淡江大學98學年度碩士班招生考試試題

73-

系別：航空太空工程學系　　科目：自　動　控　制

准帶項目請打「V」	
√	簡單型計算機

本試題共 1 張 頁，III 大題

1. (20%)

   (a) (10%) Draw a signal-flow graph for the following state and output equations:

$$\dot{\mathbf{x}} = \begin{bmatrix} 2 & -5 & 3 \\ -6 & -2 & 2 \\ 1 & -3 & 4 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} r$$

$$y = \begin{bmatrix} -4 & 6 & 9 \end{bmatrix} \mathbf{x}$$

   (b) (10%) Use Mason's rule to find the transfer function of the signal-flow graph of (a).

2. (35%) Given a unity feedback system that has the forward transfer function

$$G(s) = \frac{K(s-2)(s-4)}{(s^2+6s+25)}$$

   do the following:

   (a) (5%) Sketch the root locus.

   (b) (5%) Find the imaginary-axis crossing.

   (c) (5%) Find the gain, *K*, at the $j\omega$-axis crossing.

   (d) (5%) Find the break-in point.

   (e) (5%) Find the point where the locus crosses the 0.5 damping ratio line.

   (f) (5%) Find the gain at the point where the locus crosses the 0.5 damping ratio line.

   (g) (5%) Find the range of gain, *K*, for which the system is stable.

3. (20%) Consider a unity feedback system that has the forward transfer function

$$G(s) = \frac{K(s+1.5)}{s(s+1)(s+10)}$$

   (a) (5%) Design the value of gain, K, to yield 1.52% overshoot.

   (b) (5% each) Also estimate the settling time, peak time, and steady-state error.

本試題雙面印製

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4. (25%) For the unity feedback system with the forward transfer function

$$G(s)=\frac{K}{s(s+3)(s+5)}$$

(a) (10%) Sketch the Nyquist diagram for the system.

(b) (5% each) From the diagram, find the range of gain, *K*, for stability, instability, and the value of gain for marginal stability.