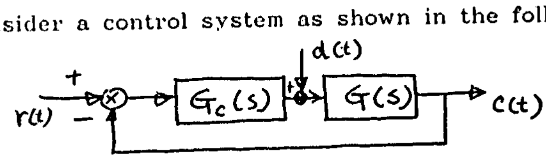
國立成功大學 81 學年度 機研所成組 考試(自動控制 試題) 共 2 頁 第 1 頁

1. Consider a control system as shown in the following figure



where,

Gc(s): transfer function of PID controller
G(s): transfer function of a second-order linear time-invariant system
r(t): input command as function of time
c(t): output time-domain response
d(t): disturbance as function of time

(1) Provide a time-domain procedure for identification of G(s).
(2) Explain the control action by Gc(s) in time domain.
(3) Find optimal PI gain for regulating system response such that ISE (Integral square error) can be minimized.
(4) Provide time-domain tracking specifications for ramp input by the control system.
(5) Use finite difference to approximate differential and provide a simulation algorithm to verify (3).
(50% with 10% for each question)

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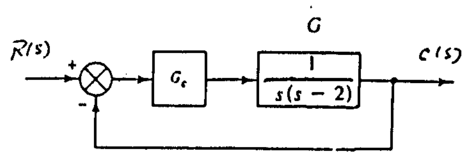
2. In the following feedback control system, the plant is open-loop unstable.

(a) Plot the root loci to determine whether the system can be stablized by P control $G_c = K_c$.

(b) If not, could the stable pole of G be canceled by a zero of G_c to stablize the system, and if not, why not?

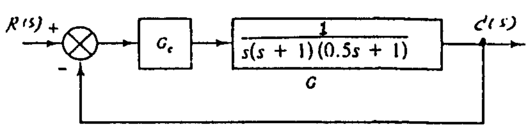
(c) Choose an idealized controller that can stabilize the system, and find the corresponding range of gains for stability. (15%)



3. (a) Describe the Nyquist Criterion and its purpose for the feedback control system.

(b) Explain the reason why that the criterion have the above function you have stated. (15%)

4. Consider a feedback control system as follows:



(a) Plot the asymptotic Bode plot, if $G_c = 1$.

(b) Find the approximate values of the phase margin and gain margin?

(c) If you want to get a larger phase margin 50°), how can you design a controller to satisfy the condition?

(d) What will be the crossover frequency and the value change of the gain margin and phase margin? (20%)