

# 國立臺北科技大學 102 學年度碩士班招生考試

系所組別：1320 車輛工程系碩士班乙組

## 第一節 自動控制 試題

第一頁 共一頁

### 注意事項：

1. 本試題共 4 題，每題 25 分，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (25%) There is a rotational system shown in Fig.1.

(a) Write the dynamic differential equations of this system. (15%)

(b) Set  $x_1 = \theta_m$ ,  $x_3 = \theta_1$ ,  $x_5 = \theta_2$ , and  $x_2, x_4, x_6$  are the change rates of  $x_1, x_3, x_5$ , respectively. A potentiometer is connected to the disk  $J_2$ . Write the state equation of this system. (10%)

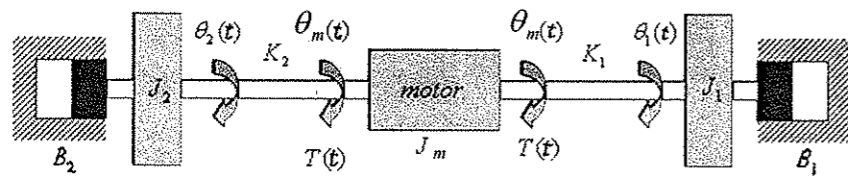


Fig.1 A rotational system

2. (25%) An open-loop system is shown in Fig.2.

(a) If this open-loop system can be approximated as  $\frac{C}{(s + \lambda_1)(s + \lambda_2)}$ , and it has a unit-step response similar to that of the original system. How to find the values of  $\lambda_1, \lambda_2, C$ ? And what's the reason? (10%)

(b) A positive gain  $K$  is added before the plant in Fig.2 to form a unity feedback system. Find the range of  $K$  to make the system stable. (15%)

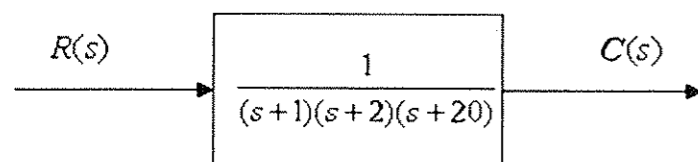


Fig.2 An open-loop system

3. (25%) A unit step response is shown in Fig.3.

(a) Find the transfer function of the system. (20%) (overshoot (%) =  $e^{-(\zeta\pi/\sqrt{1-\zeta^2})} \times 100$ )

(b) Supposed that the poles of your system locate at  $-a \pm jb$ . If the poles are moved to make the new response damp out more rapidly while the response frequency remains the same. Give one possible set of pole locations, and explain your choice. (5%)

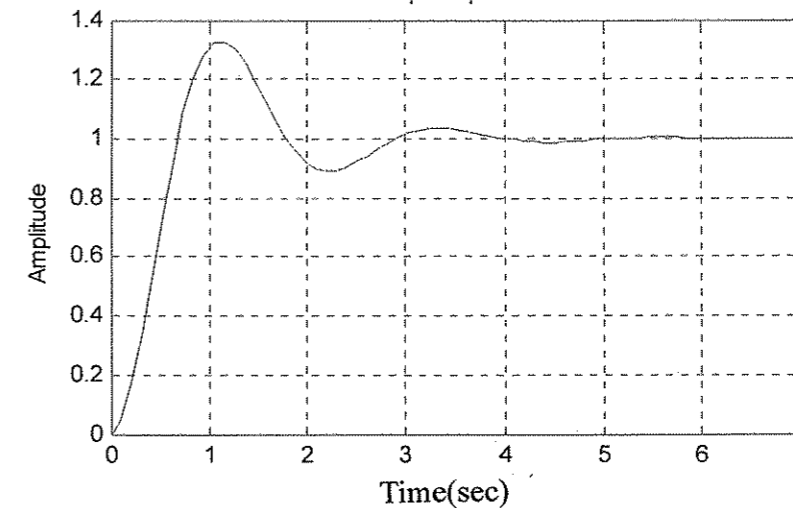


Fig. 3 unit step response

4. (25%) The open-loop frequency response of a plant, used in a unity feedback system is shown in Fig.4.

(a) Find the bandwidth, gain margin and phase margin. (10%)

(b) Determine the transfer function of this system approximately. (15%)

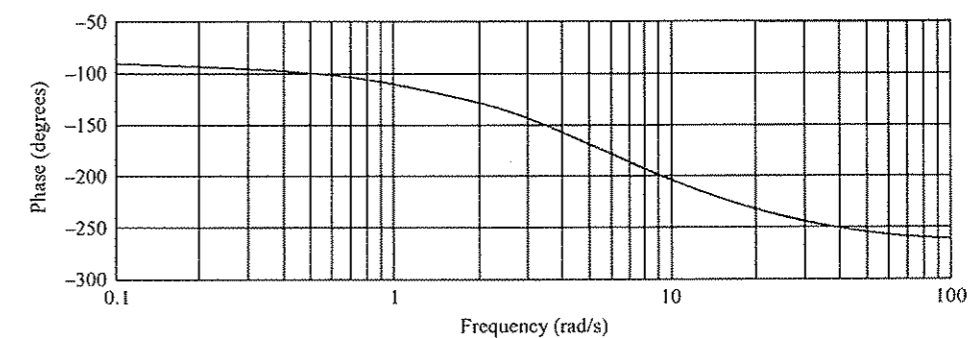
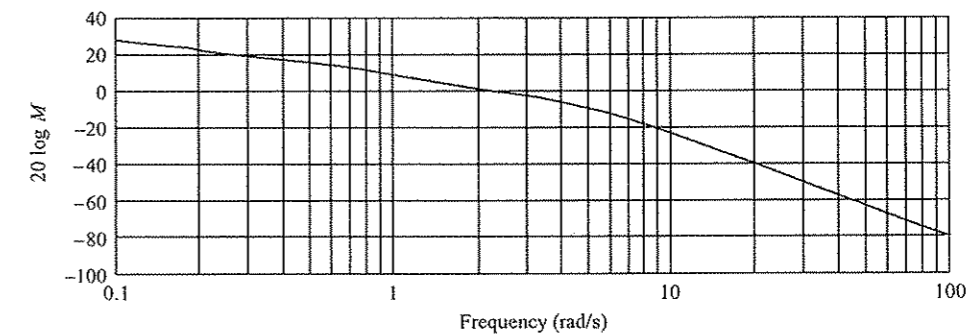


Fig.4 The open-loop frequency response.