

國立臺北科技大學

104 學年第一學期電機系博士班資格考試

控制系統(大學部) 試題

第一頁 共二頁

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注意事項：

1. 本試題共 7 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。
5. 可用計算機。

1. (20 %) Answer “Right” or “Wrong” for the following statements:
 - (a) A controllable system can be stabilized using state feedback.
 - (b) The controllability of a system can be changed via coordinate transformation.
 - (c) The zeros of a system can be moved using state feedback.
 - (d) The steady state error can be remedied using P controller.
 - (e) The bandwidth is enlarged when phase-lead compensation is applied.
2. (15 %) Explain briefly the following terms:
 - (a) Disturbance rejection.
 - (b) Gain margin.
 - (c) Robust stability.

3. (15 %) Draw the unit-step time response for the systems with the following transfer functions:

(a) $H_1 = \frac{1}{s+1}$;

(b) $H_2 = \frac{s-1}{s+1}$;

(c) $H_3 = \frac{s+1}{s-1}$.

(In your plots, the transient behavior and steady state should be drawn clearly.)

4. (15 %) (a) Find the approximate linear system at (-1, 2) for

$$\dot{x}_1 = x_1 + x_1x_2 + 3$$

$$\dot{x}_2 = -2x_2 - x_1x_2 + 2$$

(b) Is it stable at (-1, 2)?

5. (10 %) Consider that a feedback control system has the following characteristic equation:

$$s^3 + 2000s^2 + 150000s + 1.2 \times 10^6 K = 0$$

Determine the range of the K so that the system is asymptotically stable.

6. (10 %) Determine the controllability and observability of the following system:

$$A = \begin{bmatrix} 1 & 1 & -1 \\ 0 & 1 & 0 \\ -1 & -3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad C = [1 \quad 0 \quad 0]$$

7. Apply the gain formula to the SFGs in Fig. 1 to find the following transfer functions:

(a) (5 %) Y5/Y1

(b) (5 %) Y2/Y1

(c) (5 %) Y5/Y2

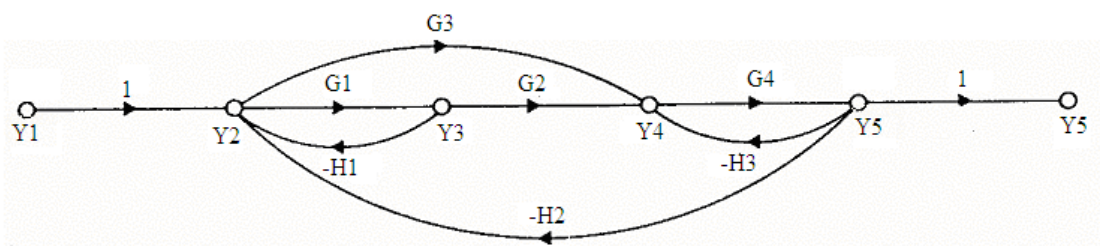


Fig. 1