TKE213202

Electric Machinery 2

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BASIC INFORMATION

Course Credit	2 / 100 minutes per Week
Course Type	Required
Course Classification	Engineering Topics
Prerequisites	Electric Machinery I; AC Circuits Analysis; Electricity and Magnetism

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Development of Engineering Solution (KP.2) Engineering Design (KP.3)

Learning Outcomes

LO1 Students are able to understand the basic principles, the physical construction, mathematical model and calculations, and practical implementations of Induction machines.

LO2 Students are able to understand the basic principles, the physical construction, mathematical model and calculations, and practical implementations of synchronous machines.

LO3 Students are able to understand and implement basic principle of electric motors.

COURSE DESCRIPTION

This course studies the fundamental principle, the physical construction, mathematical model and calculations, and practical implementations of induction and synchronous machines as well as the control of these machines.

TOPICS

1. AC machinery fundamentals

1.1 A simple loop in a uniform magnetic field
1.2 Rotating magnetic field
1.3 Magnetomotive force and flux distribution on AC machines
1.4 Induced voltage in an AC machine
1.5 Induced torque in an AC machine
1.6 Winding insulation
1.7 AC machine power flows and losses
1.8 Voltage regulation and speed regulation

2. Induction machines

2.1 Principal components
2.2 Principle of operation

2.3 The rotating field
2.4 Direction of rotation
2.5 Number of poles—synchronous speed
2.6 Starting characteristics of a squirrel-cage motor
2.7 Slip and slip speed
2.8 Voltage and frequency induced in the rotor
2.9 Characteristics of squirrel-cage induction motors
2.10 Active power flow
2.11 Torque versus speed curve
2.12 Effect of rotor resistance
2.13 Wound-rotor motor
2.14 Three-phase windings
2.15 Doubly-fed wound-rotor motor and generator
2.16 Selection and application of three-phase induction machines
2.17 Equivalent circuit

3. Synchronous generator

3.1 Number of poles
3.2 Main features of the stator
3.3 Main features of the rotor
3.4 Field excitation and exciters
3.5 No-load saturation curve
3.6 Synchronous reactance—equivalent circuit of an ac generator
3.7 Synchronous generator under load
3.8 Synchronization of a generator
3.9 Synchronous generator on an infinite bus
3.10 Active power delivered by the generator
3.11 Control of active power
3.12 Transient reactance
3.13 Power transfer between two sources
3.13 Efficiency, power, and size of electrical machines

4. Synchronous motor

4.1 Construction
4.2 Starting a synchronous motor
4.3 Pull-in torque
4.4 Motor under load
4.5 Power and torque
4.6 Mechanical and electrical angles
4.7 Reluctance torque
4.8 Excitation and reactive power
4.9 The synchronous motor versus the induction motor

5. Control of electric motor

5.1 Types of motor drives

5.2 Drives for DC and AC motor

5.3 Pulse Width Modulation

5.4 Converters and inverters

5.5 Speed control

5.6 Torque control

REFERENCES

[1] Chapman, Stephen J., 2005, Electric Machinery Fundamentals, 4th., McGraw-Hill

[2] Wildi, Theodore. 2002. Electrical Machines, Drives, and Power Systems, 5th., Prentice Hall