1997 碩士班入學考試

1.

Consider the following system with $G(s) = \dfrac{30}{s^3 + 11s^2 + 10s}$.

(a) Plot the Bode plot of $G(s)$. (10%)

(b) Determine the parameters of the controller $C(s) = \dfrac{k(s+z)}{(s+p)}$ by root locus method, such that the dominant closed loop poles are located at $-2 \pm 2j$.(15%)

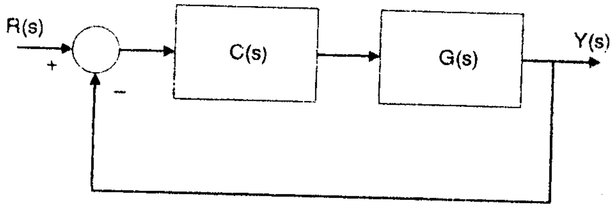

Fig.1

2. (25%)

Determine the system transfer function $G(s)$ using the following step input time response, and plot the corresponding Nyquist plot. Determine the range of k such that the closed-loop system is stable.

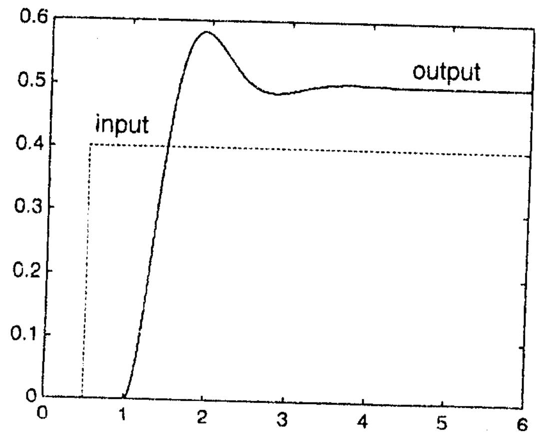

Fig.2-1. Step input response

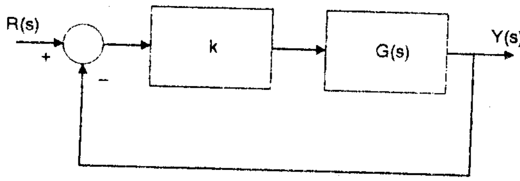

Fig.2-2.

(背面仍有題目,請繼續作答)

Linear Control

Problem 3. 20%

Find the transfer function from u to y, for the control system shown below.

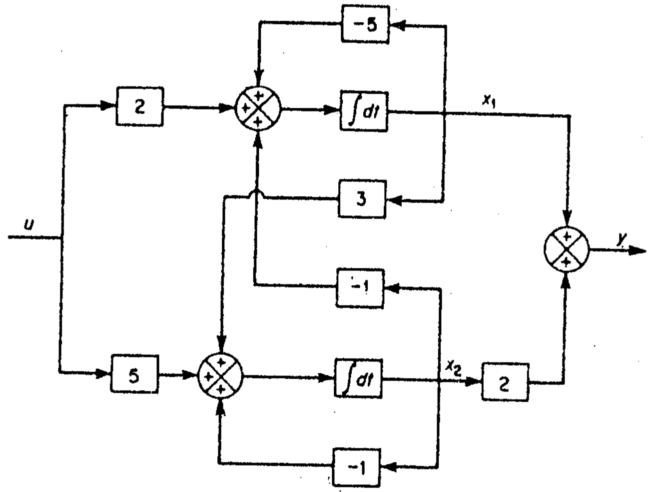

Figure of Problem 3

Problem 4. 30%

(A) Consider linear system

$$\dot{x} = Ax + Bu$$

where $x \in R^{n\times 1}$, $u \in R^{r\times 1}$, $A \in R^{n\times n}$, $B \in R^{n\times r}$.
Now, assume input $u(t)$ is given, show the solution $x(t)$ can be derived as

$$x(t) = e^{At}x(0) + \int_0^t e^{A(t-\tau)}Bu(\tau)d\tau$$

(B) Use the above formulus to find the solution of the following system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix}u, \quad x_1(0) = x_2(0) = 0$$

where $u(t) = 1$, $t \geq 0$.