

國立中正大學

111 學年度碩士班招生考試

試題

[第 1 節]

科目名稱	控制系統
系所組別	電機工程學系-電力與電能處理甲組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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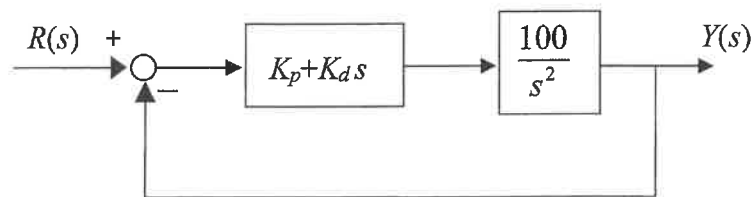
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系所組別：電機工程學系-電力與電能處理甲組

1. (30%) A PD control system is shown in the following figure. Construct a parameter plane of K_p versus K_d (K_p is the vertical axis) and show the following trajectories.

- Trajectories on which the damping is critical.
- Trajectories on which the parabolic-error constant is 1000.
- Trajectories on which the system is pole-zero cancellation.



2. (50%) Given a closed-loop unity-feedback control system described by the state equations

$$\dot{x} = \begin{bmatrix} -2 & -1 & 0 \\ 0 & 0 & -1 \\ -K & 0 & -10 \end{bmatrix} x$$

- Apply the Nyquist criterion to determine the range of K so that the system is asymptotically stable.
- Check the answer obtained in part (a) with the Routh-Hurwitz criterion.
- Construct the root locus for $K \geq 0$.
- Find the value of K so that the gain margin of the system is 20 dB.
- Find the value of K so that the phase margin of the system is 45° .

3. (20%) Given the system

$$\frac{dx(t)}{dt} = Ax(t) + Bu(t), \quad y(t) = Cx(t)$$

where $A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$, $C = [1 \ 1 \ 1]$

- Find the state-transition matrix $\phi(t)$.
- Transform the state equations into the observability canonical form (OCF) and find the transformation matrix Q where $x(t) = Q\bar{x}(t)$.