Electrical Engineering 590F.
Analysis and Computer Simulation of Transient Phenomena in Power Systems (Spring 2008)

Instructor	Dr. Dionysios Aliprantis, Assistant Professor, ECpE
Contact	1124 Coover Hall, 294-7387, `dali@iastate.edu`
Office hours	Tuesday 4:30–5:30 pm, Thursday 4:30–5:30 pm
Classroom	1226 Howe, Monday & Wednesday 4:30–6:00 pm
Web page	TBD
Revision	January 9, 2008

Course Description: In this class, we will *analyze* and learn how to *simulate* traditional and power electronics-based power systems, with particular emphasis on their transient behavior rather than the steady state. The material will include the modeling of electromechanical energy conversion devices, such as induction and synchronous machines, as well as modern power electronics topologies, e.g., rectifiers, inverters, and FACTS devices. Students who take this class will engage in projects that will involve programming dynamic simulations, including associated control systems. Selected influential papers from the technical literature will be presented and discussed in class. At the end of the semester, the students will have acquired a deeper appreciation of the challenges involved in designing, analyzing, and operating modern power electronics-based power systems.

Topics covered (tentative):

- Transmission lines
- Transformers
- Rectifiers
- Inverters
- dc/dc converters
- Reference-frame theory
- Synchronous machines
- Induction machines
- Induction machine drives

- Switched reluctance machines
- Wind turbines
- Hybrid-electric vehicles
- FACTS
- Anything else of interest

Course Prerequisites: Familiarity with basic concepts from power systems, electric machines, power electronics, ordinary differential equations, and automatic control theory is useful. Some knowledge of Matlab/Simulink is also necessary.

Textbooks: The class will include material from the following (optional) books:

- P. C. Krause, O. Wasynczuk, and S. D. Sudhoff, *Analysis of Electric Machinery and Drive Systems*. IEEE Press, Wiley-Interscience, 2002.
- C.-M. Ong, *Dynamic Simulation of Electric Machinery Using Matlab®/Simulink*. Prentice Hall PTR, 1998.
- N. G. Hingorani, and L. Gyugyi, *Understanding FACTS. Concepts and Technology of Flexible AC Transmission Systems*. IEEE Press, Wiley-Interscience, 2000.
- S. Heier, *Grid Integration of Wind Energy Conversion Systems*. Wiley, 2006.

Since this is a graduate level course, some topics might also be selected from the technical literature.

Tests: There will be no midterms or other quizzes. In lieu of a final exam, a final project will be assigned, TBD.

Assignments: There will be weekly assignments, which will include computer simulation projects or selected paper analysis.

Class Attendance: You are strongly encouraged to attend class, since some material might be presented that is not in the textbooks.

Course Grading Policy:

Homework projects	50%
Final project	30%
Professionalism	20%

Note: the "professionalism" grade will reflect the conduct of a student, his or her level of active participation in the classroom, and the overall *quality* of work done.

Letter grades will be determined by the following guidelines:

$\geq 85\%$	A
$\geq 80\%$	A−
$\geq 75\%$	B+
$\geq 70\%$	B
$\geq 65\%$	B−
$\geq 60\%$	C+
$\geq 55\%$	C
$\geq 50\%$	C−
$< 50\%$	F

Communication: Feel free to communicate with me in any way that is convenient to you (after class, during office hours, phone, email), for questions about the course material or assignments.

Special Needs: Please address any special needs or special accommodations with me at the beginning of the semester or as soon as you become aware of your needs. Those seeking accommodations based on disabilities should obtain a Student Academic Accommodation Request (SAAR) form from the Disability Resources (DR) office (515-294-7220). DR is located on the main floor of the Student Services Building, Room 1076.

Academic Misconduct: Academic Misconduct in any form is in violation of Iowa State University *Student Disciplinary Regulations* and will not be tolerated. This includes, but is not limited to: copying or sharing answers on tests or assignments, plagiarism, and having someone else do your academic work. Depending on the act, a student could receive an F grade on the test/assignment, F grade for the course, and could be suspended or expelled from the University. See the Conduct Code at `www.dso.iastate.edu/ja` for more details and a full explanation of the Academic Misconduct policies.

Tentative Schedule of Lectures:

Date	Lecture	Topic	Notes
1/14	1	Introduction to Matlab/Simulink	
1/16	2	Introduction to Matlab/Simulink	
1/23	3	Transmission lines	
1/28	4	Transmission lines	
1/30	5	Transmission lines	
2/4	6	Transformers	
2/6	7	Transformers	
2/11	8	Reference-frame theory	
2/13	9	Reference-frame theory	
2/18	10	Synchronous machines	
2/20	11	Synchronous machines	
2/25	12	Synchronous machines	
2/27	13	Induction machines	
3/3	14	Induction machines	
3/5	15	Induction machines	
3/10	16	Inverters	
3/12	17	Inverters	
3/17–21	SPRING BREAK		
3/24	18	Induction motor drives	
3/26	19	Induction motor drives	
3/31	20	Induction motor drives	
4/2	21	Synchronous machines in power systems and drives	
4/7	22	Synchronous machines in power systems and drives	
4/9	23	Synchronous machines in power systems and drives	
4/14	24	Rectifiers	
4/16	25	Rectifiers	
4/21	26	Advanced power electronics	
4/23	27	Advanced power electronics	
4/28	28	Advanced power electronics	
4/30	29	Advanced power electronics	
5/5–9	FINALS WEEK		