國立彰化師範大學 102 學年度碩士班招生考試試題

系所: 工業教育與技術學系 組別: 乙組(選考甲) 科目: 自動控制 ☆☆請在答案紙上作答☆☆ 共2頁,第1頁

- 1. Consider the system shown in Fig. 1 to determine the following: (Please show your calculation process in details)
 - (1) The gain K for a damping ratio of 0.7. (5%)
 - (2) The damping ratio and first peak time for K=20. (5%)
 - (3) The settling time for K=5. (5%)
 - (4) The time domain output for a unit step input for K=10. (10%)

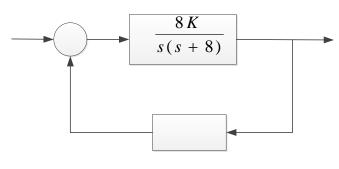


Fig. 1

2. For the system shown in Fig. 2, the following controller functions have been suggested. Using root locus, determine which system produces the best transient response. Describe the calculation process and explain your reasoning.

(1) $G_c(s)=K$ (5%)

(2)
$$G_c(s) = \frac{K(s+3)}{(s-1)} (10\%)$$

(3) $G_c(s) = \frac{K(s+2)}{(s+6)} (10\%)$

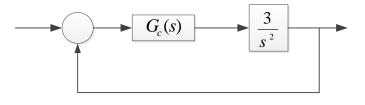


Fig. 2

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3. A system is described by

$$\dot{x}(t) = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 1 \end{bmatrix} x(t)$$

- (1) Is this system stable? (10%)
- (2) Is this system controllable? (5%)
- (3) Is this system observable? (5%)

(Please show your calculation process in details)

4. Please sketch the Bode plot (frequency responses) for the following systems.

(1)
$$G(s) = \frac{s}{s + 100}$$
 (5%)

(2)
$$G(s) = \frac{100}{s + 100}$$
 (5%)

(3)
$$G(s) = 0.01s + 1$$
 (5%)

(4)
$$G(s) = \frac{10000}{s^2 + 200 s + 10000}$$
 (5%)

(5)
$$G(s) = \frac{s}{s^2 + 200 s + 10000}$$
 (5%)

(6)
$$G(s) = \frac{s^2}{s^2 + 200 s + 10000}$$
 (5%)