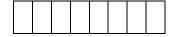
國立臺北科技大學

九十七學年第二學期電機系博士班資格考試

數位控制理論與應用試題(公告用)

第一頁 共一頁



- 1. 本試題共【5】題,配分共100分。 2. 請按順序標明題號作答,不必抄題。 3. 全部答案均須答在試卷答案欄內,否則不予計分。
- (1) (20 %)
 - a. What are the definitions for the reachability and the controllability of a discrete system?
 - b. Given an example to show the difference.
- (2) (20 %) Consider the difference equation

$$y(k+2) - 5y(k+1) + 6 y(k) = u(k)$$

where y(0)=1 and y(1)=0 and u(k) the discrete impulse function.

- a. Find the Z-transform Y(z)=?
- b. Find y(k)=?
- (3) (10 %) Consider $z^2 + a_1 z + a_2 = 0$. Determine the stable region in the $a_1 a_2$ plane.

(4) (20 %) Consider the system x(k+1) = A x(k) + B u(k)

where
$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$
 $B = \begin{bmatrix} \frac{1}{2} \\ 1 \end{bmatrix}$

Determine a linear feedback such that the characteristic equation of the closed-loop

system is
$$z^2 + p_1 z + p_2 = 0$$
.

(5) (30 %) Consider a system with a state equation $\dot{x} = Ax + Bu$.

Assume the control is applied from the computer by a Zero-Order hold, i.e., $u(\tau) = u(kT), \quad kT \le \tau < kT + T$

where T is the sampling interval. Then, we have an exact discrete representation as given by,

$$x(k+1) = \Phi x(k) + \Gamma u(k)$$
.

a. Derive the general form of the matrices $\Phi = ?$ $\Gamma = ?$

b. Let
$$A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$$
 and $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. Then, $\Phi = ?$ $\Gamma = ?$

c. Let $y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$. Find the transfer function Y(z)/U(z) = ?