國立臺北科技大學

九十四學年度機電整合研究所入學考試

自動控制試題

填准考證號碼　　　　　　　　　　　　　第一頁　共二頁

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. 20% For the mechanical system shown in Figure 1-1, in which $m = 1$, $b = 2$, $k = 2$,
   - A. Consider the motion of the massless cart $u(t)$ as the input, and the motion of the mass m, $y(t)$, as the output with all initial conditions are zero. Derive the transfer function of this system.
   - B. If the input function $u(t)$ is drawn as shown in Figure 1-2, what is the output function $y(t)$?

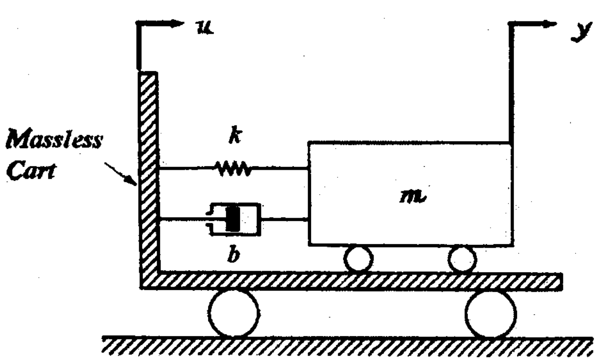


Figure 1-1

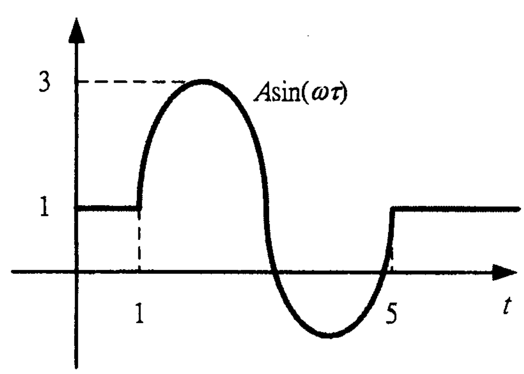


Figure 1-2

2. 20% A system as shown in Figure 2 is required to have the following specifications

   i. Percentage Overshoot < 5%

   ii. Settling Time < 2sec

   A. Draw the permissible area on the s-plane, which satisfies the above requirements.

   B. Determine the value K, p and locations of the poles such that one pole, s_1, has minimum undamped natural frequwncy ω_n and another, s_2, whose magnitude is 4 times of s_1

   C. Draw the Bode diagrams of the loop transfer function selected in B and determine the Gain Margin and Phase Margin.

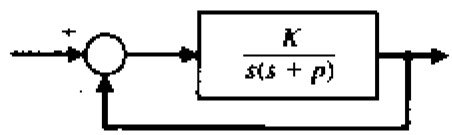


Figure 2

3. 20% For the system shown in Figure 2. if the parameters is chosen as $K = 4$, $p = 2$, design a compensator so that the static velocity error constant K_v is 20/sec, the phase margin is at least 50° ,and the gain margin is at least 10 dB.

4. 20% A continuous control plant $G_p(s)$ is discretized with sampling time T =1 and zero-order-hold and has an overall discrete transfer function,

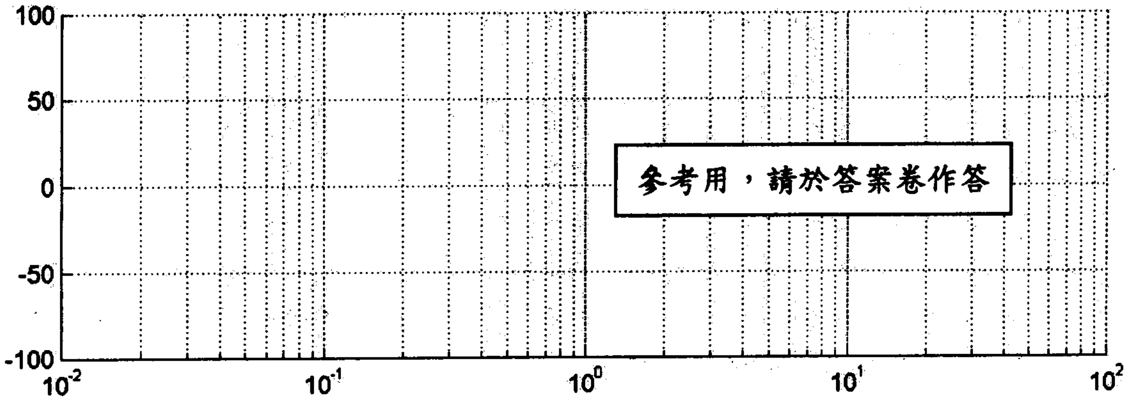
$$G(z) = \frac{0.3678z + 0.2644}{(z-1)(z-0.3678)}$$

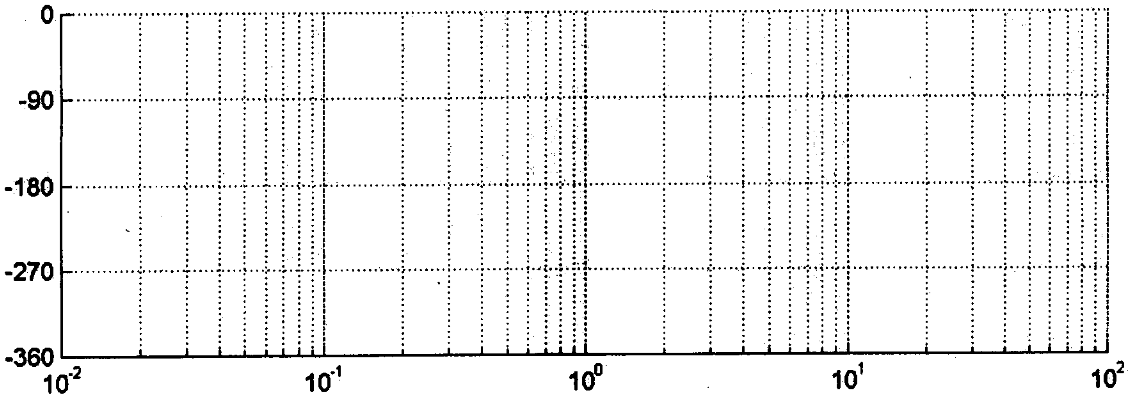
   A. Determine the stability of this discrete system.

   B. Determine the transfer function of the continuous plant $G_p(s)$.

   C. If the system hardware is upgraded such that the sampling time is shorten as T = 0.1, determine the new corresponding discrete transfer function.

注意：背面尚有試題


100
50
0
-50
-100
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
參考用，請於答案卷作答


0
-90
-180
-270
-360
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}

5. 20% For a minimum phase plant G(s) as shown by the Nichols chart in Figure 3,

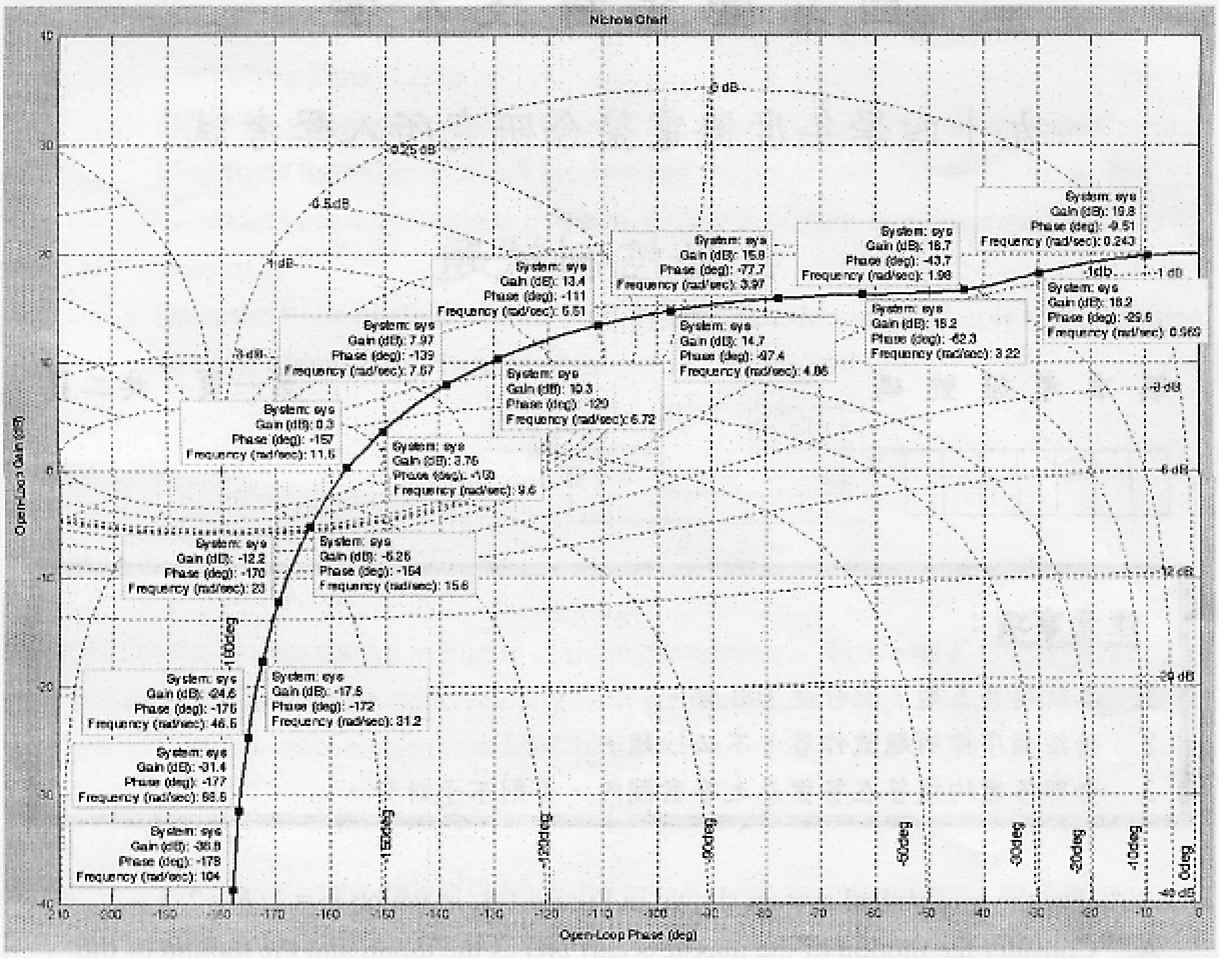


Figure 3

A. Determine the Gain and Phase Margin of this plant G(s).

B. Determine the transfer function of the plant G(s) shown.

C. If a unity negative feedback gain H = 1 is applied to this plant, what is the Gain and Phase margins of this feedback system.

D. For the unity negative feedback system, determine if there is any pole of which the real part is between -2 and -4.