Liverpool John Moores University

Title:	MODELLING AND CONTROL OF ELECTRIC MACHINES AND DRIVES
Status:	Definitive
Code:	**7009ENG** (105384)
Version Start Date:	01-08-2016
Owning School/Faculty:	Electronics and Electrical Engineering
Teaching School/Faculty:	Electronics and Electrical Engineering

Team	Leader
Emil Levi	Y

Academic Level:	FHEQ7	**Credit Value:**	20	**Total Delivered Hours:**	36
Total Learning Hours:	200	**Private Study:**	164		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	24
Practical	12

Grading Basis: 50 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Essay	AS1	Simulation of induction machine steady state operation	50	
Essay	AS2	Simulation of AC machine dynamics	50	

Aims

To develop an understanding of principles and acquire working knowledge of mathematical modelling of electrical machines.

To introduce the principles of control of variable speed electric drives using power electronic converters.

To introduce the concept of vector control as applied to induction machines.

Learning Outcomes

After completing the module the student should be able to:

1	analyse steady state behaviour of grid supplied and inverter supplied induction machines
2	use basic Matlab functions to design programmes for steady state analysis
3	undertake modelling of various transients of grid-supplied and inverter-supplied ac machines
4	use Simulink/Matlab to develop a working simulation programme for analysis of AC machine's dynamics

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

induction machine	1	2
AC machine dynamics	3	4

Outline Syllabus

Principles of AC machine steady state and dynamic modelling:

Steady state characteristics of grid supplied induction machine.
Variable-speed of operation using V/f control.
Voltage source inverter - power circuit and operation in six-step mode.
PWM control of a voltage source inverter and space vectors of a voltage source inverter.

Modelling of a three-phase squirrel-cage induction machine in terms of phase variables.
Common reference frame transformations.
Model in arbitrary d-q reference frame.
Concept of space vectors and induction machine model in terms of space vectors.
Correlation between dynamic space vector and steady-state phasor equivalent circuits.
Modelling of the three-phase sinusoidal power supply, calculation of space vectors and d-q axis quantities.
Modelling of a voltage source inverter using space vectors.
Dynamic response of a mains fed and inverter fed induction motor.

High-performance AC drives:
High performance DC motor drives and the idea of instantaneous torque control.
Current control of a voltage source and feedback requirements.
The idea of vector control and field orientation possibilities in an induction machine.
Principles of rotor flux oriented control.

Indirect rotor flux oriented control and design of the drive controller.

Learning Activities

Lectures supported by handouts.
Practical sessions will use software packages for development of the simulation software.
An individual student report is required for each of the two courseworks.

Notes

This level 7 module introduces the advanced concepts of electrical machine modelling and high performance dynamic control of variable speed AC drives.