

國立臺北科技大學 100 學年度碩士班招生考試

系所組別：1512 自動化科技研究所甲組

第二節 自動控制 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (20%) A linear feedback control system has the block diagram shown in Figure 1. Let r =input, e =error, N =noise, and c =output.

$$G(s) = \frac{K(s+2)}{s(s+1)}$$

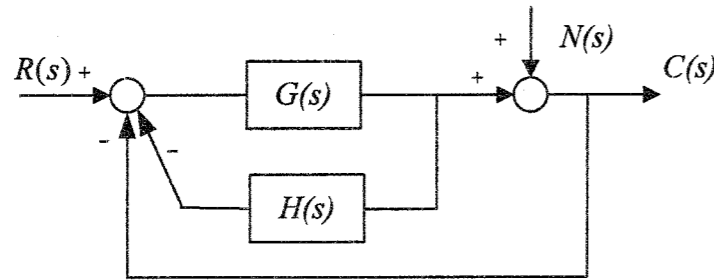


Figure 1

- (1) (10%) Find the transfer function $H(s)$ so that the output $c(t)$ is not affected by the noise; that is,

$$\left. \frac{C(s)}{N(s)} \right|_{r=0} = 0$$

- (2) (10%) With $H(s)$ as determined in part (1), find the value of K so that the steady-state value of $e(t)$ is equal to 0.1 when the input is a unit ramp function, $r = tu_r(t)$, $R(s) = 1/s^2$, $N=0$.

2. (20%) Consider an unit feedback system with open-loop transfer function :

$$G(s) = \frac{K}{(s+1)(s+4)(s+10)}$$

- (1) (10%) Determine the range of K within which the closed-loop system is stable.
- (2) (10%) If $K = 200$, find the gain margin and phase margin.

3. (20%) Consider an unit feedback system :

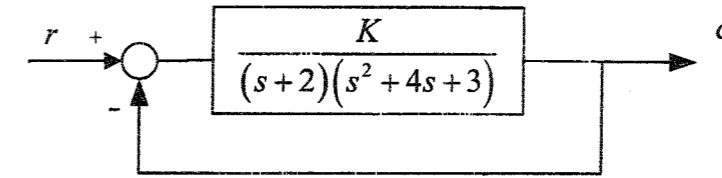


Figure 2

Determine the maximum value of K ($K > 0$) such that the system closed-loop poles are all real.

4. (20%) Consider an observer-based state feedback control $u(t) = -K\hat{x}(t)$ for the following system :

$$\begin{aligned} \dot{x}(t) &= \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ -1 \end{bmatrix} u(t) \\ y(t) &= [0 \quad 1] x(t) \end{aligned}$$

- (1) (10%) Determine the value K to move the system poles to $-0.5 \pm j0.5$.
- (2) (10%) Determine the observer gain L to let the observer mode locate at $-1 \pm j1$.

5. (20%) Consider the following tracking system :

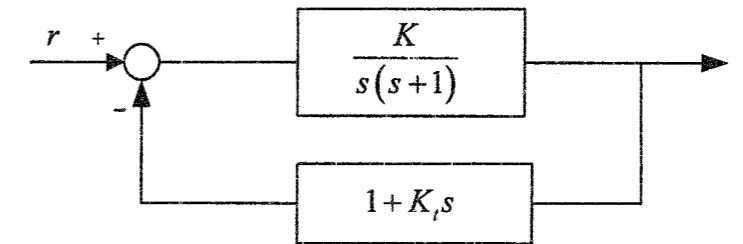


Figure 3

- (1) (10%) Determine K and K_t so that the maximum overshoot $M_p = 0.2$ occurring at time instant $t_p = 1$ second.
- (2) (10%) Determine the rise time t_r and settling time t_s .