

**San José State University  
College of Engineering**

**EE 237 Vector Control of AC Machines  
Spring 2017, Section 1**

<b>Instructor:</b>	Ping Hsu
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<b>Office Hours:</b>	Friday 6:15~6:45
<b>Class Days/Time:</b>	Friday 3:30~6:15. (on 2/10, 5:00~7:45)
<b>Classroom:</b>	ENGR 303
<b>Prerequisites:</b>	EE210 or instructor consent

**Course Description:**

This course introduces modeling and control of electrical drive for AC motors and generators including induction, permanent magnet, and synchronous machines. The dynamic model, control methods, current regulation, and space vector modulation are discussed by both analysis and computer simulation.

**Course Topics**

- Review magnetic circuit, inductors, transformers
- Vector notation and matrix algebra
- Modeling and Control of DC motor
- Electromechanical energy conversion
- Modeling of an electromagnet and a reluctant machine
- Modeling and control of Synchronous machine
- Modeling of induction machine
- Steady state (constant speed) performance of Induction motor
- Rotor-flux-oriented Control
- Direct Torque Control
- Inverter electronics
- Space Vector Modulation

## Course Learning Objectives:

Upon successful completion of this course, students should be able to:

1. Derive dynamic equation of DC, AC induction, permanent magnet, and synchronous machines.
2. Determine the steady state behavior of the machines based on their mathematical model.
3. Develop vector control algorithms for the machines for current, torque, speed, position, and power control.
4. Use computer program to simulate the dynamic behavior of the machines and the controller.

## Required Texts/Readings

Lecture note and class handouts.

## Recommended Readings

- Electromechanical Systems and Devices. Sergey Edward Lyshevs, ISBN: 978-1420069723
- Vector Control of AC Drives. Boldea and Nasar. ISBN 0-8493-4408-5. CRC Press.
- Electrical Machines, Drives, and Power System; Theodore Wildi, 7-03-010605-9
- Power Electronics: Converters, Applications, and Design. Ned Mohan, Tore M. Undeland, William P. Robbins. ISBN 978-0471226932

## Other Required Materials

- MATLAB with Simulink and Simpower tool box. Available for use in Lab ENG-387, or student version can be purchased at the Spartan Bookstore; also available on the Web: [www.MathWorks.com](http://www.MathWorks.com)

## Assignments and Grading Policy

- Homework assignments including computer simulations 60%
- One midterm exam 20%
- Final exam 20%

## Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at [http://www.sjsu.edu/provost/services/academic\\_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

## **Consent for Recording of Class and Public Sharing of Instructor Material**

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course and the following items to be included in the syllabus:

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
  - It is suggested that the greensheet include the instructor's process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
  - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

## **Academic integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2.pdf) at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

## **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at [http://www.sjsu.edu/president/docs/directives/PD\\_1997-03.pdf](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

## **Accommodation to Students' Religious Holidays**

San José State University shall provide accommodation on any graded class work or activities for students wishing to observe religious holidays when such observances require students to be absent from class. It is the responsibility of the student to inform the instructor, in writing, about such holidays before the add deadline at the start of each semester. If such holidays occur before the add deadline, the student must notify the instructor, in writing, at least three days before the date that he/she will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed. See [University Policy S14-7](http://www.sjsu.edu/senate/docs/S14-7.pdf) at <http://www.sjsu.edu/senate/docs/S14-7.pdf>.

**EE237 Course Schedule**  
**(For reference only)**

Week	TOPIC
1	Review magnetic theory and DC motor.
2	Modeling and Control of DC brushed machine
3	Driver for DC brushed machine (PWM and H-bridge)
4	Modeling of Permanent magnet brushless machines
5	Control of Permanent magnet brushless machines
6	Modeling of induction machines
7	Modeling of induction machines
8	Midterm
9	Steady State model of induction machine.
10	Rotor flux field oriented vector control of induction machine
11	Rotor flux field oriented vector control of induction machine
12	Direct Torque Control
13	Space Vector PWM Modulation
14	Control of Doubly fed induction generator for wind power application
15	Final Exam: Friday, Dec 16, 5:15 PM ~ 7:30 PM.