

ME 597: Distributed Energy Resources – Spring 2024

Tuesdays and Thursdays from 3 to 4:15 PM ET

Physics 201 and/or [on Zoom](#)

Instructor: Kevin J. Kircher, kevinjkircher.com



Image credit: [DOE Loan Programs Office](#)

Distributed energy resources (DERs) are controllable electrical devices that plug in at the edge of the power grid, typically through buildings. DERs – such as electric vehicles, heating and cooling equipment, energy storage systems, and rooftop solar photovoltaics – will play an increasingly important role in future energy systems that decarbonize, digitalize, and decentralize their operations. In this class, students will learn to model a variety of DERs, optimize DER designs, and control DERs to reduce costs, pollution, and impacts on the power grid. This class will involve a mix of coding and mathematical analysis. Students will do semester projects on current DER research and development topics.

Format: In-person and online

Grading: 20% homework, 30% take-home exam, 50% semester project

- Homework, the exam, and semester projects will involve some math and a lot of coding.
- Students can code in Matlab, Python, or Julia, but the course staff will only support Matlab.
- Students may work together on homework, but each student must submit their own solutions.
- The TA will grade homework quickly on a three-tier scale (full, half, or zero credit) based on how much of the solution is present, clear, and correct.
- Each student gets one free three-day homework extension. No questions asked; just email the TA.
- For any other extensions, students must go through the [Office of the Dean of Students](#).

- Each student will individually take a 24-hour take-home exam about halfway through the semester.
- Students can do projects individually or in teams of two or three.
- Each team will submit one final project report, written in \LaTeX in a conference paper format.
- Each team will give one final project presentation, formatted like a conference talk in \LaTeX Beamer.
- Only one student from each team will present, but the whole team should help them prepare.
- Online students will join Zoom in real time for their team's project presentation.
- Each student will assess their own project contributions in a final meeting with me and their team. I will grade each team's project as a whole then adjust individual grades based on self-assessments.

Tentative schedule: ~30 classes, 75 minutes per class

- Introduction to energy systems and DERs (1 class)
- Modeling and simulating DERs (~7 classes)
- Optimization (~4 classes)
- Control (~7 classes)
- Applications (~7 classes)
- Project presentations (~4 classes)

We may take a tour or two of nearby energy facilities.

Prerequisites

- Required: Linear algebra, ordinary differential equations, and facility with programming in a language such as Matlab, Python, or Julia.
- Not required, but may enhance appreciation: Probability, statistics, control systems, optimization, machine learning.

Textbook: None

Websites

- [Brightspace](#) hosts lectures slides and videos, homework assignments, etc.
- Students upload homeworks and midterms to [Gradescope](#).

Contact information and office hours

- Kevin Kircher (professor; kkirche at purdue dot edu): Fridays from 1 to 3 PM ET in HLAB 1022 and at <https://purdue-edu.zoom.us/my/kjkircher>.
- Priyadarshan (TA; priyada at purdue dot edu): Wednesdays from 11:30 to 12:30 PM ET and Thursdays from 5 to 6 PM ET in HLAB 2067 and at <https://purdue-edu.zoom.us/my/priyadarshan7>.