

國立台灣科技大學九十七學年度碩博士在職專班招生試題

系所組別： 自動化及控制研究所博士在職專班

科 目： 自動控制系統

總分 100 分

1. For a unity feedback hydraulic position servo with loop gain function

$$\frac{K}{s(0.5s^2 + s + 1)}$$

Sketch the loci of the closed-loop system poles for varying K and find the limiting value of K for stability. (15%)

2. Find the output $x(t)$ of a system described by the differential equation

$$2\ddot{x} + 2\dot{x} + x = 1, \quad x(0)=0, \quad \dot{x}(0) = 2. \quad (15\%)$$

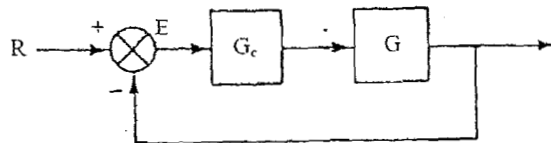
3. What is the transfer function of a system whose input and output are related by the following differential equation?

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 2y = u + \frac{du}{dt} \quad (10\%)$$

4. In the Figure as shown below, $G(s) = K_b/(ms^2 + bs + k)$ represents a lightly damped spring-mass-damper system controlled by a hydraulic servo of which the transfer function can be approximated by a constant K_b over the frequency range of interest. It is specified that the system must follow ramp inputs with zero steady-state error.

(1) Sketch loci to determine whether the simplest possible controller which will meet the error specification can be used. (5%)

(2) Sketch the general shapes of the loci for $G_c = K(s+a)/s^2$ for some positions of the zero $-a$ from far left to close to the origin. (5%)



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5. Explanation: (20%)

- (1) CNC
- (2) PAC
- (3) PID control
- (4) Gain Margin

6. State the characteristics of the Laplace Transform method and use it to solve the following system with initial conditions. (15%)

$$x' - 2y' = 1$$

$$x' - x + y = 0$$

where $x(0)=0$, $y(0) = 0$ 7. Consider a matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$

- (1) Find the eigenvalues and eigenvectors. (8%)
- (2) Suppose $A^8 = \alpha A + \beta I$, calculate α and β . (7%)

