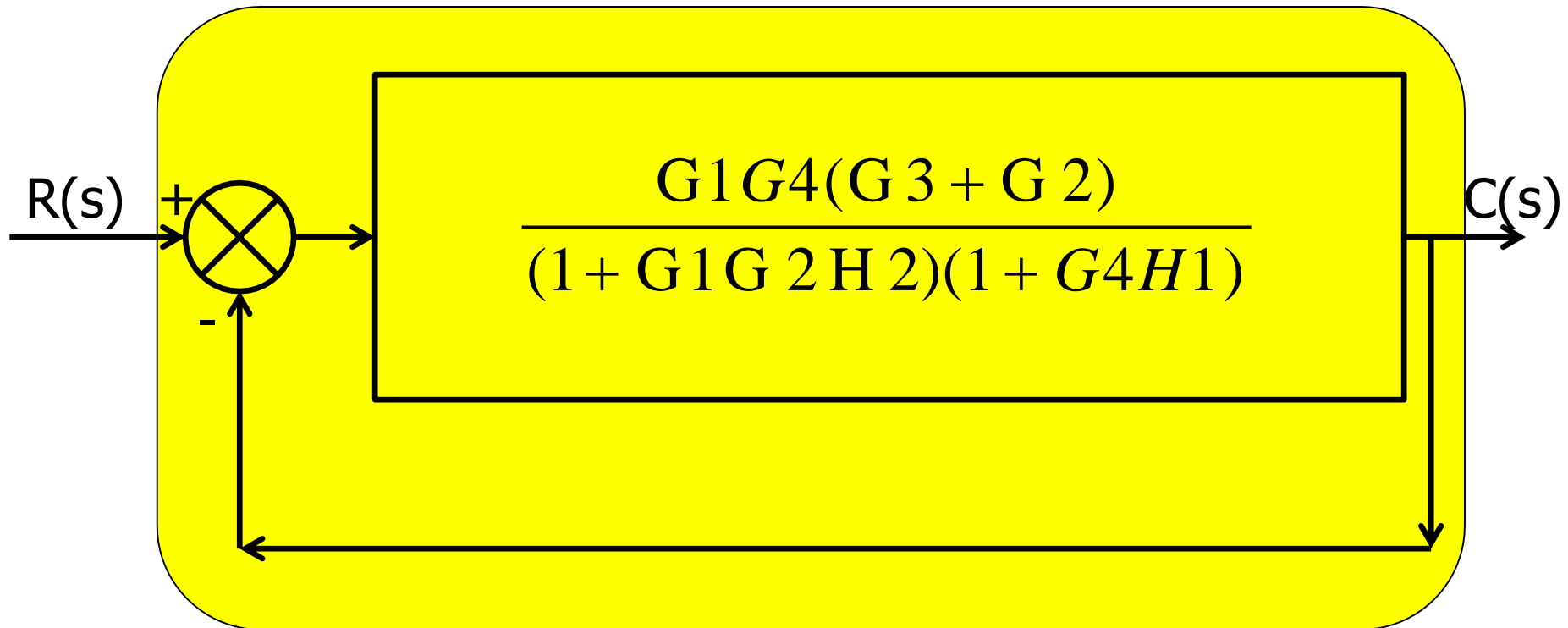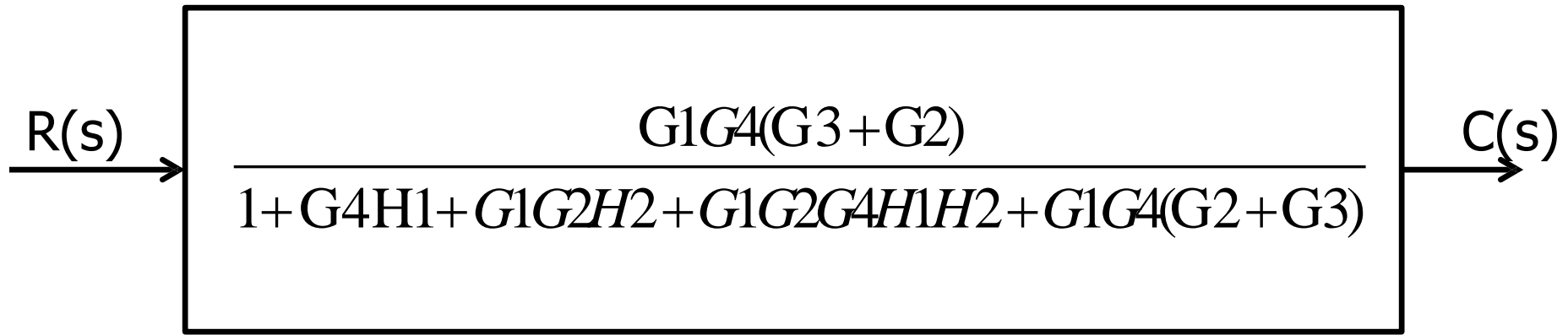
$$\frac{C(s)}{R(s)} = \frac{G1G4(G3+G2)}{1+G4H1+G1G2H2+G1G2G4H1H2+G1G4(G2+G3)}$$

Example 9

Apply rule 2   Blocks in Parallel

Apply rule 3   Elimination of Feedback Loop

Apply rule 1   Blocks in Series

Apply rule 3   Elimination of Feedback loop

Example 9   cont….

R(s) →

$$\frac{G2G3(\mathrm{G1+G4+G5})}{1+G2H1+G3H2+G2G3H1H2+G2G3H3(\mathrm{G1+G4+G5})}$$

→ C(s)

Example 9   cont....
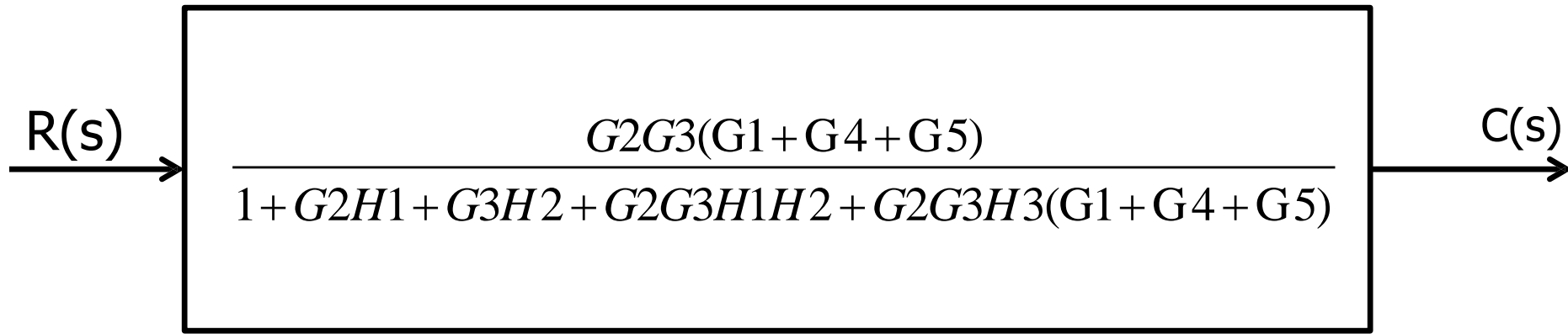
$$\frac{C(\text{s})}{R(\text{s})} = \frac{G2G3(\text{G}1+\text{G}4+\text{G}5)}{1+G2H1+G3H2+G2G3H1H2+G2G3H3(\text{G}1+\text{G}4+\text{G}5)}$$

Example 10

Apply rule 2   Blocks in Parallel
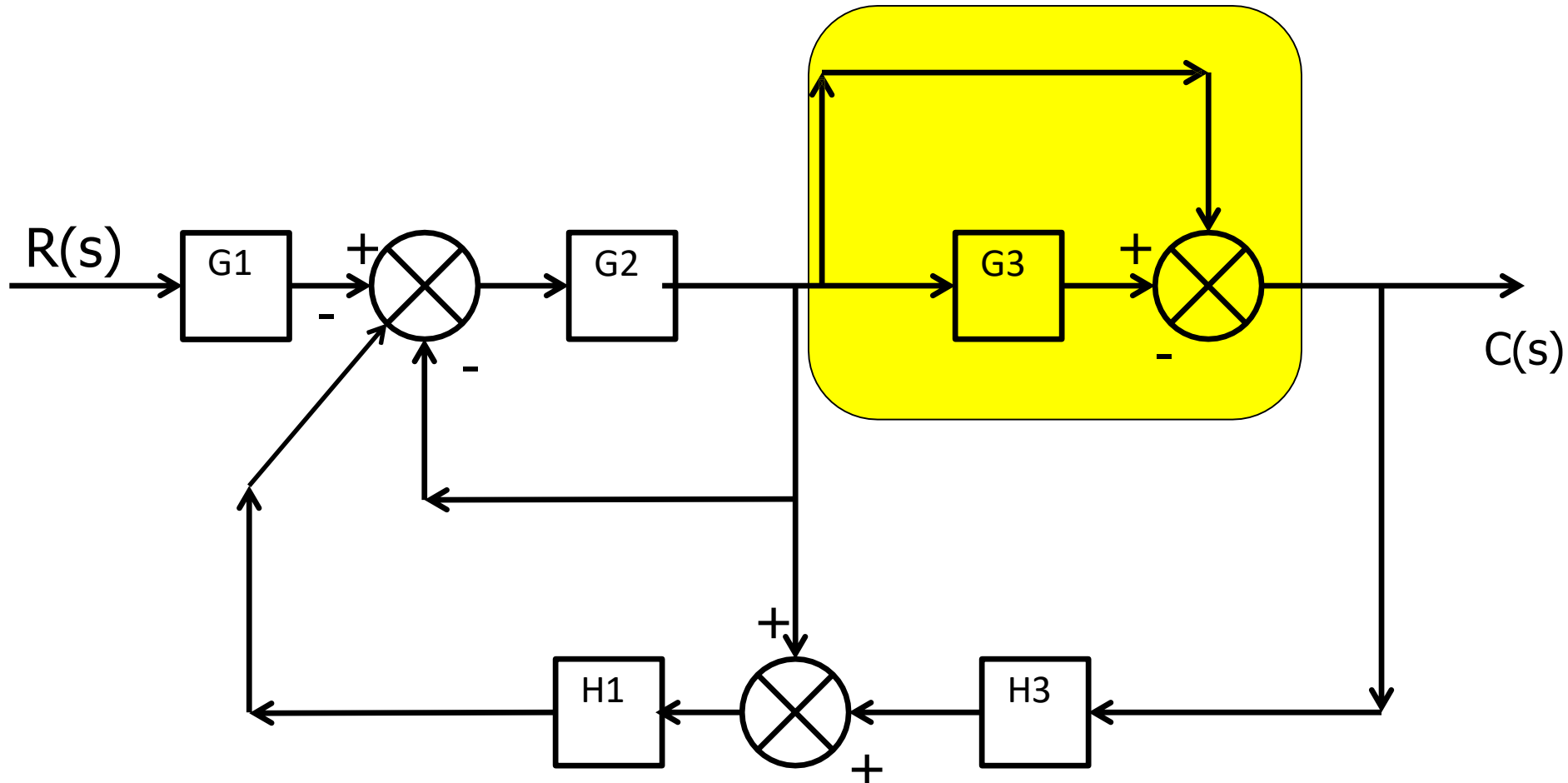
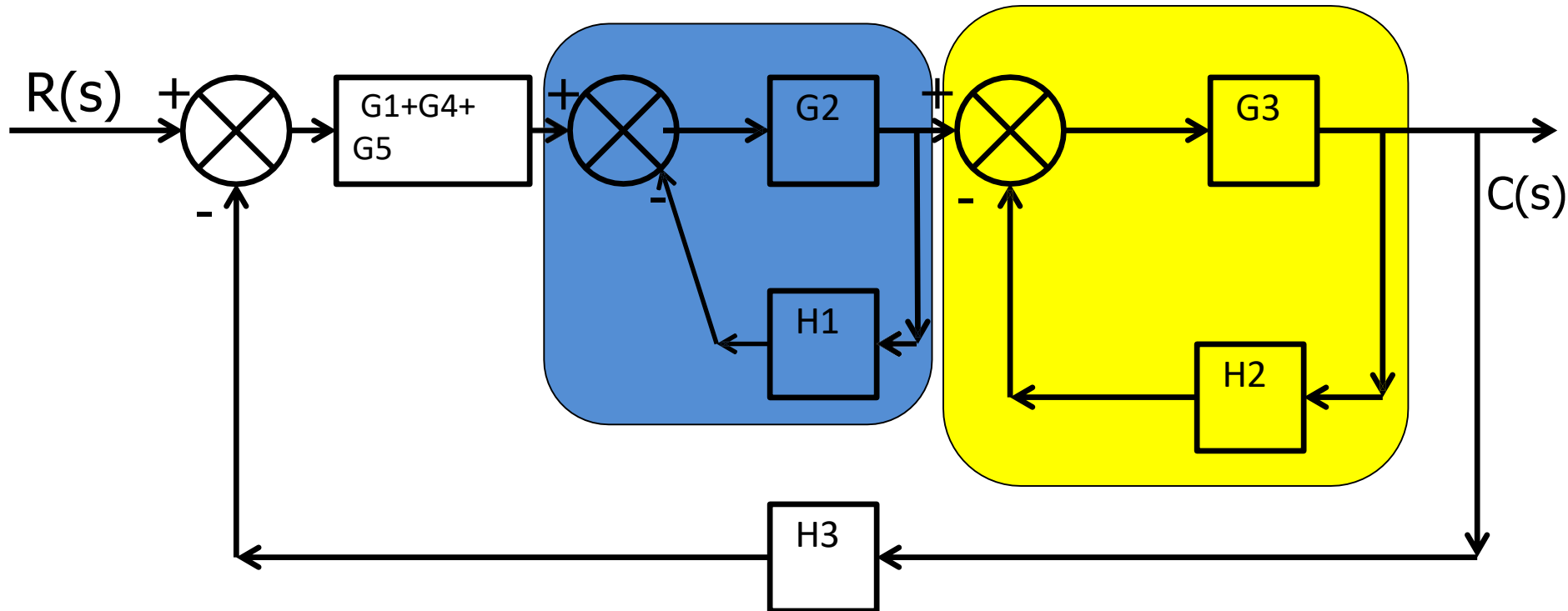# Example 10   cont….

Apply rule 3   Elimination of Feedback Loop
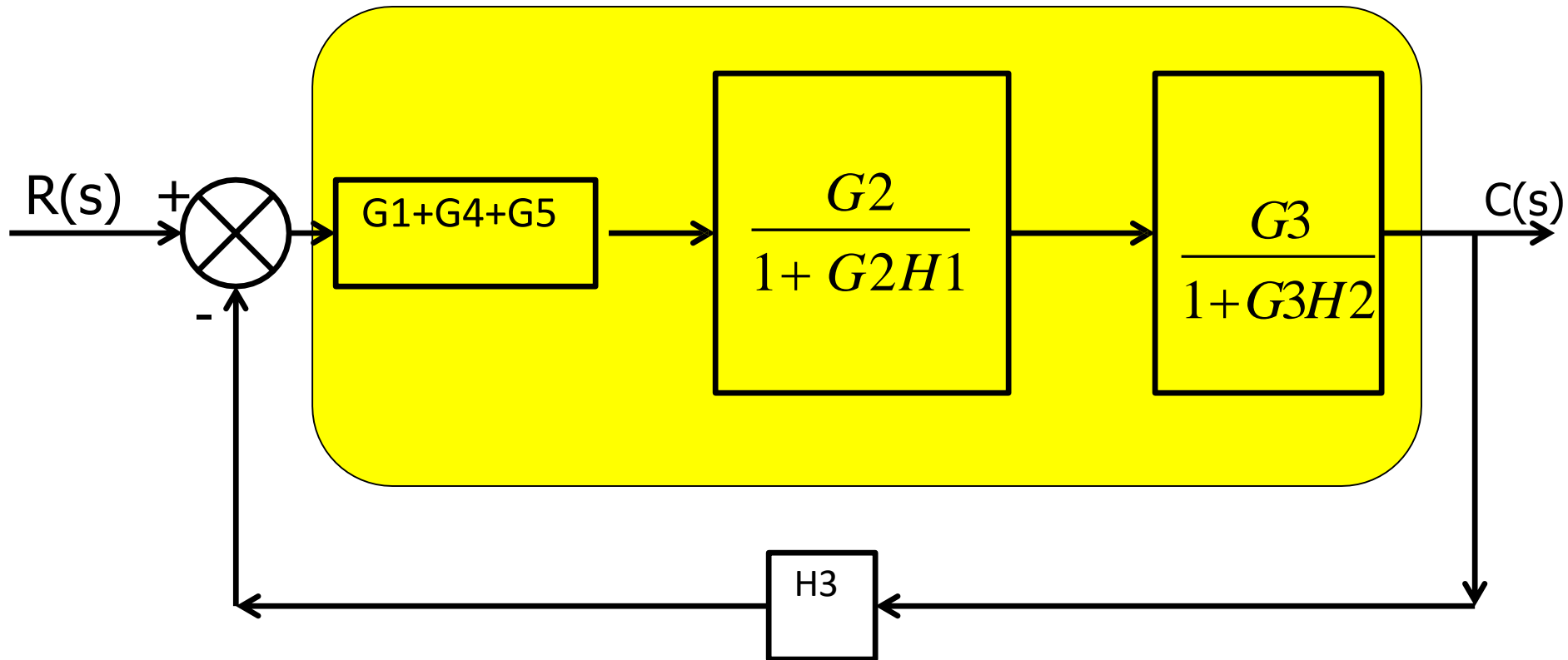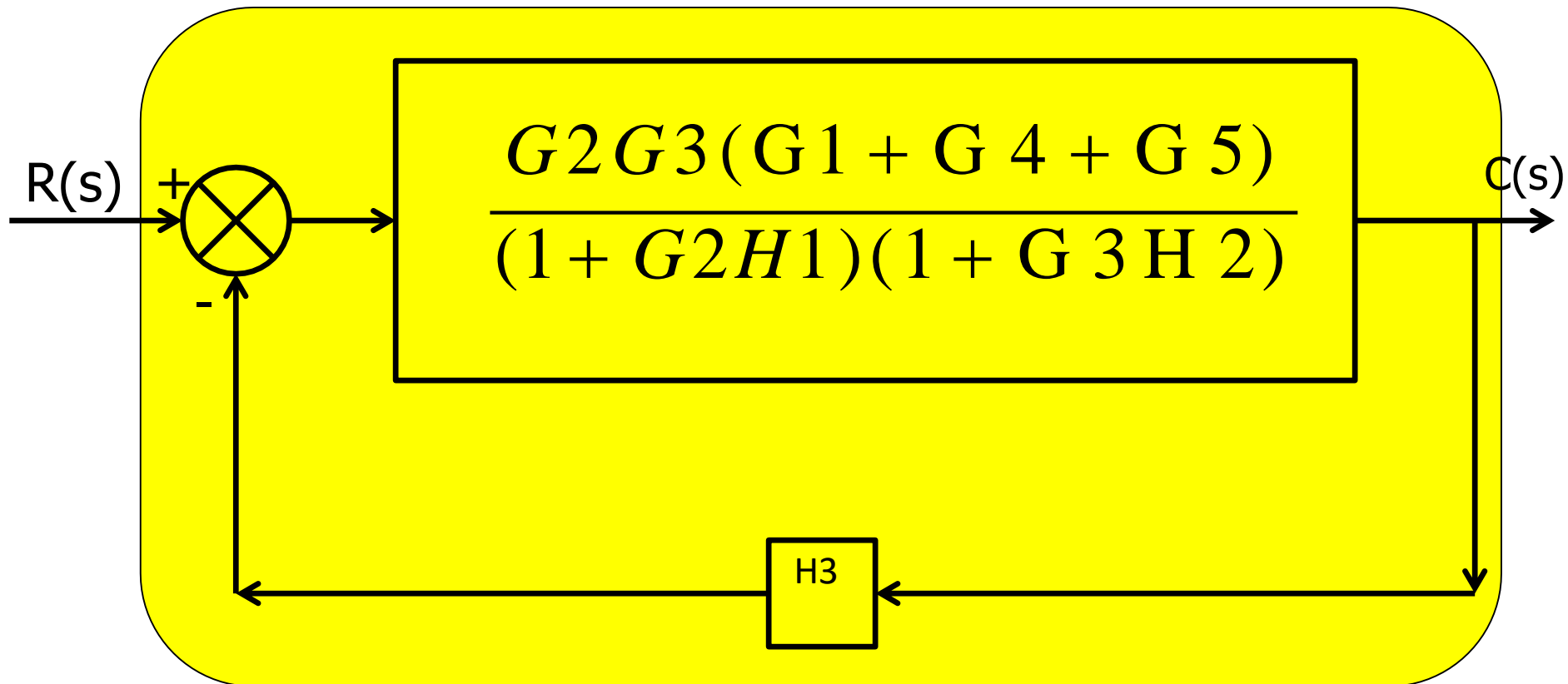
Example 10   cont….

Apply rule 8   Shift take off point after block

R(s)

G1

$+$

$-$

$-$

$$\frac{G2}{1+G2}$$

1+G3

C(s)

$+$

H1

H3

$+$

Example 10   cont....

Apply rule 1   Blocks in series

Example 10   cont....
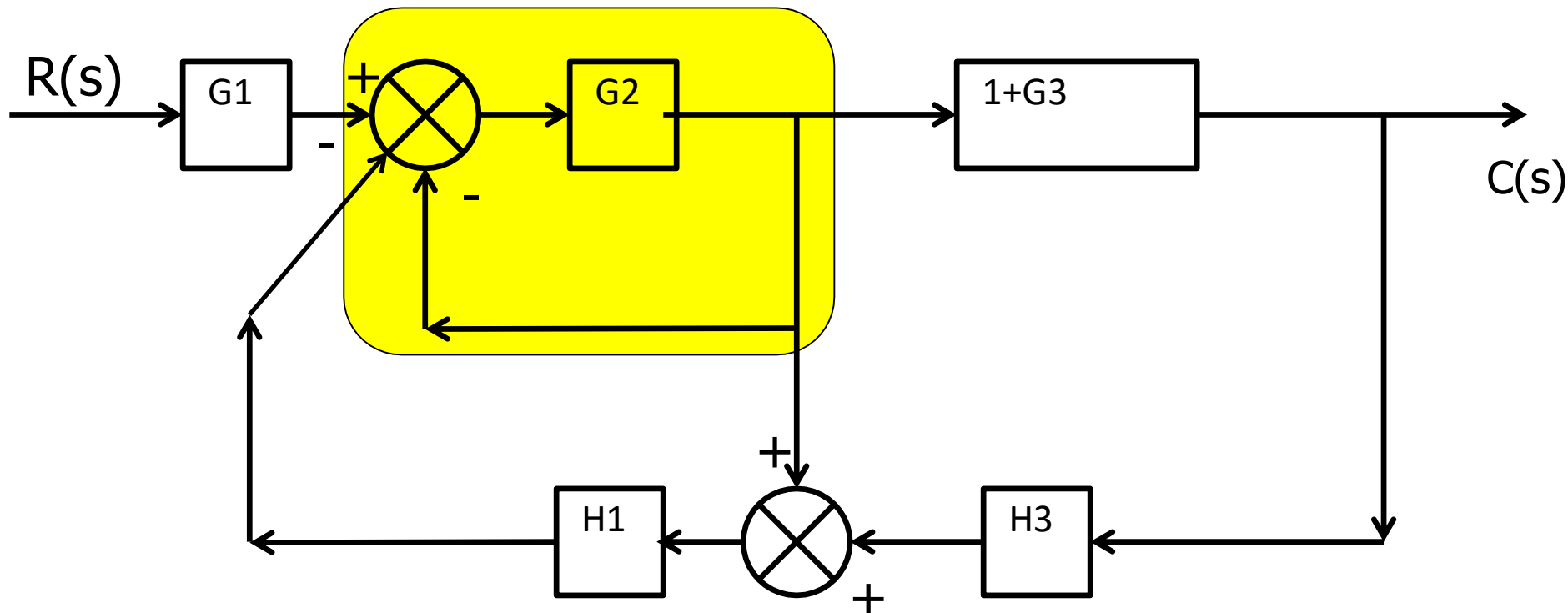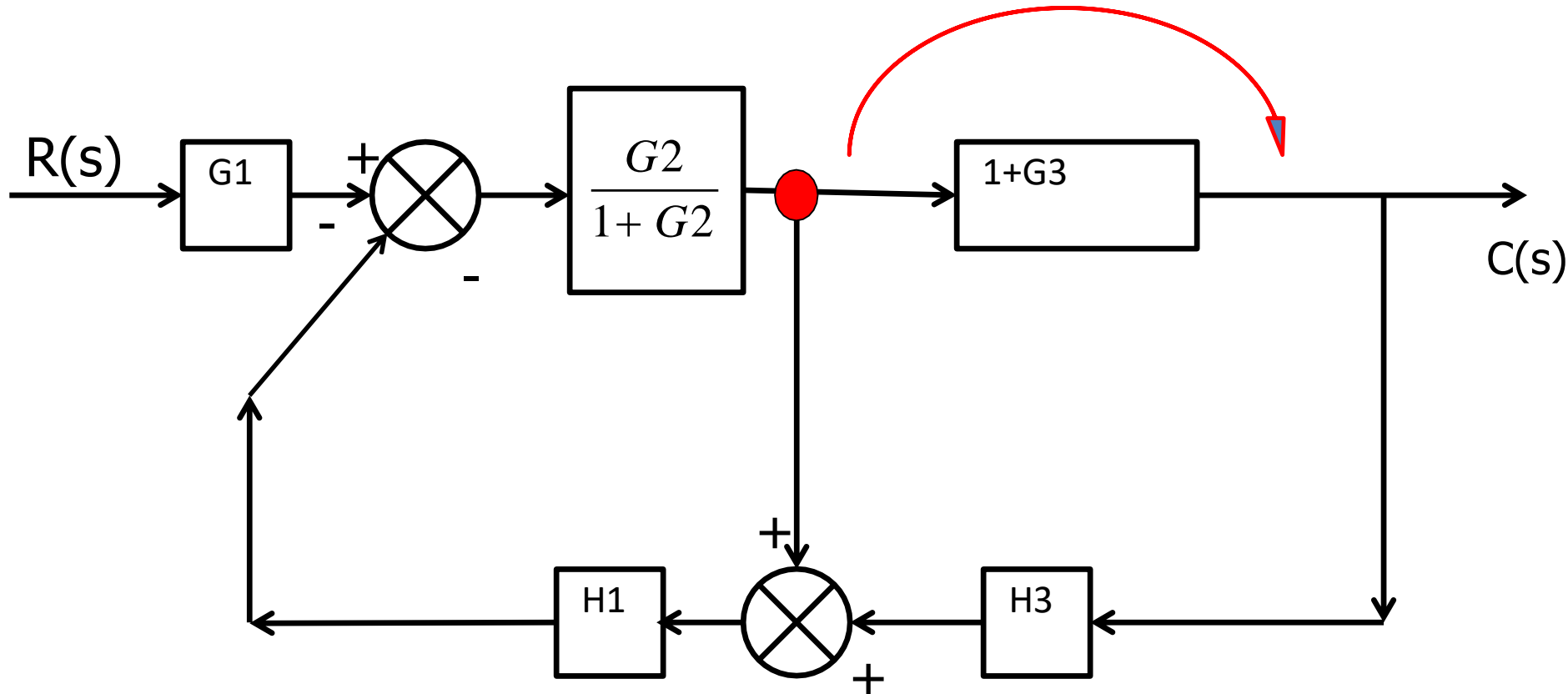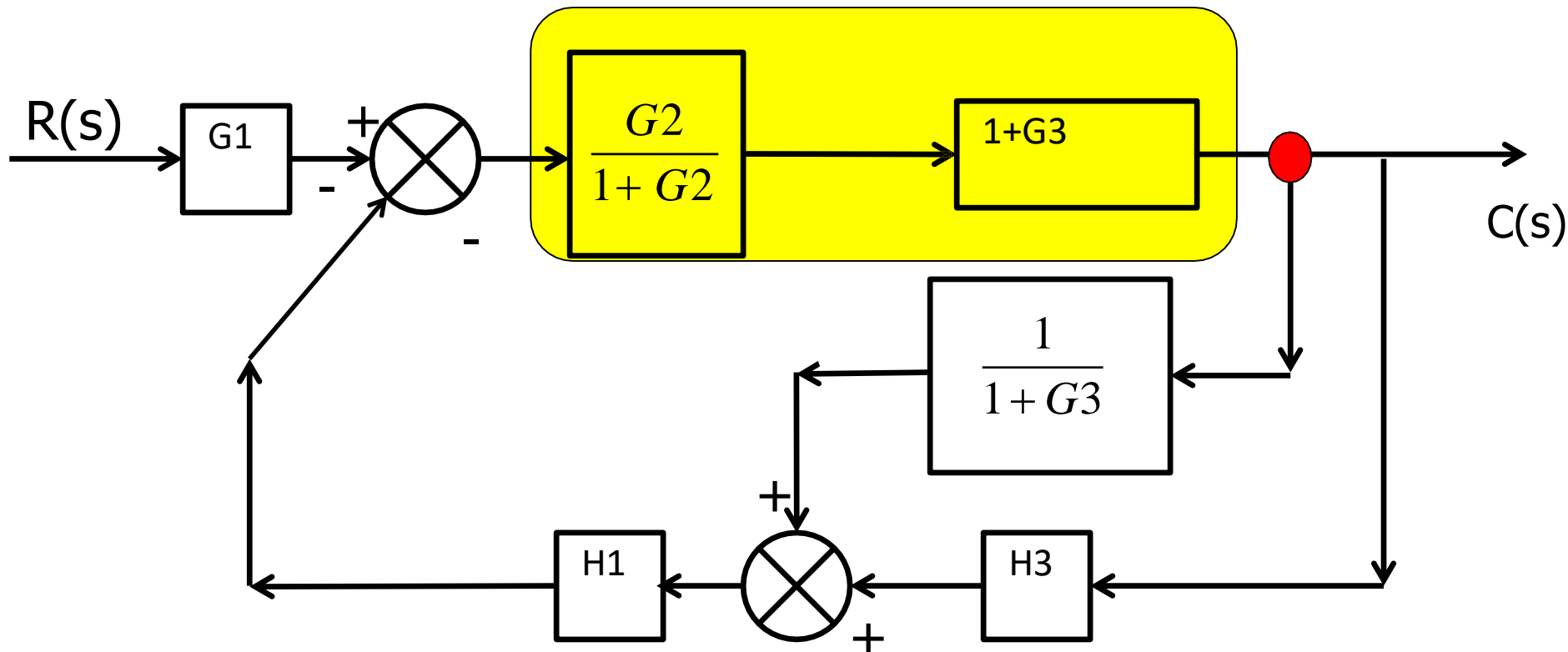
Apply rule 2   Blocks in Parallel

R(s)

G1

$+$

$-$

$-$

$$\frac{G2(1+G3)}{1+G2}$$

C(s)

$$\frac{1}{1+G3}$$

$+$

H1

H3

$+$

Example 10   cont....

Apply rule 1   Blocks in Series

R(s) → G1 → + ⊗ - →
$$\frac{G2(1+G3)}{1+G2}$$
→ C(s)

H1 ← $$H2+\frac{1}{1+G3}$$

Example 10   cont....

Apply rule 3   Elimination of Feedback loop

R(s)

G1

+

−

$$\frac{G2(1 + G3)}{1 + G2}$$

−

C(s)

$$\frac{H1(H2 + H2G3 + 1)}{1 + G3}$$

Example 10   cont....

Apply rule 1   Blocks in series

R(s)

G1

$$\frac{G2(1+G3)}{1+G2+G2H1(1+H2+H2G3)}$$

C(s)

Example 10   cont….

R(s)

$$\frac{G1G2(1+G3)}{1+G2+G2H1(1+H2+H2G3)}$$

C(s)

Example 10   cont….
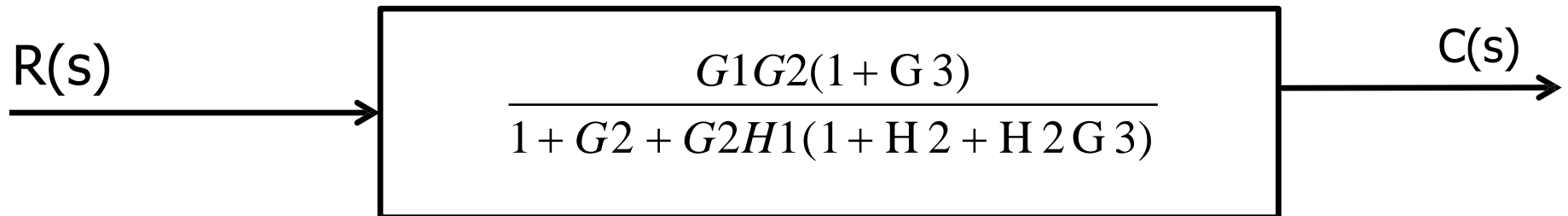
$$\frac{C(\text{s})}{R(\text{s})} = \frac{G1G2(1 + G3)}{1 + G2 + G2H1(1 + H2 + H2G3)}$$

Thank You

Anuj Jain