

國立中央大學104學年度碩士班考試入學試題

所別：機械工程學系碩士班 丁組(系統)(一般生)

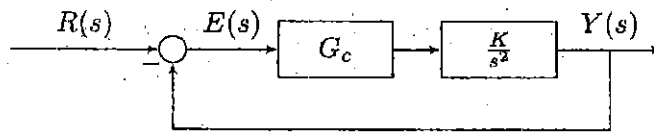
科目：自動控制 共 2 頁 第 1 頁

機械工程學系光機電工程碩士班 甲組(機電系統控制)(一般生)

機械工程學系光機電工程碩士班 乙組(光機)(一般生)

本科考試可使用計算器，廠牌、功能不拘

*請在答案卷(卡)內作答



1. Given the control loop shown,

- (3 points) Sketch the root-locus when $G_c(s) = 1$.
- (2 points) Obviously, the system is marginally stable and requires improvement. If the dominant closed-loop poles are located at $s = -1 + j1$, which (lag or lead), $G_c(s) = \frac{s+z}{s+p}$ controller, should be used.
- (10 points) Design the controller you select, assuming $z = 0.5$.
- (5 points) What is the K gain when the compensated system hits the dominant poles and what is the third pole.
- (5 points) Show the geometrical pole-zero locations while designing/solving this control problem.

2. A block diagram of a space vehicle control system is shown in the Figure 2.

- (13 points) Determine the gain K such that the phase margin is 50° .
- (12 points) What is the gain margin in this case?

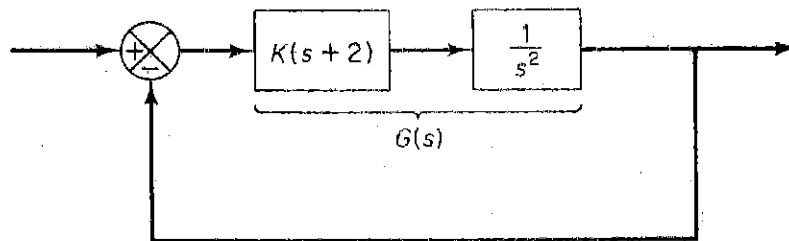


Figure 2.

3. Consider a system with an unstable plant as shown in Figure 3. Using the root-locus approach, design a proportional-plus-derivative controller (PD controller) for the closed system. The parameters K_p, T_d and T_I are parameters of the controller (represented by $C(s)$).

- (5 points) Among K_p, T_d, T_I , which parameter in $C(s)$ is zero for a PD controller?
- (5 points) Please derive the closed loop transfer function from $R(s)$ to $Y(s)$ (The transfer function contains the parameters K_p, T_d, T_I).
- (5 points) Find the region of K_p (in term of T_d and T_I) for the PD controller to stabilize the closed loop system.
- (10 points) Consider the transfer function in (b), if we wish the damping ratio (usually denoted by ζ) of the closed-loop system equal to $1/\sqrt{2}$ and the undamped natural frequency (usually denoted by ω_n) equal to 2, please determine the values for the parameters of the PD controller.

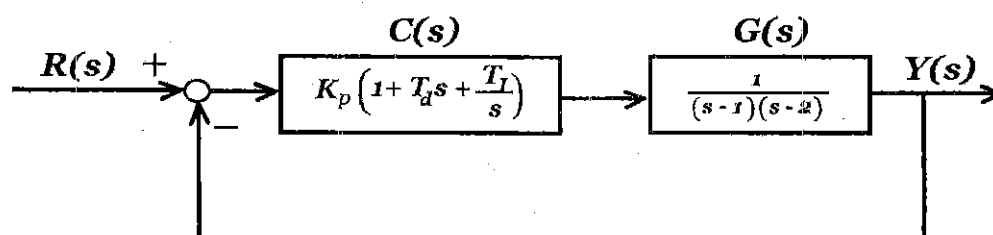


Figure 3.

注意：背面有試題

參考用

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4. Consider the following system as shown in the Figure 4.

(a) (13 points) If $K = 6$, find the value of α to make the system Type 1.

(b) (12 points) Find the corresponding velocity constant K_v .

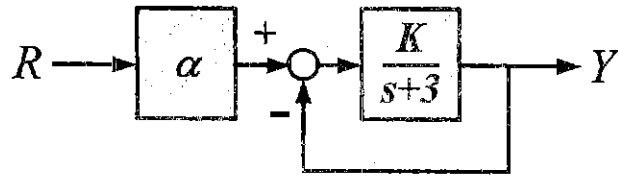


Figure 4.

參考用

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