

NEWSLETTER



FEBRUARY 2026

UNIVERSITY OF WISCONSIN-MADISON

WEMPEC Annual Review May 12-13, 2026

Registration is now open!

Come join us at this exciting 2-day event

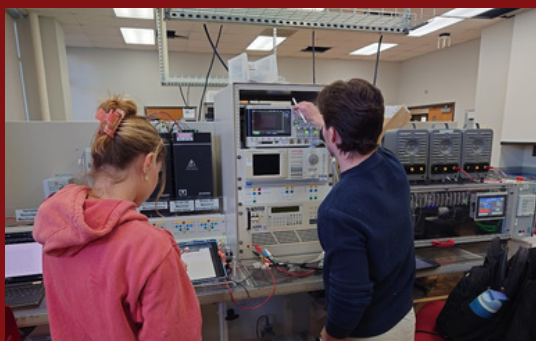
- Presentations on pre-publication research, tutorials by the WEMPEC faculty, tours through our labs, and poster presentations by the WEMPEC students.
- Have the opportunity to converse one-on-one with students, faculty, and colleagues.
- Learn something new!

REGISTER FOR
THE 2026
ANNUAL REVIEW
HERE



Photo from 2025 Annual Review.

After years of “dyne” for new lab equipment...

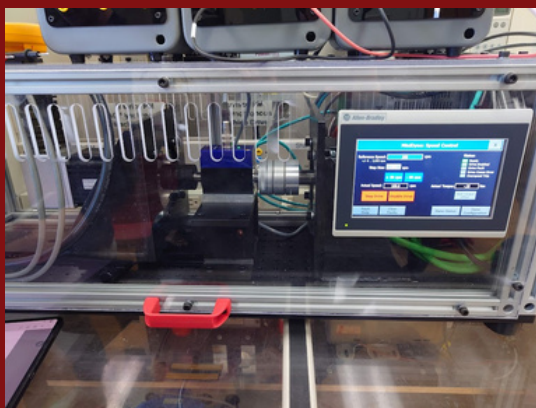


WEMPEC students throughout the years have collaborated with sponsor Rockwell Automation to design new dynamometers! Of the seven dynes, one is actively available for research use, and six are dedicated to electric machine and drive systems laboratory courses for undergraduate and graduate students.

The dynes were installed at the beginning of the year, with motors, PLCs and drives donated by Rockwell.

Students use the dynes to conveniently switch motors under test. The dynes enable students to characterize steady state and dynamic performance of DC, AC induction and AC synchronous motors, and to implement advanced drive control techniques. The laboratory courses are taught by associate professor and WEMPEC affiliate Patrick Flannery, a WEMPEC alum.

“We’re really appreciative of the support from Rockwell Automation for the dynes,” Prof. Flannery said. “This will have a meaningful impact for any students in the power area that take this class for many, many years.”



CHECK OUT THE LATEST WEMPEC NEWS HERE



WEMPEC Alum Nathan Petersen is selected for ARPA-E grant



Nathan Petersen, PhD '24, received \$500,000 for his startup Motibera, Inc. which aims to develop bearingless, sensorless electric motor and drive systems for mass commercialization. Read about the function and application of bearingless motors, as well as Nathan's inspirations!

How did your experience at WEMPEC inspire Motibera?

This project is a continuation of my PhD work. I started Motibera so that I could get bearingless motors out of the university and into industry.

WEMPEC emphasizes learning all the pieces of the puzzle – motor design, controls, and power electronics. I wouldn't have considered the startup without having all of this knowledge. It's a very well-rounded education.

What are the applications of bearingless motors?

Bearingless motors mostly have industrial applications. They should start by replacing high-speed motors that have challenges with their bearing systems – for example, compressors in air conditioners or fuel cells, and wastewater blowers in city wastewater treatment facilities.

How do bearingless motors work?

Bearingless motors operate similar to any motor: they spin, make torque and convert electrical power to mechanical power. But there's no contact between the rotor and stator since the rotor is held with magnetic levitation forces as it spins, which means zero friction, oil lubrication, or maintenance requirements.

The coils of the motor create forces that support the shaft, so that the motor becomes the bearing system. The motor has different current harmonics and windings, but it looks almost the same as a typical motor.

In this project, the coils also act as sensors. To levitate the shaft, you have to know where it is in space. Typical self-sensing controls inject a voltage, measure current and do processing based on equations. For levitation, it's the same thing. The equations are a bit more complicated because they handle the rotor not being in the center, but that part is well figured out from my PhD work.

Check out these recent WEMPEC publications!

A Study of Zero Common-mode Currents and Reduced Conducted Emissions in a Single-Stage Buck-Boost Inverter

- Commonly used pulse width modulated voltage source inverters have well-known trade-offs including high-frequency common-mode noise. Conventional solutions are bulky, costly and/or ineffective.
- This paper models a single-stage buck-boost converter with a non-switching common-mode voltage using EMI models and hardware, finding significant common-mode noise reductions compared to a VSI.

Under 10 Nanosecond Switching of 700V GaNFET Using a Chip-on-Board Optical Gate Drive

- Ultrafast power transistors create energy-efficient power electronics and are increasingly used industrially.
- Optical control is a gate-drive solution minimizing parasitics while maintaining signal integrity.
- This paper presents a novel chip-on-board phototransistor (CoB-PT) optical gate drive enabling high-speed switching of a 700 V/15.2 A GaNFET using an 808 nm laser diode and GaAs phototransistors, achieving performance comparable to state-of-the-art electrical gate drives in double-pulse testing at 500V/9A.

Transformer-less HVDC Generator Using Modular Rotating Varying Capacitance Machines with Integrated Rectifiers

- Electrostatic generators with modular cascaded bridge rectifiers facilitate high-voltage DC transmission without needing decoupled transformers to turn low-voltage AC electric generator output into HVDC.
- An scaling analysis of an averaged electrostatic generator model and multilevel bench scale experiments demonstrate a 5x decrease in active component mass and 2.5x decrease in active component volume for an offshore wind park system compared to existing approaches.