國立中央大學八十八學年度碩士班研究生入學試題卷

所別：電機工程研究所 丙組　科目：控制系統　共 2 頁 第 1 頁

1. The Nyquist diagram of the following loop gain polynomial is given in Fig. 1 for some gain K. Assume $T_1 > 0$ and $T_2 > 0$.

$$G(s) = \frac{K(s+T_2)}{s(s-T_1)}$$

Answer the following questions:

5% (a) There are ______ right half-plane loop gain poles.

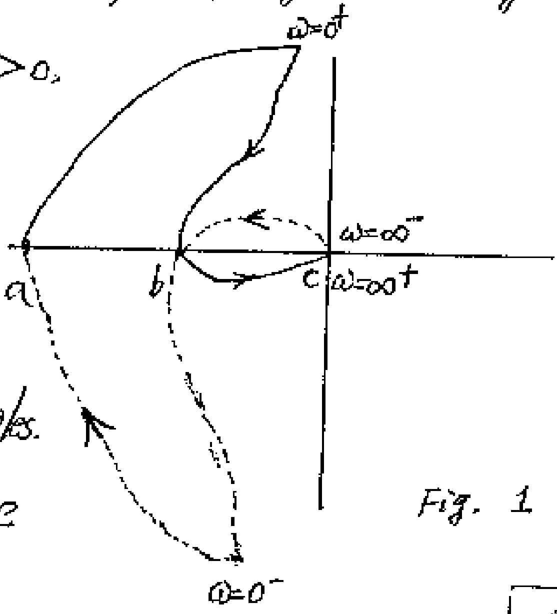


Fig. 1

Fill out the following chart given the ranges of locations of the -1 point.

	Range where -1 point is found	Number of clockwise encirclements of -1	Closed-loop system is stable or unstable
10% (b)	Between a and b		
10% (c)	Between b and c		

2. Given $G(s) = \dfrac{K}{s^4+6s^3+13s^2+12s+4}$, find the values of K for which the system shown in Fig. 2 is stable. (15%)

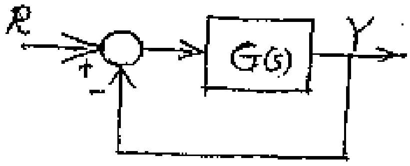


Fig. 2

3. please explain the effect that right half-plane zeros cause the response to start off in the wrong direction before recovering. (10%)

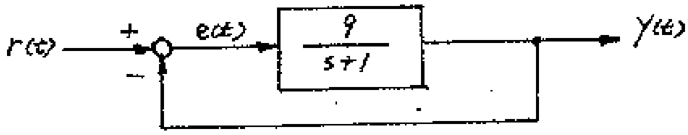
參考用

注意：背面有試題

4. Find the complete steady-state error $e_{ss}(t)$, if

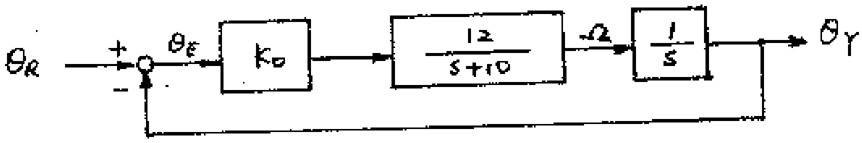
$r(t) = 4.00 + 0.200 \cos 377t$.

10%



5. Consider the following system which represents the control of one axis of a motor-driven optical tracking system. Assume that the desired tracking performance is obtained only if the steady-state angular error is less than or equal to 0.01 rad with an input signal that is changing at a constant rate of angular variation of 0.05 rad/s. The input signal, $\theta_R(t)$, is $0.05t$ rad. To obtain a desired degree of transient stability, the system must also exhibit a damping ratio of 0.6 or greater. Determine K_0 such that all specifications are satisfied.

10%



6. Consider the plant model.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 3 \end{bmatrix} u = AX + Bu$$

$$Y = \begin{bmatrix} 5 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

(1) Design a full state observer to estimate the state of the plant, and describe the model of the observer. Place the eigenvalues of the observer at $s = -15$. 10%

(2) Using the plant model and the observer in the above, implement output feedback such that the roots of $\det[sI - A + BK]$ are located at $s = -5.0$. Determine the state model of the closed-loop system. 10%

(3) Evaluate the eigenvalues of the closed-loop system. 10%