AMICE24 ADVANCE CONTROL SYSTEMS

UNIT-1 SYSTEMS IN STATE SPACE

1.1 Introduction of state space, modeling of dynamic systems, State-Space Representation in Canonical forms: Diagonal, Controllable, Observable, & Jordan Diagonal canonical form.

1.2 Linear transformations: i) State space to transfer function ii) Transfer function to state space

1.3 Solution of state equation in Laplace transform approach: i) Homogeneous state equations, ii) Non-homogeneous state equations.

1.4 State transition matrix, Properties of state transition matrix, Computation of state transition matrix an analysis of continuous time invariant systems.

1.5 State space representation of discrete-time: State space representation of time-invariant difference equations,

1.6 Discretization of Continuous-Time State-Space Equation,

1.7 Z-Transform Approach to Solution of Discrete-Time State Equations.

UNIT-2 DEFINITIONS

2.1 Controllability, Observability, Stabilizability & Detectability.

2.2 Principle of duality, Design of control systems in state space:

2.3 Design via pole placement method,

2.4 Determination of matrix K using: i) Transformation matrix T, ii) Direct substitution method, and iii) Ackermann,s formula.

2.5 Design of observers: Full and reduced order observers.

UNIT-3 NON-LINEAR SYSTEMS ANALYSIS

3.1 Introduction to non-linear systems, Behaviour of non-linear systems,

3.2 Different methods of linearization,

3.3 Phase plane analysis: Phase plane analysis of linear and non-linear control systems.

3.4 Singular points, Classification of singular points, Constructing phase portraits,

3.5 Limit cycle: existence of limit cycles.

UNIT-4 DESCRIBING FUNCTION ANALYSIS

4.1 Describing function fundamental, Basic assumptions and basic definitions,

4.2 Common Physical non-linearities,

4.3 Describing function of common non-linearities,

4.4 Describing function analysis of non-linear system,

4.5 Stability of limit cycles, Reliability of describing function analysis.

UNIT-5. LIAPUNOV STABILITY ANALYSIS DEFINITIONS

5.1 Systems, Equilibrium state, Equilibrium points.

5.2 Stability definitions: Asymptotic stability, Asymptotic stability in the large, Instability.

5.3 Scalar functions, i) Positive definiteness of scalar functions ii) Negative definiteness of scalar functions iii) Positive semidefiniteness of scalar functions iv) Negatives semidefiniteness of scalar functions v) Indefiniteness of scalar functions

5.4 Quadratic Forms,

5.5 Direct method or Second Method of Liapunov,

5.6 Liapunov's stability analysis of linear system,

5.7 Liapunov's methods in feedback design.

Reference Books:

1. Skelton R. E. Dynamic System Control and Linear System Analysis and Synthesis. John Wiley,1993.
2. Kuo B. C. , Automatic Control System, 7th edition, Prentical Hill, New Delha1995.
3. C. T. Chen Linear System Theory and Design, 3rd edition, Oxfod University Press, U.K. 1998.