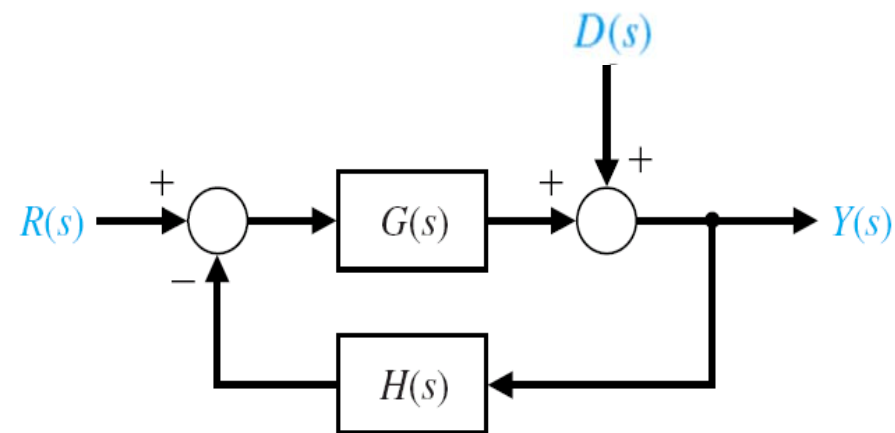


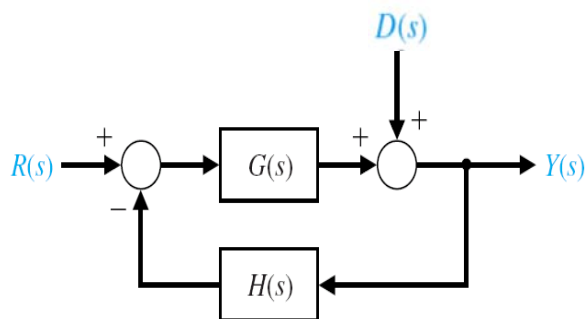
练习:

- 1、求  $Y(s)/R(s)$ ,  $Y(s)/D(s)$
- 2、求单位阶跃参考输出  $r(t)$  作用下的稳态误差  $e_{ss}$
- 3、求单位阶跃干扰输入  $D(s)=1/s$  作用下的  $y(t)$



$$G(s) = \frac{K}{s+10}$$

$$H(s) = \frac{14}{s^2 + 5s + 6}$$



1、

$$\begin{aligned}\frac{Y(s)}{R(s)} &= \frac{G(s)}{1 + G(s)H(s)} = \frac{\frac{K}{s+10}}{1 + \frac{K}{s+10} \cdot \frac{14}{s^2+5s+6}} \\ &= \frac{K(s^2+5s+6)}{(s+10)(s^2+5s+6)+14K} = \frac{K(s^2+5s+6)}{s^3+15s^2+56s+60+14K}\end{aligned}$$

注意Y/D的传函是正  
反馈还是负反馈

$$\begin{aligned}\frac{Y(s)}{D(s)} &= \frac{1}{1 + G(s)H(s)} = \frac{1}{1 + \frac{K}{s+10} \cdot \frac{14}{s^2+5s+6}} \\ &= \frac{(s+10)(s^2+5s+6)}{(s+10)(s^2+5s+6)+14K} = \frac{s^3+15s^2+56s+60}{s^3+15s^2+56s+60+14K}\end{aligned}$$

2、

$$\frac{Y(s)}{R(s)} = \frac{K(s^2 + 5s + 6)}{s^3 + 15s^2 + 56s + 60 + 14K}$$

误差为

$$E(s) = R(s) - Y(s) = \left[ 1 - \frac{K(s^2 + 5s + 6)}{s^3 + 15s^2 + 56s + 60 + 14K} \right] R(s)$$

$R(s) = \frac{1}{s}$  根据终值定理,

$$\begin{aligned} e_{ss} &= \lim_{s \rightarrow 0} sE(s) = \lim_{s \rightarrow 0} s \left[ 1 - \frac{K(s^2 + 5s + 6)}{s^3 + 15s^2 + 56s + 60 + 14K} \right] R(s) \\ &= 1 - \frac{6K}{60 + 14K} = \frac{60 + 8K}{60 + 14K} \end{aligned}$$

3、

$$\frac{Y(s)}{D(s)} = \frac{s^3 + 15s^2 + 56s + 60}{s^3 + 15s^2 + 56s + 60 + 14K}$$

$$D(s) = \frac{1}{s}$$

$$Y(s) = \frac{s^3 + 15s^2 + 56s + 60}{s^3 + 15s^2 + 56s + 60 + 14K} \cdot \frac{1}{s}$$

$$y(t) = \textit{ilaplace}[Y(s)]$$