

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0395

Roll No.

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B. Tech.

(SEM. VIII) THEORY EXAMINATION 2010-11

## OPTIMAL CONTROL

Time : 3 Hours

Total Marks : 100

Note : (1) Attempt all questions.

(2) All questions carry equal marks.

1. Attempt any two parts : (10×2=20)

(a) What is the optimal control problem? How is it formulated? Explain with an example.

(b) Enlist the procedure followed in dynamic programming. What are the disadvantages of dynamic programming? Explain.

(c) What is the two-point boundary value?

2. Attempt any two parts :

(a) Figure 1 shows the optimal control servo system. Both the position  $\theta$  and angular velocity  $\dot{\theta}$  are to be controlled.

TIC801/RFW-21937

control

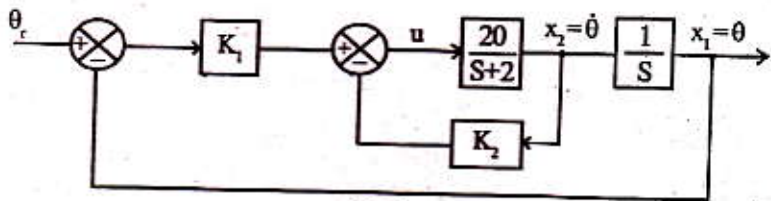


Fig.1

It is desired to regulate the angular position to a unit-step function  $\theta_r$ . Find the optimum values of the gains  $K_1$  and  $K_2$  that minimize

$$J = \int_0^{\infty} \{ [x_1 - \theta_r]^2 + u^2 \} dt$$

- (b) Explain the discrete time linear state regulator and compare it with the continuous time linear state regulator.
- (c) What is the Minimum-time control for Linear Time Invariant systems? Explain.

3. Attempt any two parts :

(10×2=20)

- (a) What are Stochastic processes? Give examples. How a control problem is classified between stochastic and deterministic?
- (b) Consider the combined estimation and control problem for the following system :

$$\dot{\mathbf{x}}(t) = -0.5\mathbf{x}(t) + u(t) + w(t)$$

$$y(t) = \mathbf{x}(t) + v(t)$$

$$Q = 6, R = 1, P_0 = 0, t_0 = 0$$

Find the optimal control law that minimizes the following performance index :

$$J = E \left\{ \frac{1}{2} x^2(2) + \frac{1}{2} \int_0^2 \{ 2x^2(t) + u^2(t) \} dt \right\}$$

Also give a suitable scheme for the implementation of the above control.

(c) Explain the Stochastic Optimal Linear Regulator.

4. Attempt any two parts : (10×2=20)

- What do you mean by a Microprocessor ? Explain its architecture.
- Explain the Microprocessor control of a control system with the help of an example.
- What is digital signal processing ? Explain. What are its advantages and disadvantages ?

5. Attempt any two parts : (10×2=20)

- What is quantization ? What are its effects ? On what factors does the quantization error depend ? Explain.
- What do you mean by Pole placement ? Explain the closed loop pole placement. What effect does it have on the transient performance of the control system ?
- Discuss the time delays in microprocessor based control systems.