# ECE 566: Grid Integration of Wind Energy Systems

Syllabus Spring Semester, 2021

Professor:	Dr. James Cale	Email:	jcale@colostate.edu
Office Hours:	By appointment	Phone:	$(970) \ 412 - 0494$

### Meeting Location and Time

Online only via Zoom, Tuesday/Thursday evenings, 4:00-5:15 PM (MST)

# $\mathbf{Prerequisites}^{\dagger}$

- ECE 461/462 Power Systems-I/Laboratory OR ECE 565 Electric Power Engineering AND
- Working knowledge of MATLAB/Simulink (or similar software) is required.
- ENGR 570 Coupled Electromechanical Systems is recommended, but not required

# Textbooks

(Required): S. Heier. *Grid integration of wind energy conversion systems*. 3rd Ed. John Wiley & Sons: W. Sussex, England, 2014. ISBN: 978-1-119-96294-6.

(Supplementary, but not required): P.C. Krause, O. Wasynczuk, S. Sudhoff, *Analysis of Electric Machinery*, Wiley/IEEE Press, 1995. ISBN: 978-0-780-31101-5.

**Course Description:** The modern electricity grid is evolving to include increasing numbers of variable and renewable generation sources. This course covers several aspects of wind energy conversion systems (WECS) and their interconnection to the power grid. The course provides students with the background to understand, model and simulate a complete wind turbine system, including the wind resource, mechanical torque production, electrical motor and drive system responses. Various wind turbine topologies and control concepts are covered. The integration and impact of wind generators on the power grid are also discussed.

# Course Grading Weights

Homework:	20%
Mid-term exam:	30%
Simulation Project 1:	25%
Simulation Project 2:	25%

# Homework

Homework sets will consist of shorter analytical or numerical problems. All homework will be graded and will generally be due two weeks after distribution (dates/times will be listed on the assignment). No late homework will be accepted.

<sup>&</sup>lt;sup>†</sup>Contact the instructor (jcale@colostate.edu) with questions and/or requests for waivers for the prerequisites.

### **Simulation Projects**

This course includes two simulation projects, covering component and/or system-level aspects of wind turbine systems discussed in class. These simulations will include electromagnetic transients and switching-level behavior, generally on  $\mu$ s timesteps. MATLAB/Simulink is highly recommended for performing these simulations, and this software is available to all CSU students. An alternative is EMTDC/PSCAD. Examples and solutions given in this class will use MATLAB/Simulink.

### **Final Grade Assignments**

Grade	Score
A+	96.67 - 100.00
А	93.33-96.66
A-	90.00-93.32
B+	86.67 - 89.99
В	83.33-86.66
B-	80.00-83.32
C+	76.67 - 79.99
С	70.00 - 76.66
D	60.00-69.99
F	0.00 - 59.99

#### Professor Office $Hours^{\dagger}$

- Open office hours will be held at least 30 min before classes start, via Zoom
- One-on-one teleconferences via Zoom can be scheduled by appointment only<sup>‡</sup>

<sup>&</sup>lt;sup>†</sup>Messaging through Canvas or email is typically the best (fastest) way to obtain answers to most questions. <sup>‡</sup>Individual meetings are limited to one hour per student, per week.