國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：自動控制【機電系碩士班丙組】　　題號：438004

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　共 2 頁第 1 頁

1. (10%) In Fig. 1, let $G_c(s)=1, G(s)=\dfrac{K(s^2+4s+6)}{(s+3)(s+5)(s^2+2s+5)}$.

   (a) (5%) Plot the root loci for the system.

   (b) (5%) Find K to yield a steady-state error of 0.1 for a unit step input.

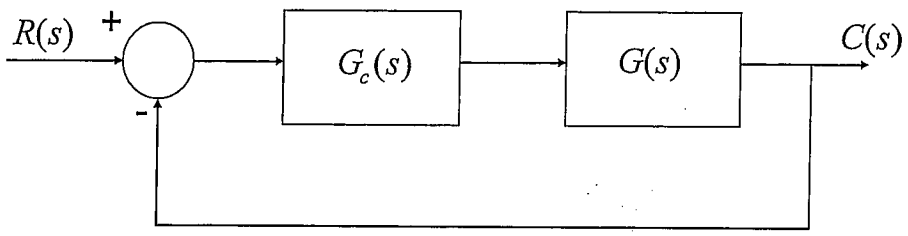

Fig. 1

2. (10%) The control system is shown in Fig. 2.

   (a) (5%) Plot the Bode magnitude and phase plots.

   (b) (5%) Determine the gain margin and phase margin from (a).

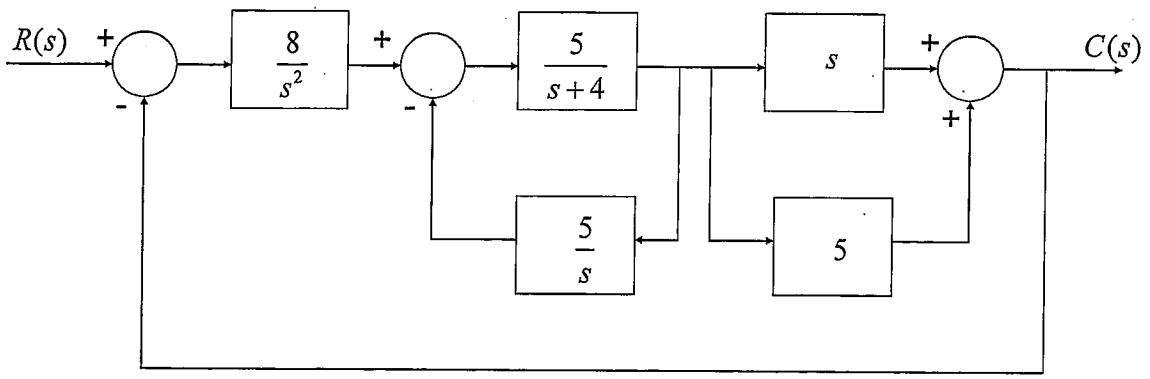

Fig. 2

3. (10%) In Fig. 1, let $G_c(s)=K, G(s)=\dfrac{60}{(s^2+10s+60)(s+10)^3}$.

   (a) (5%) Find the value of K that will yield oscillations.

   (b) (5%) Find the frequency of oscillations.

4. (20%) In Fig. 1, let $G(s)=\dfrac{K}{s(s+5)(s^2+10s+50)}$.

   (a) (10%) Please design a lead controller $G_c(s)$ to fulfill a 10% overshoot and a peak time of 0.86 second for a unit step input (assume a compensator zero at -5 on the real axis).

   (b) (10%) Derive the unit step response from (a).

背面有題

5. (10%) This problem considers the following three systems whose transfer functions are

$$G_1(s)=\frac{1}{(s+2)(s+3)} \quad G_2(s)=\frac{s+1}{(s+2)(s+3)} \quad G_3(s)=\frac{1}{(s+2)(s+3)(s+1)}$$

Which system has the largest bandwidth? Which system has the smallest bandwidth? Why?

6. (20%) With a unit step input, this problem considers following three systems whose transfer functions are

$$G_1(s)=\frac{25}{s^2+6s+25} \quad G_2(s)=\frac{25}{s^2+8s+25} \quad G_3(s)=\frac{25(s+1)}{s^2+6s+25}$$

(a) (10%)Assuming the desired output for a unit step input is 1, which of the above three systems has the largest steady-state error? Why?

(b) (10%)Among these three systems, who has the largest overshoot? Who has the smallest overshoot? Why?

7. (20%) With a unit step input, this problem considers following three systems whose transfer functions are

$$G_1(s)=\frac{s+1}{s^2+6s+25} \quad G_2(s)=\frac{s+2}{s^2+6s+25} \quad G_3(s)=\frac{s+3}{s^2+6s+25}$$

(a) (10%)Which of these three systems has the largest overshoot? Why?

(b) (10%)Which of these three systems has the smallest peak time? Why?