

## **EE 519: ADVANCED CONTROL SYSTEMS (3-0-0: 3)-Revised**

### **Discrete Time Control System Design**

Issues involved in the method of sampling in practical control systems, frequency folding, bilinear transformation and stability analysis of sample data systems, frequency domain design of digital control system, study of digital optimal dead beat control, digital PID controllers, DDC approach of control systems, position and incremental PID algorithms.

### **State Estimator Based Control Design**

Issues of state feedback design, concept of state estimators, full order and reduced order design of state estimator, compensator design by separation principle, a case study of state estimator based position servo mechanism.

### **Lyapunov Stability Analysis**

Nonlinear systems and equilibrium points, concepts of stability, linearization and local stability, Lyapunov's direct method, system analysis based on Lyapunov's direct method, control design based on Lyapunov's direct method.

### **Sliding Mode Control**

Sliding surfaces, Filippov's construction of the equivalent dynamics, direct implementations of switching control laws, continuous approximations of switching control laws, modeling/performance trade-offs.

### **Adaptive Control**

Basic concepts in adaptive control, adaptive control of first-order systems, adaptive control of linear systems, adaptive control of nonlinear systems, robustness of adaptive control systems, on-line parameter estimation.

### **Textbooks and References:**

1. B. C. Kuo, "Digital Control Systems", Oxford University Press.
2. M. Gopal, "Digital Control Engineering", New Age International.
3. J. C. Doyle, B. A. Francis, A. R. Tannenbaum, "Feedback Control Theory", Mcmillan Publishers.
4. J. E. Slotine and W. Li, "Applied nonlinear control", Prentice Hall.
5. H. J. Marquez, "Nonlinear Control Systems: Analysis and Design", John Wiley Interscience.
6. H. K. Khalil, "Nonlinear Systems", Prentice Hall.
7. V. I. Utkin, "Sliding mode and their application in variable structure system", MIR Publishers.
8. S. Sastry, and M. Bodson, "Adaptive Control: Stability, Convergence, and Robustness", Prentice-Hall.