大同大學 103 學年度研究所碩士班入學考試試題

考試科目:控制系統　　所別:電機工程研究所　　

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

1. Consider the feedback control system shown in Fig. P-1, where $Y(s)$ is the output, $R(s)$ is the input, and $D(s) = k\dfrac{s+z}{10s+1}$ is the compensator, for which k and z are two constants to be determined.

   (a) (5%) Please find the transfer function $G(s)= Y(s)/R(s)$.

   (b) (10%) Use Routh's criterion to determine the region in the k versus z plane for which the system is BIBO stable (Use k as the horizontal axis and z as the vertical axis.)

   (c) (10%) From (a) and (b), what conditions must k and z satisfy so that the system is stable and its output can track a unit step reference input with constant steady-state error ?

   (d) (10%) From (a) and (b), please find k and z so that the closed-loop system poles are located at $s=-2\pm j\sqrt{2}$.

   (e) (10%) Sketch the asymptotes for $D(s)$ with k and z given from (d) according to Bode plot rules.

   (f) (5%) From (e), is $D(s)$ the lead or lag compensator ? Explain your answer and simple lead and lag will not be granted any point.

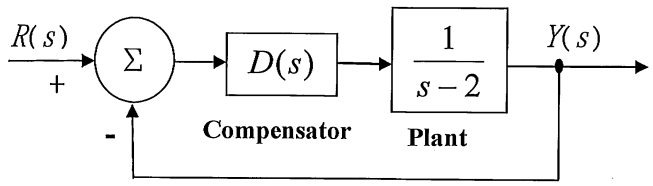

Fig. P-1

2. Consider the continuous-time system with the following differential equation

$$\ddot{y}(t)=u(t)$$

   (a) (15%) Determine the state-space representation of the above continuous-time system.

   (b) (15%) Determine a state-feedback controller such that the characteristic equation of the closed-loop system is $s^2+a_1s+a_2=0$. (in terms of a_1 and a_2)

3. Consider the discrete-time system

$$y(k+2)+0.6y(k+1)=u(k)$$

   where $y(k)$ is the system output and $u(k)$ is the input.

   (a) (10%) For which values of P in the proportional controller

$$u(k) = P\left[r(k)-y(k)\right]$$

   is the closed-loop system stable, where $r(k)$ is the reference input ?

   (b) (10%) Determine the stationary error $r(k)-y(k)$ when $r(k)$ is a unit step function and when $P=1$ in the controller as shown in (a).

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