國立成功大學 78 學年度電研所入學考試(控制工程試題) 共 1 頁 第 1 頁

1. The block diagram of a unity feedback control system is shown in Fig. 1.
   (a) Determine the gain margin in dB when the phase-crossover frequency $\omega_\pi < 10$.
   (b) Determine the stability of this system.
   (c) Draw the Bode plot of the open-loop transfer function.

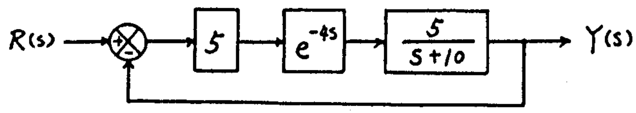

Fig. 1

2. Given a system $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -16 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ and $\begin{bmatrix}x_1(0)\\ x_2(0)\end{bmatrix}=\begin{bmatrix}1\\ -1\end{bmatrix}$, $y=[1\ \ 4]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$
   (a) Find a Lyapunov function V(x) for the system with $-\dot{V}(x)=x_1^2+4x_1x_2+10x_2^2$. Determine the stability using the Lyapunov's method.
   (b) Evaluate $J=\int_0^\infty [x_1^2(t)+4x_2^2(t)]dt$ and $J=\int_0^\infty y^2(t)dt$

3. Obtain the transfer function Y(s)/R(s) of the system shown in Fig. 2.

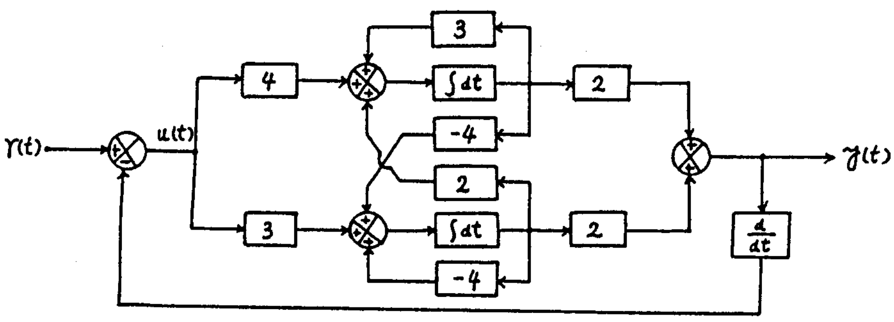

Fig. 2

4. The block diagram of a second-order system is shown in Fig. 3. Suppose that the time-domain response equation of this system to the input r(t)=2u(t) is given as $c(t)=5[1-xe^{-yt}\sin(500t+1)]$.
   (a) Calculate the values of x and y.
   (b) Determine the values of system parameters A, B, and D.
   (c) Determine the system transfer function using the parameter values.

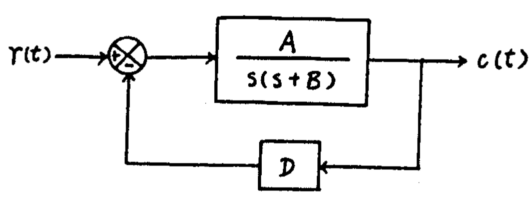

Fig. 3