

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

Electrical & Electronics Engineering
(Control Systems, Guidance and Navigational Control, Power System and Control)

01EE6114 Adaptive Control

Max. Marks: 60

Duration: 3 Hours

(Answer any two full questions from each part)

PART A

1. Explain the different types of adaptive schemes with help of block diagram. (9)
2. Design a model following Minimum Degree Pole Placement controller for a continuous time process $G(s) = \frac{1}{s(s+1)}$. The sampling period is 0.5sec. The desired closed loop system has natural frequency of 1 rad/sec and relative damping of 0.7. (9)
3. i) What are the classifications of self-tuning regulators (5)
ii) Explain the significance of exponential forgetting in least square method. (4)

PART B

4. Derive MRAS for a first order system described by the model $\frac{dy}{dt} = -ay + bu$ using Lyapunov method (9)
5. Design a controller using adaptive feedback linearization for system described by $\frac{dx_1}{dt} = x_2 + \theta f(x_1)$, $\frac{dx_2}{dt} = u$, where θ is an unknown parameter and f is a known differentiable function (9)
6. i) What is adaption gain? How the adaption gain is determined for adjusting feed forward gain of a plant with transfer function $kG(s)$, where $G(s)$ is known and k is an unknown parameter? (5)
ii) Explain the stabilization of a nonlinear system using back stepping (4)

PART C

7. Design a gain scheduling controller for the system $\frac{dx_1}{dt} = f_1(x_1, x_2), \frac{dx_2}{dt} = f_2(x_1, x_2, u)$ (12)
so as to get the closed loop system dynamics equivalent to the transfer function
$$\frac{w^2}{s^2 + 2\zeta ws + w^2}$$
8. What are the practical aspects taken in to consideration while implementing an adaptive controller? (12)
9. i) Explain any one application of gain scheduling (6)
ii) What are the operational issues in practical implementation of adaptive control? (6)
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