八十八學年度 工科系 系（所） 丁 組碩士班研究生招生考試

科目 控制原理 科號 3504 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

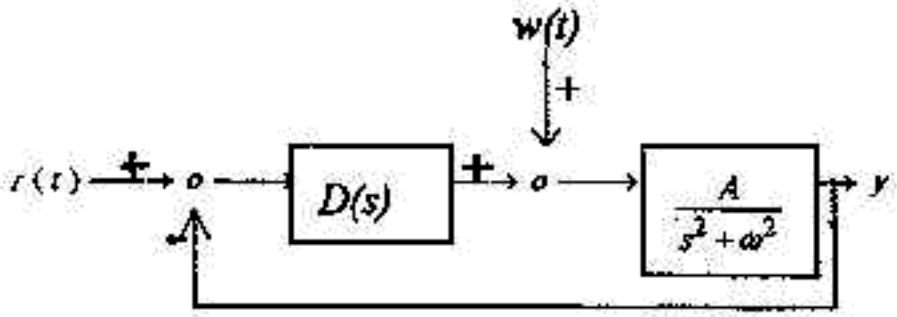
1. Consider a unity feedback system, the open loop transfer function is $G(s)$ and the compensator is $D(s)$, which are defined as follows:

   $G(s) = 1/s(s+3)$ and $D(s) = k(s+z)/(s+p)$.

   (a) Find k, z, and p so that the closed-loop system has the dominated closed-loop poles at $-2 \pm j2$ and the extra pole and zero have the minimum effects on the time response which results from the dominated poles. (17%)

   (b) Explain why the extra pole and zero of your design have the minimum effects. (8%)

2. Consider the system shown below.

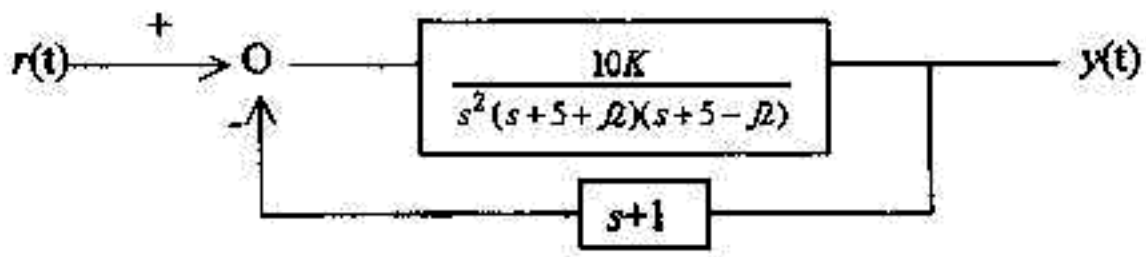


   If the compensator, $D(s)$, consists of proportional (P), integral (I), and derivative (D) control, you are requested to use the simplest control and satisfy the desired requirement. You should explain why you choose this design.

   (a) If $R(s) = W(s) = 1/s$, design $D(s)$ so that the system is type 0 for reference input and performs properly. What is the steady state error? (10%)

   (b) Design $D(s)$ so that the system is type I for input reference. What is the steady state error if $R(s) = 1/s^2$ and $W(s) = 0$. (10%)

3. For the system shown below.



   (a) Sketch the locus of closed-loop roots with respect to k. (15%)

   (b) Find the maximum value of k for which the system is stable. (5%)

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4. Consider the open-loop transfer function

$$\frac{k(10s-1)}{(s+2)(s+4)}$$

(a) If $k = 1$, plot the Bode and Nyquist plot approximately. (14%)

(b) The system is unity feedback. Find the stable region of k using Nyquist plot. (6%)

(c) Using Routh's criterion, determine the unity feedback closed-loop stability of this system for all values of k. (5%)

5. Using the indicated state variables, write the state equations for the system shown below. (10%)