義守大學九十二學年度博碩士班研究所考試試題

系所別	電機工程學系	考試日期	4月12日
考試科目	控制工程		

本科可使用計算機

1. (20 %) Shown in Figure 1 is a feedback control system.

   (1) Write the system transfer functions Y(s)/R(s) and Y(s)/D(s).

   (2) Considering the options as listed in the following equations, which option provides the best disturbance rejection ? (Consider *s* approaching zero.)

   a. $G_1 = 2,\ G_2 = \dfrac{10}{s+1},\ H = 0.2$

   b. $G_1 = 10,\ G_2 = \dfrac{2}{s+1},\ H = 0.2$

   c. $G_1 = 2,\ G_2 = \dfrac{2}{s+1},\ H = 0$

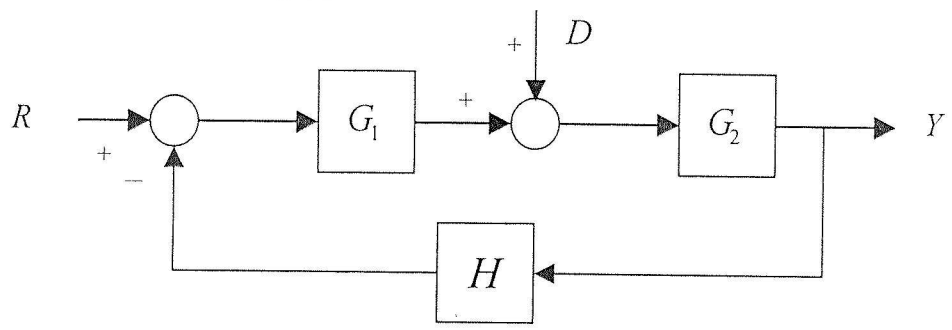

Figure 1.

2. (20 %) The transfer function of a linear control system is

$$\frac{Y(s)}{U(s)} = \frac{s+m}{s^3 + 2s^2 - s - 2}$$

   (1) Determine the values of m so that the system is either uncontrollable or unobservable.

   (2) With the values of m found in part (a), define the state variables so that one of them is uncontrollable. Write the dynamic equations of the system.

3. (20 %) Considering a system for which $G(s)H(s) = \dfrac{10}{\frac{s}{4}+1}$

   (1) Plot Bode plots of both gain (in decibels) and phase.

   (2) Determine the phase margin and the gain margin.

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義守大學九十二學年度博碩士班研究所考試試題

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4. (20 %) Considering the system of Figure 2, determine if the point $s = -1 + j1$ is a point on the loci of roots of the characteristic equation for $K \geq 0$. Use the angle criterion to test this point. If it is a point on a root locus, determine the value of K at this point using the magnitude criterion.

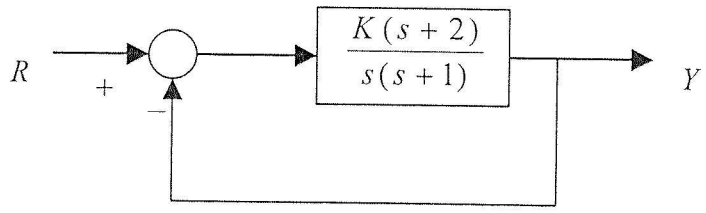

Figure 2.

5. (20 %) Design a controller for the system of Figure 3 such that the steady-state error with a step input is zero, the damping radio is unity, and the undamped natural frequency is 4 rad/s. The plant cannot be changed. A finite zero is acceptable in the transfer function model.

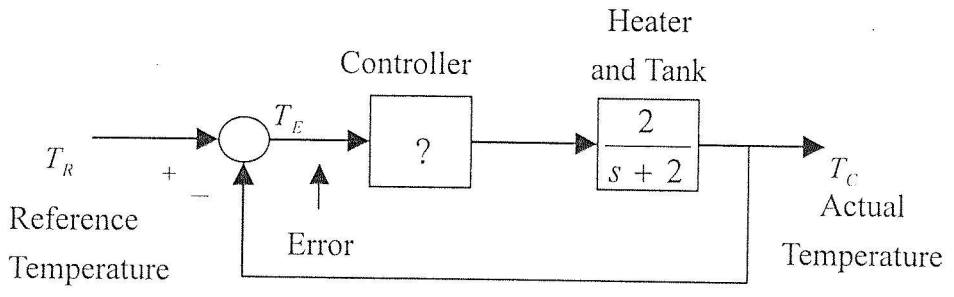

Figure 3.

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