大同大學 九十 學年度研究所碩士班入學考試試題

考試科目：控制系統　　　所別：電機工程研究所　　　第2/2頁

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

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4. The forward-path transfer function of a unity-feedback control system is

$$G(s) = \frac{K}{(s+4)^4}.$$

   (a) Construct the root loci of the characteristic equation of the closed-loop for $K \geq 0$ including the asymptotes, departure angles and breakaway points for each pole. (8%)

   (b) What is the range of values of K for which the system is unstable? (6%)

5. The block diagram of a guided-missile attitude-control system is shown in Fig. 3. The command input is $r(t)$, and $d(t)$ represents disturbance input.

   (a) Let $G_c(s) = 1$ and set $d(t)$=0. Find the steady-state value of $e(t)$ when $r(t)$ is a unit-step function. (6%)

   (b) Let $G_c(s) = 1$ and set $r(t)$=0. Find the steady-state value of $y(t)$ when $d(t)$ is a unit-step function. (6%)

   (c) Let $G_c(s) = (s+\alpha)/s$, $\alpha > 0$, and set $r(t)$=0. Find the steady-state value of $y(t)$ when $d(t)$ is a unit-step function. (6%)

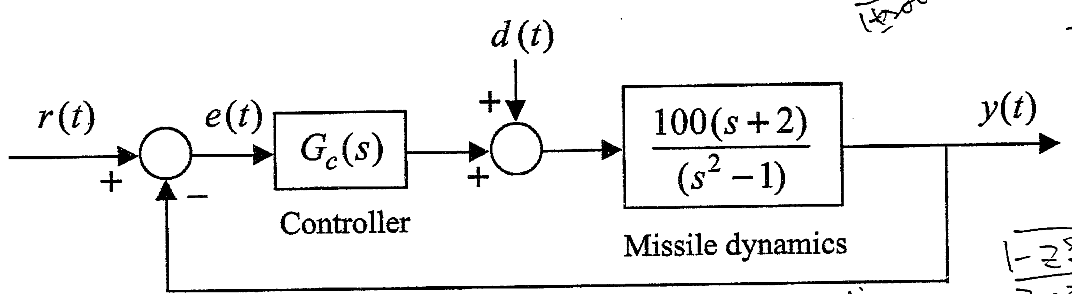

Fig. 3

6. The block diagram of the discrete data control system is shown in Fig. 4.

   (a) Find the transfer function $G_T(z) = Y(z)/R(z)$ of the system. (8%)

   (b) Find $Y(z)$ when the input $r(t)$ is a unit-step function. (6%)

   (c) Find $y(kT)|_{k\to\infty}$ when the input $r(t)$ is a unit-step function. (6%)

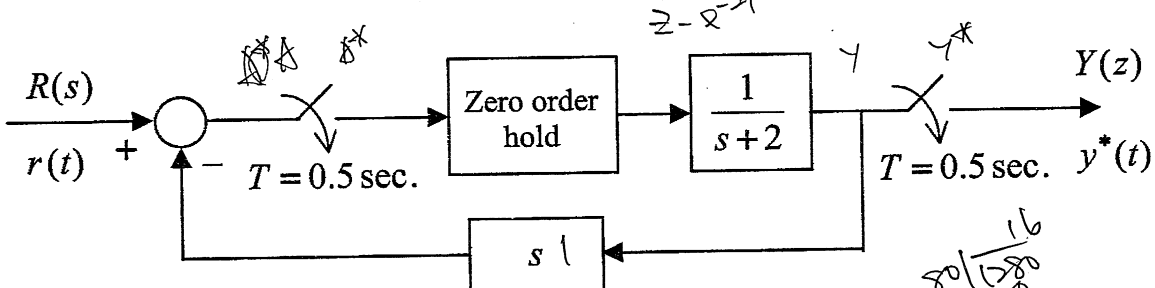

Fig. 4

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考試科目：控制系統　　所別：電機工程研究所　　第1/2頁

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1. Consider the block diagram of the system shown in Fig. 1.
   (a) Find the impulse response of $y_1(t)$. (5%)
   (b) Find the impulse response of $y_2(t)$. (5%)
   (c) Find the value of $y_2(\pi/2)$. (5%)

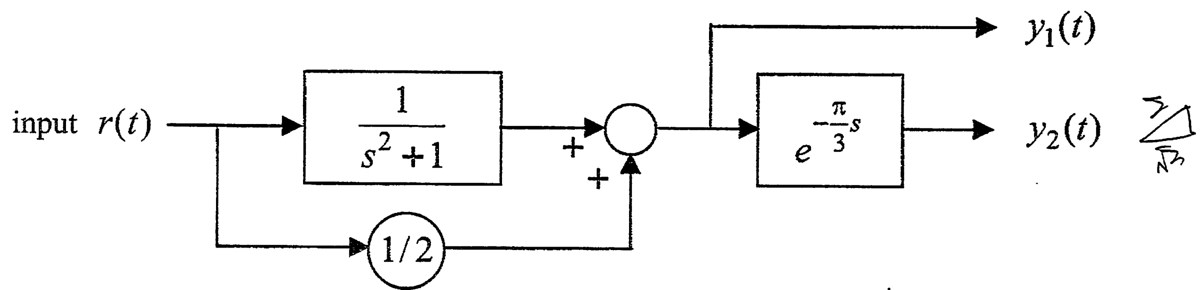

Fig. 1

2. The state equation of the linear time invariant circuit system shown in Fig. 2 is

$$\dot{\mathbf{x}}(t)=\begin{bmatrix}0 & -7\\ 1 & -8\end{bmatrix}\mathbf{x}(t)+\begin{bmatrix}7\\ 8\end{bmatrix}u(t),\ \text{where}\ \ \mathbf{x}(t)=\begin{bmatrix}i_L(t)\\ v_C(t)\end{bmatrix}.$$

Y(lnA - lnV)

$\dot{x}(0)=Ax(0)$

   (a) Find the value of R, L and C. (9%)
   (b) If input $u(t)=0$, under the certain initial state $\mathbf{x}(0)=\begin{bmatrix}i_L(0)\\ v_C(0)\end{bmatrix}$, the output $y(t)=v_C(t)=-e^{-t}+7e^{-7t}$, $t\geq 0$. Find the initial state vector $\mathbf{x}(0)$. (6%)

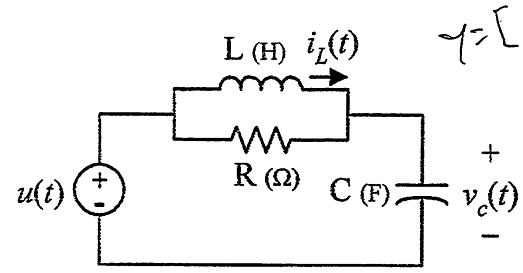

Fig. 2

3. The flow of traffic in a single lane can be described by the following dynamical equation:

$$\frac{dy}{dt}=V-Ae^{-\alpha/y},$$

where y = relative distance between two cars,
V = constant velocity of the lead car,
A,α = real positive constants.

   (a) Obtain the equilibrium value Y that results in dy/dt=0. (6%)
   (b) Obtain the range of V/A in $0\leq V/A\leq\infty$ for which $Y>0$. (6%)
   (c) Linearize the equation around Y, and write the resulting linearized equation. (6%)

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