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ELECTRICAL MACHINE MODELING & ANALYSIS (Professional Elective-IV)

Learning objectives:

- 1. To know the concepts of generalized theory of electrical machines.
- 2. To represent the DC and AC machines as Basic Two Pole machine.
- 3. To model the electrical machines with voltage, current, torque and speed equations.
- 4. To investigate the steady state and transient behaviour of the electrical machines.
- 5. To understand the dynamic behaviour of the AC machines.

Unit – I

Basic concepts of Modeling

Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine voltage, current and Torque equations.

Unit – II

DC Machine Modeling - I

Mathematical model of separately excited D.C motor – Steady State analysis-Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor

Unit – III

DC Machine Modeling - II & Modeling of Special machines

Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations, modeling of BLDC motor, modeling of Switched Reluctance motor

Unit – IV

Reference frame theory & Modeling of single phase Induction Machines

Linear transformation-Phase transformation - three phase to two phase transformation (abc to $\alpha\beta0$) and two phase to three phase transformation $\alpha\beta0$ to abc -Power equivalence Mathematical modeling of single phase induction machines.

Unit – V

Modeling of three phase Induction Machine

Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-state space model with flux linkages as variables

Unit – VI

Modeling of Synchronous Machine& Special machines

Synchronous machine inductances –voltage equations in the rotor's dq0 reference frame electromagnetic torque-current in terms of flux linkages-three synchronous machine model modeling of PM Synchronous motor.

Text books:

- 1. Electric Motor Drives Modeling, Analysis& control -R.Krishnan- Pearson Publications 1st edition -2002
- 2. P.S.Bhimbra," Generalized theory of Electrical Machines"-Fifth edition, Khanna publishers.

Reference books:

- 1. Analysis of Electrical Machinery and Drive systems P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff Second Edition-IEEE Press.
- 2. Dynamic simulation of Electric machinery using Matlab / Simulink CheeMunOngPrentice Hall.