國立臺灣師範大學 101 學年度碩士班招生考試試題

科目：**自動控制**　　適用系所：**機電科技學系**

注意：1.本試題共 3 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

1.Basic structure of a negative feedback control system is shown in Fig. 1, define the symbols of controlled system element is J, command input is A, and the output signal is K. Please fit all elements and signals into its location in Fig. 1. (Note: please redraw Fig.1 in the answer sheet and fill the answers in each block and line.) (17 分)

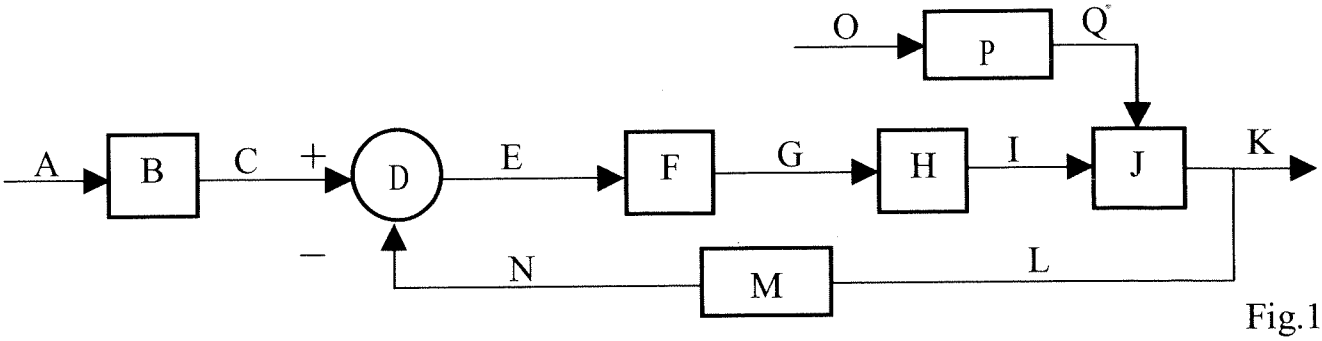

Fig.1

Answer:

- Actuator element
- Command input
- Controlled system
- Reference input elements
- Reference input signal
- Error detector
- Feedback signal
- Feedback element
- System error signal
- Output signal
- Disturbance input signal
- Control signal
- Manipulated variable
- Disturbance transfer function
- Controller
- Disturbance

2. A gain-limited integrator with the parameters R_1=10kΩ , R_2=1kΩ, R=5kΩ, C=0.05μF is shown in Fig. 2.

(a)Use impedance approach to find the transfer function between input node(e_i) and the output node(e_0).(5 分)

(b)What are the AC gain and DC gain for the circuit?(5 分)

(c)Find the time constant τ in the circuit.(5 分)

(d)When drive a input voltage $e_i(t)$=1 Volt, please find the expression in time domain of output voltage $e_0(t)$? (5 分)

(e)What are the main function of the circuit?(5 分)

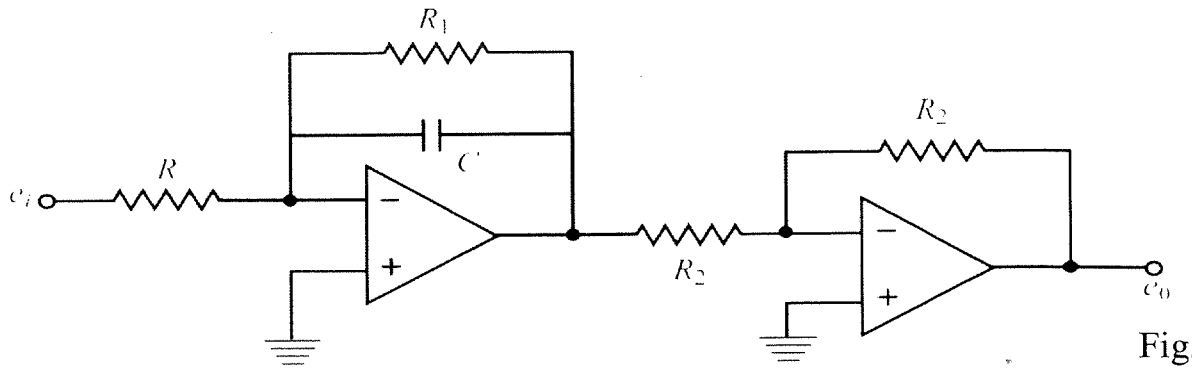

Fig.2

3. A unity feedback system is shown in Fig. 3.

(a)Determine the range of values of K gain (K>0) such that the system is stable.(10 分)

(b)Determine the gain margin (G. M.) of the system.(Note: log 5=0.6989, log 6=0.7782, log 7=0.8451, log 8=0.9031) (5 分)

(c)For the gain that results in marginal stability, determine the oscillation frequency.(5 分)

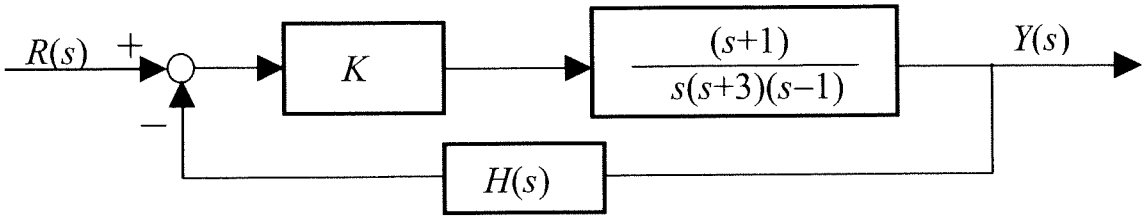

Fig.3

4. A single-axis robot system has a block diagram given in Fig.4. The input signal is a voltage represents the desired angel θ_r and amplifier gain is 500.

(a)Find the steady-state error(e_{ss}) of the system when $\theta_r=90^0$ with (1)$D(s)$=1, (2)$D(s)$=1+0.5s, (3)$D(s)$=2+1/s. (12 分)

(b)What is the effect of the derivative term in the PD controller on e_{ss}?(5 分)

(c)What is the effect of the integral term in the PI controller on e_{ss}?(5 分)

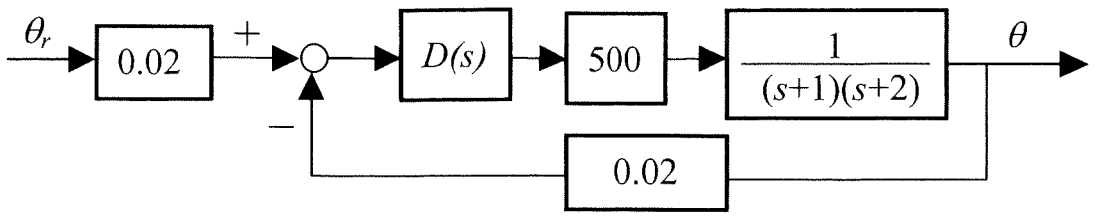

Fig.4

5. Figure 5 shows the system frequency response data on Bode plots.

(a)Find: (1)gain crossover frequency ω_g, (2)gain margin *G.M.*, (3)phase crossover frequency ω_ϕ, and (4)phase margin *P.M.*(12 分)

(b)Assume that the system has minimum phase transfer function, estimate the transfer function.(4 分)

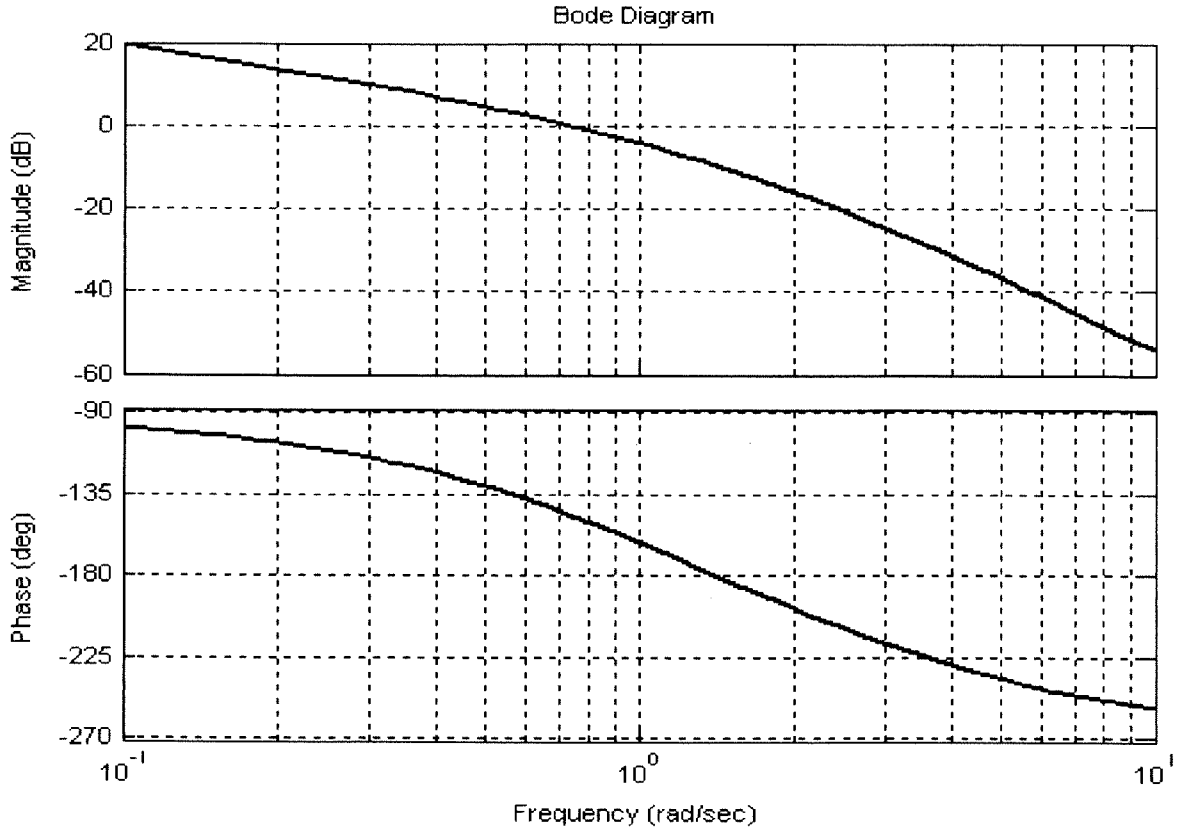

Fig.5