Advanced Electrical Drives
ECE 817 - section 001
Fall 2021

Course Information

Instructor: Dr. Shanelle N. Foster
Office: 3212 Engineering Building
Phone: (517) 432-4589
Email: hogansha@egr.msu.edu

Instructor’s Office Hours: M W 1 - 2 pm, or by appointment
Join Zoom Meeting
https://msu.zoom.us/j/94851793857
Meeting ID: 948 5179 3857
Passcode: Drives

Course Schedule: Days: M W
Time: 3 - 4:20 pm
Classroom: A218 Wells Hall

Course Website: D2L website: https://d2l.msu.edu/

Prerequisites: Undergraduate courses in Electrical machines - Energy conversion
Undergraduate courses in Control systems

Textbook: Kwang Hee Nam
AC Motor Control and Electrical Vehicle Applications
Second Edition
CRC Press, 2020

Additional Resources: Rik De Doncker, Duco W.J. Pulle & André Veltman
Advanced Electrical Drives: Analysis, Modeling, Control
Springer, 2011
Electronic copy available

A. Veltman, D.W.J. Pulle & R. W. De Doncker
Fundamentals of Electrical Drives
Springer, 2007
Electronic copy available

Seung-Ki Sul
Control of Electric Machine Drive Systems
Electronic copy available
Additional Resources (continued): Paul C. Krause, Oleg Wasyczuk & Scott D. Sudhoff
_Analysis of Electric Machinery and Drive Systems_
_Electronic copy available_

Course Description

Modeling and control of AC motors - this course has students of various levels of knowledge and experience on the subject. Fundamentals will be taught to ensure a common starting point. It is expected that everyone will improve their level of knowledge and skills.

Course Objectives

At the completion of this course, each student should be able to do the following:
1. Model AC machines at various frames of reference. The purpose here is to prepare for the analysis of operation and design of controls and fault diagnosis methods.
2. Understand basic drive control schemes and implement them, at least in MATLAB. These will include versions of field orientation, direct torque control, etc.
3. Design torque, speed and position controller of motor drives and validate their designs in MATLAB.
4. Develop observers and study their stability and errors, as well as the effect of errors on the operation of the drive.
5. Understand pulse width modulation and account for delays, dead-times in controllers and inverters.
6. Determine experimentally the characteristics of electrical machines, so that they can be used in the implementation of controllers.

Face Coverings and Appropriate Distancing

“SPARTANS have always worn helmets. Today, we wear mask.” Campus health and safety depends on all of us. As part of the essential effort to slow the spread of COVID-19, Michigan State University is directing everyone to take personal responsibility to protect the health and safety of all MSU faculty, staff, students and visitors. This includes wearing a face covering indoors and outdoors as well as maintaining a 6-foot physical distance. Please refer to the MSU Community Compact, “Together We Will” ([https://msu.edu/together-we-will/](https://msu.edu/together-we-will/)).

Health & Wellness

College students often experience issues that may interfere with academic success such as academic stress, sleep problems, juggling responsibilities, life events, relationship concerns, or feelings of anxiety, hopelessness, or depression. If you or a friend is struggling, we strongly encourage you to seek support. Helpful, effective resources are available on campus, and most are at no-charge.

- If you are struggling with this class, please contact the instructor/TA as soon as possible.
- Meet with your academic advisor if you are struggling in multiple classes, unsure whether you are making the most of your time at MSU, or unsure what academic resources are available at MSU.
- Visit [https://caps.msu.edu](https://caps.msu.edu) for online health assessments, hours, and additional information.
• Drop by Counseling & Psychiatric Services (CAPS) main location for a same-day mental health screening (3rd floor of Olin Health Center at 463 E. Circle Drive).
• Call CAPS at (517) 355-8270 any time, day or night.
• 24-hour MSU Sexual Assault Crisis Line (517) 372-6666 or visit [https://centerforsurvivors.msu.edu/](https://centerforsurvivors.msu.edu/).

Course Delivery Structure

This course will be delivered both in-person and through the course management system. Your MSU NetID is required to login to the course from the D2L homepage ([https://d2l.msu.edu/](https://d2l.msu.edu/)). You may forward your D2L email to an external email address ([https://help.d2l.msu.edu/node/4410](https://help.d2l.msu.edu/node/4410)). In D2L, you will access online lessons, course materials and additional resources. Activities may consist of readings, discussion forums, email, and other online activities.

D2L Technical Assistance

If you need technical assistance at any time during the course or to report a problem you can:

1. Visit the Distance Learning Services Support Site ([https://lib.msu.edu/dls/](https://lib.msu.edu/dls/))
3. Or call Distance Learning Services: (800) 500-1554 or (517) 355-2345

Contingency Planning

1. In the case of an outbreak of COVID-19 virus, it may be required to change instructional modality for this course. You should be prepared to complete the course work as dictated by the circumstances of the state and university policies.
2. In the case of connectivity issues, particularly during assessments, please e-mail the instructor.
3. In the case of illness or testing positive for COVID-19:
   • Please email the instructor **before the next class** to make arrangements.
   • Please reach out to your advisor and college student affairs offices.

Course Policies

Attendance Policy

Classroom attendance is expected for all students that appear on the official class list. Absence is **not** an excuse for anything. **Students are expected to know exactly what is discussed in class and assigned - homework, notes, study, or changes in schedule.**

Students that will need to miss class due to COVID-19 **must** contact the instructor **before** class. If you are feeling ill or have tested positive for COVID-19 and have questions, contact MSU’s COVID-19 Triage Hotline at 855-958-2678 or your primary health care provider.

E-Mail Policy

All e-mails to me regarding this course **MUST** start the subject with “**ECE 817**”. To request a meeting, please send an e-mail at least 24 hours in advance and suggest three days/times that are convenient for you.
Homework Policy
Homework assignments will be posted on the course website regularly, including their due dates. Postings of new assignments will be announced in class. You must submit your homework before class on the due date. Late homework is subject to 20% penalty.

Homework should be clean, legible, self-contained and self-explanatory. Homework must be original copies in the students’ own handwriting. The final answer of every question must be enclosed with a box/circle or highlighted for the question to be graded. All assumptions must be stated and thoughts outlined. Sequences of equations and results are not adequate for a grade. There is no partial credit given for problems not solved to the end. Work that is not legible or well explained will not be graded.

**Homework is not designed to test.** Homework is meant to promote active learning and progress toward meeting the course objectives.

Exam Policy
The 80-minute mid-term exam will be held in the classroom during the regularly scheduled class time. There are **NO MAKEUP EXAMS**. The exam is closed book and notes.

Grading Policy
Final grades for this course are earned based on your performance on projects, exams and homework. Points are distributed as shown below.

<table>
<thead>
<tr>
<th>Homework</th>
<th>Midterm Exam</th>
<th>Final Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>30%</td>
<td>45%</td>
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</tbody>
</table>

Grading is assigned using the straight scale shown below.

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
<th>Score</th>
<th>Grade</th>
<th>Score</th>
<th>Grade</th>
<th>Score</th>
<th>Grade</th>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 90%</td>
<td>4.0</td>
<td>≥ 85%</td>
<td>3.5</td>
<td>≥ 80%</td>
<td>3.0</td>
<td>≥ 75%</td>
<td>2.5</td>
<td>≥ 70%</td>
<td>2.0</td>
</tr>
<tr>
<td>≥ 75%</td>
<td>2.5</td>
<td>≥ 70%</td>
<td>2.0</td>
<td>≥ 65%</td>
<td>1.5</td>
<td>≥ 60%</td>
<td>1.0</td>
<td>≥ 60%</td>
<td>0.0</td>
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Tolerance and Civility
“Michigan State University strives to build an academic community with living and learning environments that expects tolerance of viewpoints and civility toward others, whether at public forums, athletic events, in residential communities, classrooms or laboratories. We call upon all who participate in university events to promote tolerance and civil behavior and to hold themselves to high standards that reflect the university’s commitment to respect viewpoints that may be different from their own. Only by respecting individuals with diverse perspectives and ideas can we build an environment of civility that is conducive to advancing knowledge and transforming lives.”

Code of Ethics and Professional Conduct
Students are expected to adhere to the Spartan Code of Honor which states,

”As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do.”
Religious Observance

Michigan State University has long had a policy to permit students, faculty/academic staff, and support staff to observe those holidays set aside by their chosen religious faith. If you wish to be absent from class to observe a religious holiday, make arrangements IN ADVANCE with the instructor.

Important Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Event or Note</th>
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</thead>
<tbody>
<tr>
<td>Monday, September 6</td>
<td>No class - Holiday</td>
</tr>
<tr>
<td>Wednesday, September 8</td>
<td>The last day to add this course.</td>
</tr>
<tr>
<td>Monday, September 27</td>
<td>The last day to drop this course with full refund.</td>
</tr>
<tr>
<td>Monday, October 18</td>
<td>Midterm Exam (TENTATIVE - subject to change)</td>
</tr>
<tr>
<td>Wednesday, October 20</td>
<td>The last day to drop this course with no refund and no grade reported.</td>
</tr>
<tr>
<td>Monday, October 25</td>
<td>No class - Break Day</td>
</tr>
<tr>
<td>Monday, December 13</td>
<td>Final Exam, 3:00 - 5:00 pm</td>
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