



ECE 8020: Electric Motor Control
Section 001 and 843
FALL 2020

MEETING TIME: Tuesday and Thursday 3:30pm to 4:45pm

MEETING LOCATION: Riggs 223 for main-campus and TBA for Charleston Zucker Family Center

INSTRUCTOR(s): Dr. Christopher S. Edrington, Riggs 213, cedring@clemson.edu

OFFICE HOURS AND PROCEDURES: Office hours will be established after the first class meeting to best accommodate both students and instructor. All office hours will be VHO (Virtual Office Hours) to be held via Zoom.

COURSE MODALITY: Hybrid

COURSE DESCRIPTION: Dynamic modeling and analysis of electrical machines for design of AC and DC drive systems; implementation of such models on a digital computer; voltage-fed inverters; pulse width modulation and analysis techniques for inverters; harmonic generation and reduction.

COURSE PREREQUISITES: Students are expected to have completed a course comparable to ECE 4340 before enrolling in this course.

STUDENT LEARNING OUTCOMES:

- Be able to model an induction machine in both abc and reference frame variables
- Be able to model a switched reluctance machine
- Be able to synthesize and simulate various converter/inverter topologies
- Be able to apply basic control strategies for performance objectives relevant to induction and switched reluctance machines.

REQUIRED MATERIALS: Although this course does not require any specific text book, it is encouraged that you obtain a copy of either the 1st, 2nd, or 3rd edition of the text Analysis of Electrical Machines and Drive Systems, P. Krause, O. Wasynczuk, and S. Sudhoff, Wiley Interscience, with the caveat that some material may be slightly different in arrangement and/or notation.

ALSO the student is required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone (please refrain from accepting or making calls while in a class session).

TOPICAL OUTLINE: 3 credit hours

- Reference frame theory (brief review)
- Induction machines (brief review)

- Converters/active rectifiers
- Inverters
- Modern control objectives for induction machines
- Modern control objectives for switched reluctance machines
- Basic control concepts for speed loop and position loop controls
- Predictive control structures for drive systems

CLASS CANCELLATION POLICY: Class is cancelled if the instructor is more than 15 minutes late to class.

GRADING POLICY: The grade scale is 90-100 A, 80-89.9 B, 70-79.9 C, 50-69.9 F.

WEIGHTING is Quizzes 20% and Projects 80%

COURSE WORK:

- All projects will be submitted online via Canvas. Projects will have a defined template provided by the instructor. As a graduate class all projects will be done individually. 25% of the grade of the project will be regarding the ability to correctly follow the format and to be grammatically correct. It is encouraged that non-native English speaking students use a tool such as Grammarly to check their work. 75% of a project will be on the technical competency illustrated in the project writeup.
- All quizzes will be online through Canvas. Typically quizzes will occur about every 3 weeks. The quizzes are always going to be over the lecture material that has been presented.
- No late work will be accepted. You will have plenty of time to address the project oriented work (typically 3 – 4 weeks).
- Do not procrastinate on a project. Attack the work early so that I can help you address questions. Waiting until the last week to attempt to get it done is not going to work in a course such as this. I will be checking on the progress for each person in the class and will be asking each person to send me a weekly summary of the progress they are making in the project.

ATTENDANCE POLICY:

1. The university will assign students a day of the week they are to come this class; on other days, they must attend online.
2. Attendance is optional on days students are to come physically.
3. Online attendance is optional; however to get the most out of the class it is highly encouraged to attend unless circumstances prevent.
4. Please email me if you are going to be unable to attend either physically or online.
5. Classroom entry and dismissal. To maintain physical distancing, individuals arriving first to the classroom should sit farthest from the door. Similarly, at the conclusion of class, students closest to the door should leave first.
6. While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. If a student does not have a face covering or refuses to wear an approved face covering without valid documented accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the Office of Community & Ethical Standards

as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222.

7. Please note that the University may convert to a purely online mode at any time. University classes are initially in a purely online mode and will remain so until Sept. 21.

ACCESSIBILITY STATEMENT: Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

TITLE IX STATEMENT: Clem[son] University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972.

SAFE CAMPUS: Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

ACADEMIC INTEGRITY: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the *Undergraduate Announcements* and in the *Graduate School Policy Handbook*.

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<https://clemson.libguides.com/copyright>.

MODIFICATION STATEMENT: This syllabus is a living document and is subject to change depending on an assessment of the circumstances. The current modification date is:

8/6/2020