Modelling and Analysis of Electric Machines - Video course

COURSE OUTLINE

This course deals with the development of mathematical models for electrical machines, suitable for transient analysis of machine performance. The course covers the following topics.

Basics of magnetic circuits - flux, mmf, reluctance - self, leakage, magnetizing and mutual inductances.

Analysis of magnetic circuits with airgap and permanent magnets.

Analysis of singly excited electromechanical system with linear magnetics - nonlinear magnetics using energy and co-energy principles. Derivation of force from co-energy.

Inductances of distributed windings - salient pole, cyclindrical rotor.

Analysis of the doubly excited rotational system with two coils on stator and two on rotor - electrical and mechanical equations.

Reference frames - stator attached alpha-beta, synchronous reference frame, arbitrary speed reference frame - power invariance and non-power invariance.

Derivation of dc machine systems from the generalized machine - electrical and mechanical equations.

Analysis of induction machine - synchronous reference frame - with currents as variables - with rotor flux as variables - basis for vector control - small signal modelling of induction machine.

Analysis of the alternator - synchronous reference frame - derivation of salient and cylindrical rotor machine phasor diagrams - three phase short circuit of alternator and various time constants.

COURSE DETAIL

Modules	No. of lectures
Basics of magnetic circuits.	2
Analysis of magnetic circuits with airgap and permanent magnets.	3
Analysis of singly excited electromechanical system with linear magnetics.	2
Nonlinear magnetics using energy and co-energy principles.	3
Inductances of distributed windings - salient pole, cyclindrical rotor.	4

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Electrical Engineering

Pre-requisites:

1. Basic course in Electric Machines, electric and magnetic circuits.

Additional Reading:

1. Krause.

Coordinators:

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Analysis of the doubly excited two-phase rotational system.	2
Reference frames power invariance and non-power invariance.	4
Derivation of dc machine systems from the generalized machine.	3
Analysis of induction machine - synchronous reference frame - with currents as variables - with rotor flux as variables.	5
Basis for vector control - small signal modelling of induction machine.	5
Analysis of the alternator - synchronous reference frame.	3
Derivation of salient and cylindrical rotor machine phasor diagrams.	3
Three phase short circuit of alternator and various time constants.	3
Total	**42**

References:

1. Fitzgerald and Kingsley, "Electric Machinery".
2. O'Simmons and Kelly, "Introduction to Generalized Machine Theory".
3. Hancock, "Matrix Analysis of Electric Machinery".