國立成功大學 102 學年度碩士班招生考試試題

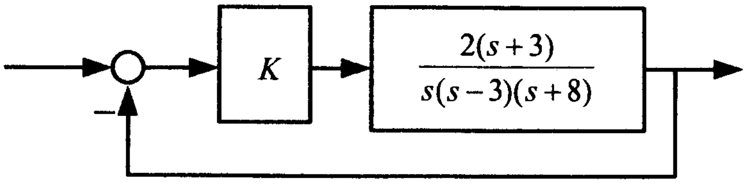
系所組別：電機工程學系乙組

考試科目：控制系統

考試日期：0223，節次：2

※ 考生請注意：本試題不可使用計算機

1. (15%) Consider the system in the figure, determine the range of K so that the closed-loop system is stable.



2. (18%) A negative unity feedback control system has the open loop transfer function $\frac{\omega_n^2}{s(s+2\zeta\omega_n)}$ in which the damping ratio satisfies $0<\zeta\leq\frac{1}{\sqrt{2}}$. Determine

(a) the peak value of the magnitude of the closed-loop frequency response. (9%)

(b) the -3dB system bandwidth. (9%)

3. (33%) A lag-lead compensator is given with the transfer function $G_c(s)=\left(\frac{s+0.1}{s+0.01}\right)\left(\frac{s+1}{s+10}\right)$.

(a) Implement this compensator with a passive network. (11%)

(b) Implement this compensator with active realization. (11%)

(c) Implement this compensator using cascade lag and lead networks with isolation. (11%)

4. (24%) A unity feedback control system has the open-loop transfer function, $KG(s)=K(s+8)^2/s^3$.

(a) Please sketch the Nyquist plot for this system and determine the range of K via this plot such that the feedback control system is stable.. (14%)

(b) If $K=20$, please give the gain margin of this system and its meaning. (10%)

5. (10%) Reduce the state equation $\dot{X}=\begin{bmatrix}\lambda_1 & 1 & 0 & 0 & 0\\ 0 & \lambda_1 & 1 & 0 & 0\\ 0 & 0 & \lambda_1 & 0 & 0\\ 0 & 0 & 0 & \lambda_2 & 1\\ 0 & 0 & 0 & 0 & \lambda_2\end{bmatrix}X+\begin{bmatrix}1\\2\\0\\0\\3\end{bmatrix}u$, $y=\begin{bmatrix}0 & 3 & 2 & 0 & 1\end{bmatrix}X$, into a controllable and observable equation.