

國立臺北科技大學 100 學年度碩士班招生考試

系所組別：2112、2130 電機工程系碩士班甲、丙組

第一節 控制系統 試題 (甲組選考)

第一頁 共一頁

注意事項：

1. 本試題共四題，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. Consider the feedback system as shown in Fig. 1, where $D(s) = K \frac{as+1}{0.01s+1}$,

$$G(s) = \frac{5}{s(s+5)}, \text{ and } H(s) = 1.$$

- (a) If the steady-state error is 0.1 for a ramp input $r(t) = 5tu_s(t)$ where $u_s(t)$ is the unit step function, calculate the value of K . (10%)
- (b) If $D(s)$ is a phase-lead controller and provides a maximum phase-lead angle 45° , find the value of a . (10%)

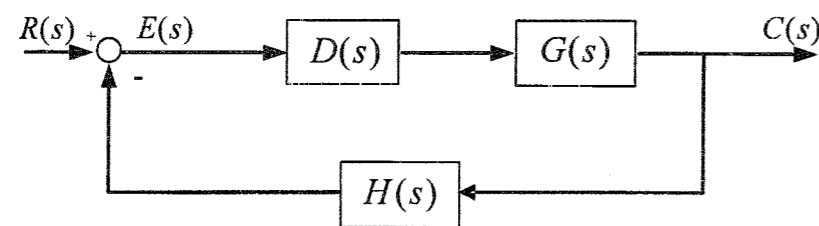


Fig. 1

2. For a negative unity feedback system, the plant is given as

$$G(s) = \frac{s-1}{(s/10+1)(s/100+1)}$$

- (a) Sketch the Bode plot. (10%)
- (b) What can you conclude about the stability from the obtained Bode plot? Why or why not? (10%)
- (c) Sketch the Nyquist plot and determine the stability. (10%)

3. Consider the transfer function

$$\frac{Y(s)}{U(s)} = G(s) = \frac{s+a}{s^3+6s^2+11s+6}$$

- (a) If one can obtain an observable but uncontrollable realization for this system, please find all possible values of a ? (5%)
- (b) Calculate the observability canonical form of $G(s)$. (10%)
- (c) If the input $u(t)$ is a unit impulse function, please find the output $y(t)$ for $a = 5$. (5%)
- (d) Please design the observer gain to place the observer poles at $-1, -5 \pm 5j$. (5%)

4. For some digital control system, the characteristic equation is given as

$$\Delta(z) = z^3 + 0.7z^2 + 0.1z + K = 0, \quad K > 0$$

- (a) Draw the root locus of the system. (5%)
- (b) Calculate the intersection of the asymptotes. (5%)
- (c) Calculate the breakaway point. (5%)
- (d) Find the range of K for which the system stable. (10%)