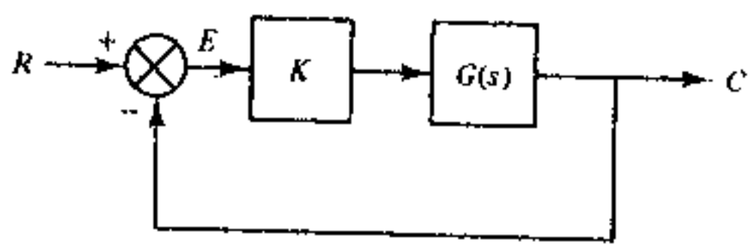
九十二學年度 工程與系統科學 系（所） J 組碩士班研究生招生考試

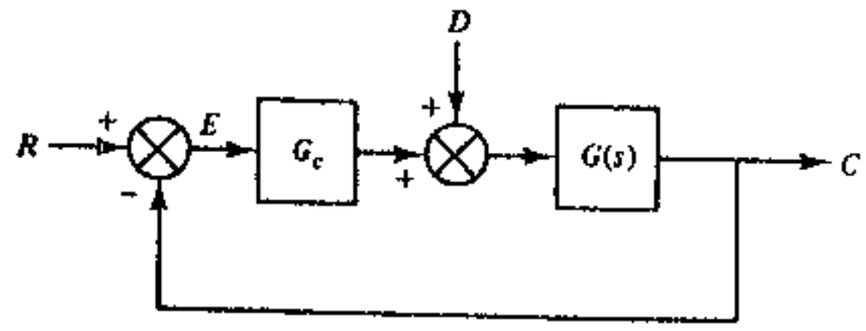
科目 控制原理 科號 3905 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

1. Consider a system with one minimum-phase zero.
   (a) What is minimum-phase zero?
   (b) What phenomenon does this system possess when responses to a step input?
   (c) Can this phenomenon be eliminated by feedback control? (10%)

2. Consider the system shown below with $G(s) = 1/[(s+1)(s+10)]$:
   (a) How long would transients take to decay almost completely if there were no feedback?
   (b) What is the characteristic equation of the closed-loop system, and where must the dominating system pole be located if the time in part (a) is to be halved?
   (c) What value of K will achieve this?
   (d) What is the corresponding steady-state error for a unit step input? (15%)



3. Consider the system shown below. Let $G(s) = 1/[s^2(\tau s+1)]$ and $G_c(s)$ be P, I, D, or their combinations. A unit step input is applied to D. The steady-state error due to disturbance is required to be zero. Design the simplest controller and explain your reason. (20%)



4. Sketch the root locus with respect to K for the equation $1 + KG(s) = 0$, where $G(s) = 1/[(s+1)(s+3)(s^2+4s+5)]$ (20%) (K>0)

5. Consider a system with transfer function
   $G(s) = 1/[(s+1)(0.1s+1)]$
   Determine the frequency at which the output lags the input by 90° and find the ratio of output to input amplitude at this frequency. (15%)

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6. The figure shown below is the frequency response of a stable open-loop system for gain K=1 on the complex plane.
   (a) Determine the appropriate transfer function.
   (b) Sketch the Nyquist plot.
   (c) Determine the limits on K for stability. (20%)