國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：自動控制【機電系碩士班丙組】　　題號：438003

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）　　共2頁第1頁

1. (10%) The forward-path transfer functions of a unit-feedback control system are given in the following:

   (a) $G_1(s)=\dfrac{K(s+0.5)}{s^2(s+4)}$ (b) $G_2(s)=\dfrac{K(s-2)}{s(s+2)(s^2+5s+25)}$

   Construct the root loci for $K>0$.

2. (20%) Obtain the closed loop transfer function $\theta_o(s)/\theta_i(s)$ of the system shown in Fig. 1. Find the range of K required for stability. Also find the gain K required for 25% overshoot.

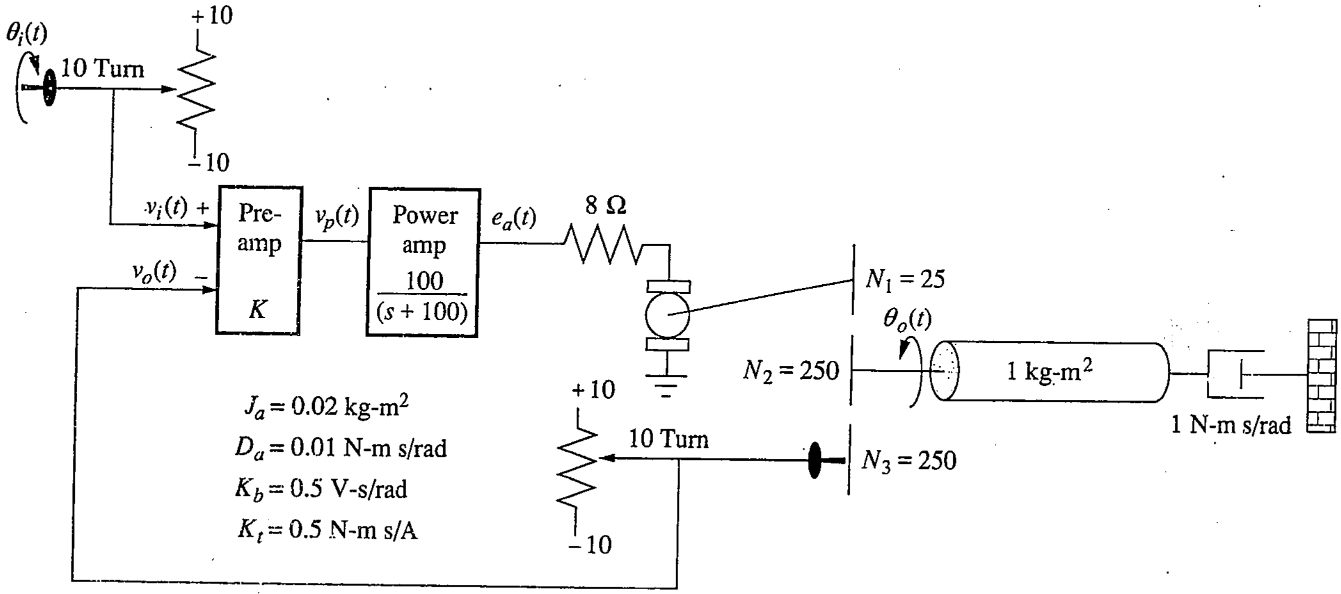

Fig. 1

3. (20%) In Fig. 2, let $G_p(s)=\dfrac{4}{s^2}$ and $G_c(s)=K_p+K_d s$.

   (a) Find the values of K_p and K_d so that the roots of the characteristic equation correspond to a relative damping ration of 0.707 and $\omega_n=1$ rad/sec. Plot the unit-step response and find the maximum overshoot.

   (b) Find the values of K_p and K_d so that the overshoot is zero and the rise time is less than 0.06 sec.

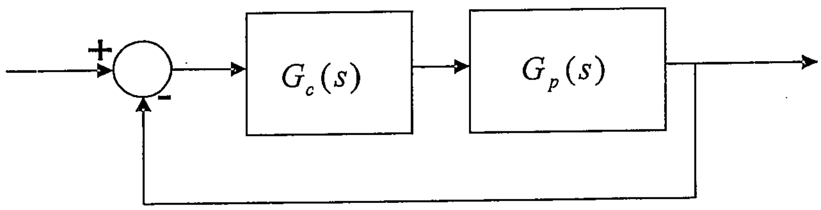

Fig. 2

4. (20%) Let $G_1(s)=\dfrac{1}{s+1}$ and $G_2(s)=\dfrac{1}{s+2}$, represent the transfer functions of two control systems.

   (a) Which system has faster speed of response? Why?

   (b) Which system has larger bandwidth? Why?

   (c) Which system has smaller overshoot? Why?

   (d) What is the steady-state response of G_1 if its input is $\cos(2t)$?

5. (30%) For the system shown in Fig. 2, here we assume that $G_p(s) = \dfrac{4}{s^2 + 1.4s + 1}$ and $G_c(s) = K_p$.

(a) What will happen to the phase margin of the closed-loop system if we increase K_p?
(b) What will happen to the bandwidth of the closed-loop system if we increase K_p?
(c) What will happen to the time constant of the closed-loop system if we increase K_p?
(d) What will happen to the maximum value of the closed-loop system frequency response if we increase K_p?
(e) What will happen to the resonant frequency of the closed-loop system frequency response if we increase K_p?
(f) Can the closed-loop system become unstable if K_p is excessively large? Why or why not?