TO: The Faculty of the College of Engineering

FROM: Elmore Family School of Electrical and Computer Engineering

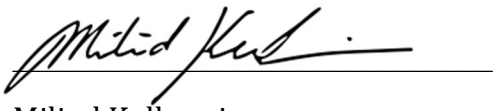
RE: New Graduate Course, ECE 61010 Time Domain Simulation and Optimization for Design

The faculty of the School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 61010 Time Domain Simulation and Optimization for Design
Sem. 1, 2 and 3, Lecture 1, Cr. 1.
Restrictions: College of Engineering students only

Description: This is a skills course that teaches time domain simulation and multi-objective design optimization. This course will serve the needs of students in power and energy system and component design, but is widely applicable to all areas of engineering and does not require domain specific knowledge.

Reason: It is a goal for this course that students can take the course in any semester in order to facilitate their research and take advanced courses requiring time domain simulation skills and/or optimization based design skills. Note that while this is a skills course, the theory behind these techniques and alternative techniques will be considered. The course material will be taken from redundant elements of ECE61012, ECE61014, and ECE63300. This material will then be removed from those courses so that their domain specific coverage can be increased.



Milind Kulkarni,
Associate Head for Teaching and Learning
Elmore Family School of Electrical and Computer Engineering

ECE695, Time Domain Simulation & Optimization Design

Syllabus, Summer 2021

Course Information

- **Instructional Modality:** This course is asynchronous online. There are no required in-person or online meetings.
    - **Run dates:** June 14-July 16 (5 weeks)
- **Course credit hours:** 1
- **Prerequisites:**
    - Basic background in linear algebra (MA511) and ordinary differential equations.
    - Should be familiar with MATLAB and writing MATLAB scripts and functions.
    - Simulink will be used, but prior knowledge of Simulink is not necessary.
    - Access to MATLAB for solving homework problems

Instructor(s) Contact Information

- **Name of the instructor:** Dr. Scott Sudhoff

Course Description

This skills course teaches time domain simulation and multi-objective design optimization. This course will serve the needs of ECE students in power and energy system and component design but is widely applicable to all areas of engineering and does not require domain specific knowledge.

Audience: The intended audience for this course is students with an undergraduate engineering background who are interested in time-domain simulation of systems and components, as well as the design of systems and components, using multi-objective optimization. Students should have had at least one circuits course with RLC circuits, be familiar with linear algebra (eigenvalues, eigenvectors), and be able to write scripts and functions in MATLAB.

Learning Resources, Technology & Texts

Required Textbook

Sudhoff, S.D. (2014). *Power Magnetic Devices: A Multi-Objective Design Approach*. Wiley.

- We will use only Chapter 1, Optimization-Based Design.

Optional references:

- L.O. Chua, P.M. Lin, *Computer Aided Analysis of Electric Circuits: Algorithms & Computation Techniques*, Prentice-Hall, 1975.

- Walter Gautschi, *Numerical Analysis, Second Edition*, Birkhauser, 2012.

MATLAB

You will need access to MATLAB® for this course.

Options for Accessing MATLAB:

1. Purchase a student version of MATLAB for $99.
2. Use MATLAB through Purdue Software Remote.
    - Additional information on Software Remote.
    - For assistance using Software Remote, contact ITaP.

Important: Purdue has a limited number of MATLAB licenses for Software Remote, and access may be unavailable during busy times.

Learning Outcomes

After completing this course, you will be able to:

- Code simulation engines.
- Code accurate and computationally efficient simulation models.
- Comprehend the theory of single- and multi-objective optimization.
- Utilize single-and multi-objective optimization effectively/efficiently.

Assignments

During the course of the semester, 6 coding assignments and 3 homework assignments are assigned. In the coding assignments, the speed, accuracy, and style/documentation of your code will be assessed. The homeworks will involve short calculations or problems that can be solved with a simple MATLAB script.

This course will be graded based on the following criteria:

Item	Points	Approx. %	Rubric Items
CP1	10	4%	Documentation, Functionality, Accuracy, Computational Speed
CP2	10	4%	Accuracy
CP3	50	21%	Documentation, Functionality/Correctness, Computational Speed.
CP4	50	21%	Documentation, Correctness, Results
CP5	30	12%	Documentation, Functionality, Results
CP6	40	16%	Documentation, Functionality, Results
HW1	25	10%	
HW2	20	8%	
HW3	10	4%	

Grading Scale

After rounding your cumulative score to an integer, your grade will be based on the following (+,-) scale.

A-: 90-92, A: 93-96, A+: >= 97
B-: 80-82, B: 83-86, B+: 87-89
C-: 70-72, C: 73-76, C+: 77-79
D-: 60-62, D: 64-66, D+: 67-69
F: <=59

Course Schedule

The course schedule is provided separately in Brightspace.

Course Help

To get help with course content, go to the course discussion forum in Piazza and post your questions. You can ask questions related to course topics, homework, coding problems, and share concerns with your peers or the instructor.

Discussion Guidelines

Please follow these guidelines when contributing to the Piazza forum in this course.

- Do not use offensive language. Present ideas appropriately.
- Be cautious in using the Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular or slang language. This could possibly lead to misinterpretation.
- Do not hesitate to ask for feedback.
- Be concise and to the point.
- Think and edit before you push the “Send” button.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect

among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the Critical Needs Fund.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Addendum: EFD 13-22

Previous Course Offerings:

ECE 69500 Time Domain Sim and Optim Design, Fall 21 (24), Sum 21 (12), Spring 21 (2), Fall 20 (10), Sum 20 (3), Spring 20 (4), Sum 19 (3), Spring 19 (1)