88 學年度 國立成功大學 碩士班招生考試 電机工程研究系所 控制工程 試題 共一頁 第一頁

1. Consider a unity feedback system with the open-loop transfer function $G(s)=\dfrac{K(s+4)(3s+2)}{s(s-1)(s+6)}$. Use Routh's method to determine the range of K so that all the roots of the closed-loop characteristic equation are to the left of $s=-1.0$ axis. (14%)

2. A unity feedback system has the open-loop transfer function $G(s)=\dfrac{25}{s(s+5)}$. Determine the rise time (from 10% to 90%) and the maximal overshoot of the output when the input is a unit step. (20%)

3. The unity feedback system with $G(s)=K/s^2$ is to be designed for a settling time (±2%) of 1.667 seconds and a 16.3% peak overshoot. If the compensator zero is placed at -1, find the compensator pole. (13%)

4. Consider the Bode magnitude plot of $G(s)$ shown in Figure 1, where no poles or zeros are located in the RHP. Please determine the transfer function $G(s)$. (13%)

5. Show mathematically that the dc gain of a zero-order hold is T. (10%)

6. Show that if the discrete system is stable, the system unit pulse response $c(kT)$ approaches zero as $k\to\infty$. (10%)

7. Suppose the Jordan form of an $n\times n$ matrix A is defined as $J=\begin{bmatrix}\lambda & 0 & 0 & 0 & 0\\ 1 & \lambda & 0 & 0 & 0\\ 0 & 1 & \lambda & 0 & 0\\ \vdots & \ddots & \ddots & \ddots & \vdots\\ 0 & \cdots & 0 & 1 & \lambda\end{bmatrix}$, please derive and explain how to determine Q such that $J=Q^{-1}AQ$. (10%)

8. Consider the dynamical equation $\dot{X}=\begin{bmatrix}-1 & 1 & 0\\ 0 & -1 & 0\\ 0 & 0 & -2\end{bmatrix}X+\begin{bmatrix}0\\1\\1\end{bmatrix}u$ and $y=\begin{bmatrix}1 & 1 & 1\end{bmatrix}X$. Is it possible to choose an initial state at $t=0$ such that the output of the dynamical equation is of the form $y(t)=te^{-t}$ for $t>0$? (10%)

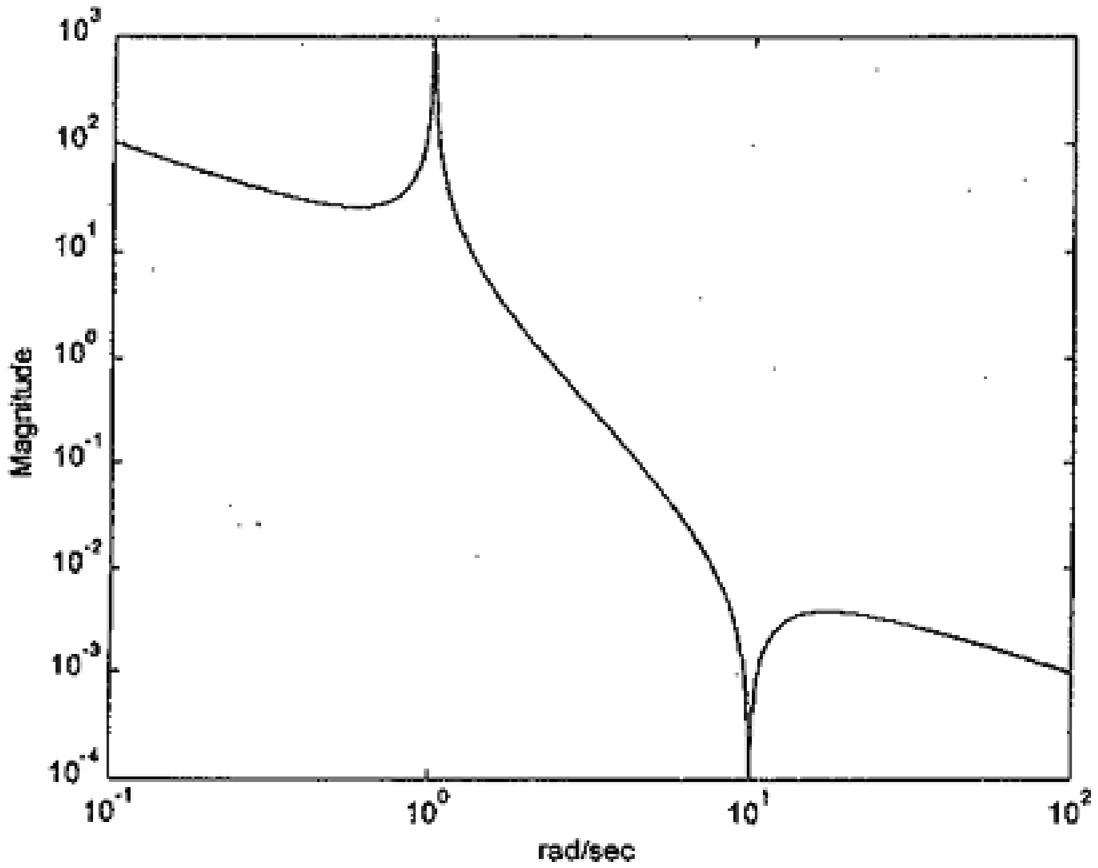

Figure 1

7>1>B