所別：電機工程學系碩士班　丙組　　科目：控制系統

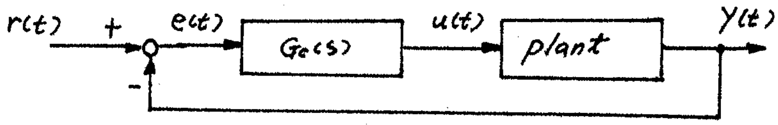
(1). Suppose that a closed-loop system model using observer feedback is described by

20%

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{\hat{x}}_1 \\ \dot{\hat{x}}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -2 & -3 & -23 & -7 \\ 27 & 0 & -27 & 1 \\ 142 & 0 & -167 & -10 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \hat{x}_1 \\ \hat{x}_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 3 \\ 0 \\ 3 \end{bmatrix} r.$$

Find the eigenvalues of the closed-loop system.

(2). Consider the following control system:



The plant model is

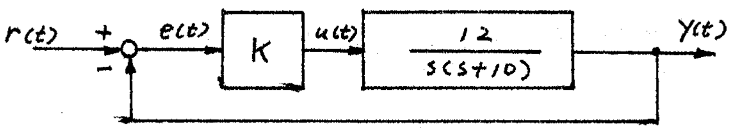
15%

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 5 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 3 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Design the controller $G_c(s) = \dfrac{bs+c}{s+a}$, so that the closed-loop poles are -5, -15, and -5.

(3). Consider the following tracking system:



15%

Determine K so that the steady-state error of e(t) is less than or equal to 1% rad. with the input signal $r(t) = 0.05t$ rad.

參考用

注意：背面有試題

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(4) Discuss the following problems

(1) Does the state feedback alter the controllability of the open-loop system ? (5%)

(2) Does the state feedback alter the observality of the open-loop system ? (5%)

(3) When output feedback is used, is observability of the open- and closed-loop system the same ? (10%)

(4) Is the stability of the closed-loop system the same as that of the open-loop system ? (5%)

(5) Discuss the stability of the following system

$$\dot{\underline{x}} = \begin{bmatrix} -4-\sqrt{50}\sin\omega t & 1 \\ 25\cos(2\omega t) & -4+\sqrt{50}\sin(\omega t) \end{bmatrix} \underline{x} \qquad (15\%)$$

(6) A single-input, single-output system is described by $\dddot{y}+\ddot{y}+b\dot{y}+(K-3)y=u(t)$.
What is the range of values of K for stability ? (10%)
(where $\cdot$ denotes the differentiation with respect to time)

參考用