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國立中央大學94學年度碩士班考試入學試題卷 共 2 頁 第 1 頁
 所別：電機工程學系碩士班 丙組 科目：控制系統

1. Given the unity-feedback control system as follows:

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

Determine the values of K and T for stability of this control system. (10%)

2. Design a 3rd order controller whose three roots are located at the following locations in the s -plane: -1 ; -1 ; -2 . The transfer function of the system to be controlled is given by

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

Determine the controller gain matrix, K . (20%)

3. Show that the state feedback can cause a loss of observability. (20%)

注意：背面有試題

0.12

4. (i) Plot the root locus of the eq. : $s^4 + 22s^3 + 40s^2 + ks + k = 0$. (10%)
 (ii) Plot the asymptotes, too. (5%)
 (iii) Specify the crossover frequency and the corresponding k . (5%)
 ($0 \leq k < \infty$)

5. (i) If $G(s) = \frac{s^2 + 5s + 6}{s^3 + 9s^2 + 23s + 15}$, find the controllable (10%)

canonical form:
$$\begin{cases} \dot{x} = Ax + bu \\ y = cx \end{cases}$$

- (ii) Is the system in the above observable? Why? (5%)

6. Consider a plant described by (15%)

$$\ddot{y} + 5\dot{y} + 3y = u.$$

Assign the states as $x_1 = y$, $x_2 = \dot{y}$, and $x_3 = \ddot{y}$.

Design $K := [a \ b \ c]$ so that the characteristic polynomial becomes $s^3 + 6s^2 + 5s + 8$ after

utilizing
$$u = -K \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}.$$