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Question Paper Code : Z 7215

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Second Semester

Applied Electronics

AN 1653 — DIGITAL CONTROL ENGINEERING

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention any two frequency response specifications.
2. What is the function of compensator in control systems?
3. How is sampling time selected in digital control system?
4. What is meant by zero-order hold circuit?
5. Obtain the Z-transform of delayed step sequence.
6. What are the advantages of canonical state models?
7. What are the Z-plane specifications?
8. What are the advantages of digital controller over analog controller?
9. What are the ill-effects of finite word length?
10. Comment on steady state error in PID control systems.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the difference between frequency and time response analysis of control systems. (10)

(ii) Draw the frequency response of lag and lead compensator and explain. (6)

Or

(b) With suitable mathematical equations, explain the working of PI, PD, and PID controller. (16)

12. (a) (i) Obtain the mathematical of sample and hold circuit. (8)

(ii) Explain the reconstruction process in detail. (8)

Or

(b) (i) With suitable illustrations, explain aliasing. (8)

(ii) Explain the factors limiting the choice of sampling rate. (8)

13. (a) Obtain the response y(KT) of the following system:

$$\frac{Y(s)}{X^*(s)} = \frac{1}{(s+1)(s+2)}$$

where $x(t)$ is the unit-step function and $x^*(t)$ is its impulse - sampled version. Assume that the sampling period T is 0.1 sec. (16)

Or

(b) Obtain three different state space models for the following pulse - transfer function

$$\frac{Y(z)}{U(z)} = \frac{z^3+8z^2+17z+8}{(z+1)(z+2)(z+3)}.$$ (16)

14. (a) Consider the digital control system shown in Fig. 1. Design a digital controller in the w-plane such that the phase margin is 50°, the gain margin is atleast 10 db, and the static velocity error constant K_v is 2 sec^{-1}. Assume that the sampling period is 0.2 sec.

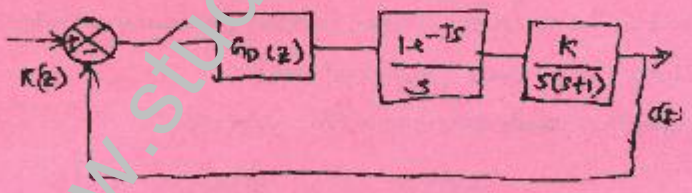

Fig. 1

(16)

Or

(b) Design a digital proportional-plus-derivative controller for the plant whose transfer function is $\frac{1}{s^2}$, as shown in fig. 2. It is desired that the damping ratio 's' of the dominant closed-loop poles be 0.5 and the undamped natural frequency be 4 rad/sec the sampling period is 0.1 sec. After the controller is designed, determine the number of samples/cycle of damped oscillation.

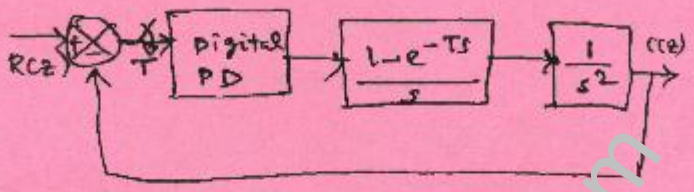

Fig. 2

(16)

15. (a) With suitable block diagram, explain the working of micro controller based temperature control system. (16)

Or

(b) Explain the working of micro controller based motor speed control system. (16)

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