EE595S – Electric Drive Systems
Fall 2005 Course Syllabus (4th Offering)

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Prerequisites: Graduate standing or both EE321 and EE382. Topically, the student should have a basic understanding of electromechanical devices. It is helpful, but not essential, that the student have some familiarity with brushless dc and induction machines. It is essential that the student have a basic background in classical control techniques such as the design of P, PI, PID controls, transfer function development, and stability analysis.

Course Description: This is a beginning level graduate course focusing on electric drive systems (power electronics driven electromechanical devices). The focus of the course will include permanent magnet synchronous machine drives (brushless dc) and induction motor drives. There will be a heavy emphasis on operation, physical modeling, and applied control.

Course Objectives: After taking this course, the student should be able to:

- Model and simulate electric drive systems [1,3,4,a,b,e]
- Design modulation strategies for power electronics converters [3,4,5,c,e]
- Design appropriate current/voltage regulators for electric drives [3,4,5,c,e]
- Design appropriate supervisory (example torque) control algorithms [3,4,5,c,e]
- Design speed and position controls for systems using electric drives [3,4,5,c,e]

Required Text: *Analysis of Electric Machinery and Drive Systems*, Second Edition, by Krause, Wasynczuk, Sudhoff. IEEE Press / Wiley Inter-Science, ISBN 0-471-14326-X.

Lecture Topic (30 lecture periods at 2 per week)	Periods
Reference Frame Theory	3
Modeling and Parameter Identification of SMPM Machines	1
Fully-Controlled Bridge Converters	2
Modulation Techniques	5
Voltage and Current Regulation	3
Control of SMPM Drives	5
Modeling and Parameter Identification of Induction Machines	3
Volt/Hertz Induction Motor Drives	2
Indirect and Direct Field Oriented Control	5
Optimal Control of Induction Motor Drives	1

Laboratory Topic (15 laboratory periods at 1 per week)	Periods
Introduction to Advanced Continuous Simulation Language	2
Six Step Inverter Simulation	1
Modulator Simulation	1
Voltage / Current Control Simulation	2
SMPM Characterization	1
SMPM Drive	2
Induction Machine Characterization	2
Induction Machine Volts Per Hertz Control	2
Induction Machine Constant Slip Control	2

Homework:

A number of homework assignments will be made throughout the semester. Each one will be weighted differently based on difficulty. If turned in late, you will lose 2.5 % per day. I will be checking to make sure you made a solid attempt – I will not grade these (although there are points associated with turning it in). You may consult with each other but the homework is to be worked independently.

Labs:

Laboratory reports will vary widely by the specific experiment. Some will be group; some will be individual; some will be written; some will be oral. Material from the laboratory will be considered fair game for exams. Note, this is the first time many of the hardware labs have ever been run. Problems will no doubt occur, so we will all have to be flexible.

Exams:

There will be two one-hour exams in the course of the semester. There will be a 1 hour non-cumulative final during finals week.

Final Grade:

At this point, it is anticipated that 20% of your grade will be based on the homework, 60% on laboratory reports, and 10% on each of two exams.

Cheating Policy:

At a minimum, cheating will result in a zero on the assignment/exam/quiz in question. At a maximum, it will result in failure of the course and removal from the University. All instances of cheating, even suspected cheating, will, without exception, be reported to the assistant dean of students. It is okay and encouraged to discuss and compare homework and projects and labs, and to argue about them, and if you feel you are wrong to change your approach or to convince someone to change theirs. It is not okay to copy. Failure to apply with exam policies is treated as cheating. (For example, if notebook accidentally left open on floor during closed book exam).