EGGN589: Design and Control of Wind Energy Systems

Instructor Info

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Office Hours:	Tues 11:00 am – 12:00 noon
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Course Logistics

Semester:	Spring 2017
Course time:	TR 2:00 pm – 3:15 pm
Course location:	Brown Building W375
Course web site:	Canvas: "Sprg.2017.EGGN589A"
	Note change from the Blackboard eLearning system. Log in to Canvas via https://elearning.mines.edu/login/saml
Textbook:	Manwell, *Wind Energy Explained*, 2nd edition (recommended) or Hau, *Wind Turbines: Fundamentals, Technologies, Application, Economics*, 3rd edition (recommended)
Software:	Excel, Matlab, Simulink

Course Description

Wind energy provides a clean, renewable source for electricity generation. Wind turbines provide electricity at or near the cost of traditional fossil-fuel fired power plants at suitable locations, and the wind industry is growing rapidly as a result. Engineering R&D can still help to reduce the cost of energy from wind, improve the reliability of wind turbines and wind farms, and help to improve acceptance of wind energy in the public and political arenas. This course provides an overview of the design and control of wind energy systems.

Prerequisites

EENG307: Introduction to Feedback Control Systems (or consent of instructor)

Learning Objectives

By the end of this course, you should be able to
- explain the benefits and drawbacks of wind energy and its role in a sustainable energy future;
- describe the major subsystems of a wind energy system, including the wind resource, rotor aerodynamics, turbine mechanical dynamics, electrical systems of the turbine and utility interconnection, and control system;
- design a controller for a wind turbine simulated under time-varying wind input conditions, model this controller using available software, and evaluate the benefits of your controller compared to a given baseline;
- analyze a specific wind energy application and complete a design and experiment; and
- improve your student- and self-driven learning skills.

Course Format

The primary format for this course will be discussion- and activity-based, with "content" delivery based on reading, web-based, and other resources. Occasional short lectures will be delivered. Lecture materials from a previous semester (when the course was taught in a more traditional format) are available for reference on Canvas.

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Course Schedule

Please see the Canvas course web site for a schedule of course topics. Note that the schedule is tentative and subject to change.

Grading and Assignments

This course will be very hands-on and design intensive, and the grading of the course will reflect that. Grading will be weighted as follows:

Item	Weight
Assignments	15%
Quizzes	10%
Turbine Design Proposal	10%
Control Design Project	15%
Semester Project (multi-part)	40%
Participation and Presentations	10%

Readings

Please prepare for class by completing the readings noted in the schedule (on Canvas) prior to attending class. Although reading assignments are not graded directly, they will enhance your learning and your ability to participate in class discussion. Occasional in-class activities, including possible pop quizzes, will be related to pre-class reading.

Quizzes

In-class (announced and unannounced) and/or Canvas-based quizzes will be given periodically during the semester. No make-up quizzes will be allowed, but your lowest two quiz grades will be dropped.

Assignments

Short assignments such as homework and design problems will be assigned throughout the semester. Some assignments may be team-based. **No late homework assignments or design problems will be accepted.** Your lowest homework or design problem grade will be dropped.

Projects

You will work in pairs or groups to complete the class projects. The control design project is a simulation-based project in which you will design a controller for a model of a wind turbine. The turbine design proposal will allow you to think creatively about how you would design a turbine that can charge small electronic devices. Finally, the semester project (in several parts) will result in two small scale turbines designed for wake control experiments to be tested in a wind tunnel.

Presentations and Participation

Active participation in class is strongly correlated with effective learning. In addition to informal discussion, there will be several opportunities for oral presentations of projects and smaller assignments in varying levels of formality throughout the semester.

Matlab

We will use Matlab and Simulink in the course. I expect students to be comfortable using Matlab and Simulink prior to enrolling in this course.

Attendance and Participation

We will enjoy richer and more rewarding class sessions if everyone prepares for and attends class regularly. The differing viewpoints you will bring to class discussions will enhance learning for your fellow students and for me.

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Ethics

For most class activities and assignments, I encourage you to work with your classmates in formal or informal groups. Most students understand plagiarism in general and strive to avoid it, but common misconceptions often arise unintentionally. One common error is the use of figures or quotes from any source prepared by another individual, including course lecture notes, without providing a reference. The consequences for academic dishonesty at the Colorado School of Mines are severe and can lead to expulsion. As graduate students it is imperative that you take responsibility for your education in a responsible manner and adhere to the academic dishonesty policy.

For "Other Assignments," it is perfectly acceptable for students to work together, though all students must understand what they turn in. Copying of solutions without understanding them is not allowed; if a student copies a solution and cannot explain it adequately this is considered academic dishonesty.

For more information, please see me or review the CSM Academic Integrity Policy (http://inside.mines.edu/UserFiles/File/policies/STU/AcademicIntegrityPolicy.pdf).

Disability Support

The Colorado School of Mines is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you are registered with Disability Support Services (DSS) and I have received your letter of accommodations, please contact me at your earliest convenience so we can discuss your needs in this course. For questions or other inquiries regarding disabilities, I encourage you to visit disabilities.mines.edu for more information.

Etiquette

Class etiquette should be aligned with the Golden Rule: Treat others as you would like to be treated.

Cell phones are distracting to your classmates and me and are not appropriate for use during class.

Absences

Absences should be cleared with me beforehand so that reasonable accommodations can be made as appropriate. In the case of unexpected absences (e.g., due to illness), please contact me as soon as possible.