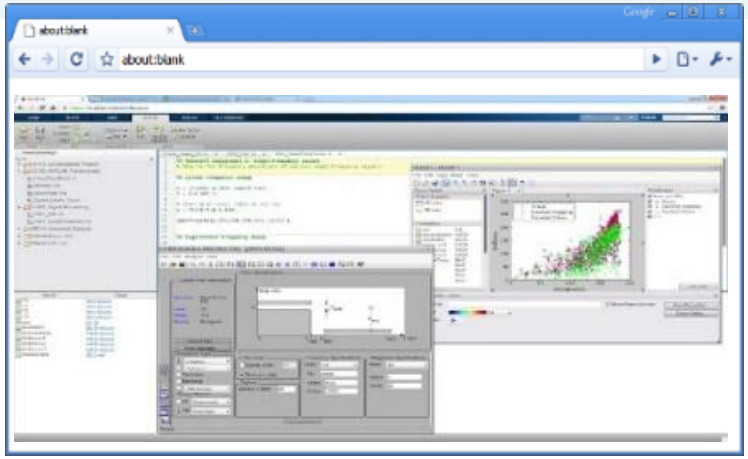
효과적인 전력전자 강의를 위한
MathWorks Tools and offering

오승석 부장 / 공학박사
Education Customer Success Engineer

Teaching Tools

MATLAB® & SIMULINK®

MATLAB Online



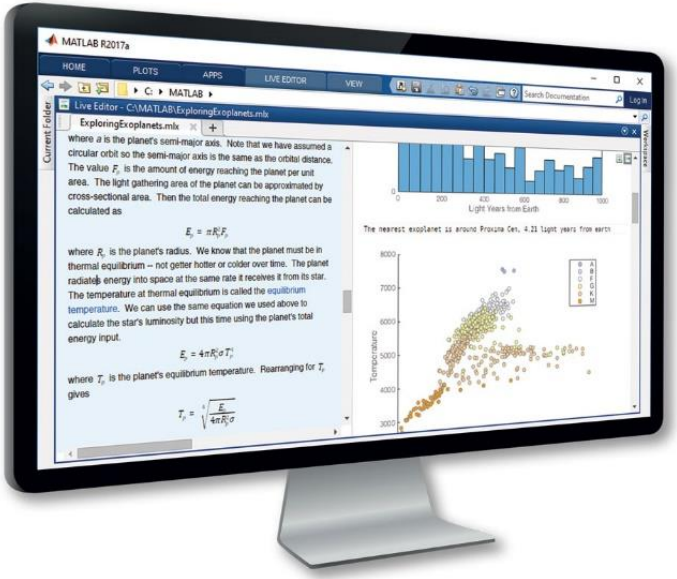
MATLAB Online

MATLAB Mobile

MATLAB Drive

MathWorks

MATLAB Live Editor



MATLAB in an Executable Notebook

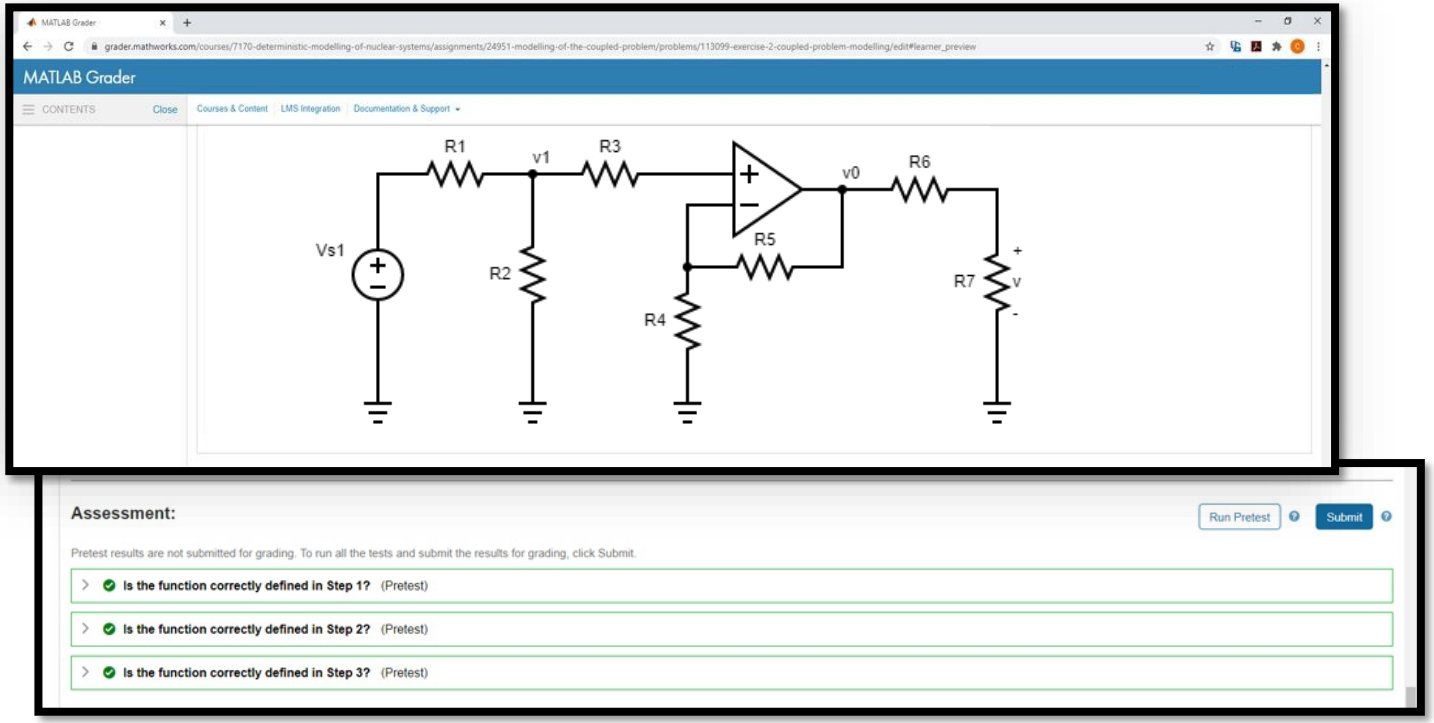
Use live scripts to create engaging lectures that combine explanatory text, mathematical equations, code, and results

Share live scripts directly with colleagues or students

Work in a single environment to eliminate context switching

MathWorks

Teaching and Automatic Grading with MATLAB Grader



MathWorks

MATLAB Engineering Project Ideas

Gain practical experience through capstone or final-year projects or master's thesis

Portable Charging System for Electric Vehicles

Design a portable charger for electric vehicles.

Impact
Help make electric vehicles more reliable for general use.

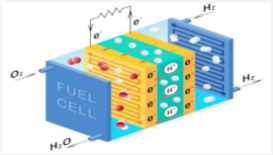
Expertise Gained
Sustainability and Renewable Energy, Control, Electrification, Modeling and Simulation

Wind Turbine Predictive Maintenance Using Machine Learning

Improve the reliability of wind turbines by using machine learning to inform a predictive maintenance model.

Impact
Contribute to providing the world with reliable green energy.

Expertise Gained
Industry 4.0, Sustainability and Renewable Energy, Machine Learning, Electrification, Modeling and Simulation, Predictive Maintenance, Wind Turbines



Green Hydrogen Production

Develop a model of a reversible fuel cell integrated into a renewable-energy microgrid structure.

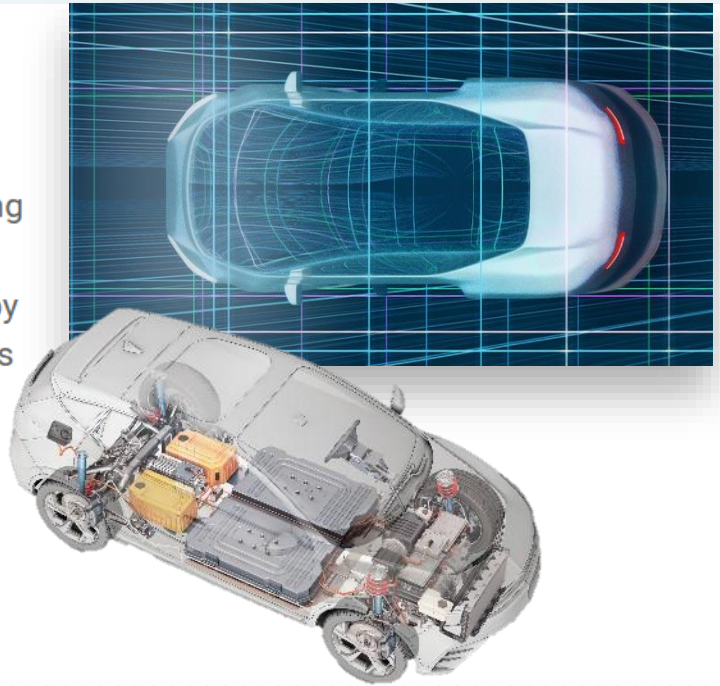
Impact
Contribute to the global transition to zero-emission energy sources through the production of hydrogen from clean sources.

Expertise Gained
Sustainability and Renewable Energy, Electrification, Digital Twins, Modeling and Simulation

MathWorks

Bosch and National Institute of Technology Calicut Collaborate on EV Course to Prepare Students for Industry

> "The collaboration between NIT Calicut, MathWorks, and Bosch narrowed the gap between academia and industry, producing an electric vehicle system engineering course that has been both well received by our students and highly useful for them as well."
>
> — *Dr. Kumaravel Sundaramoorthy, NIT Calicut*



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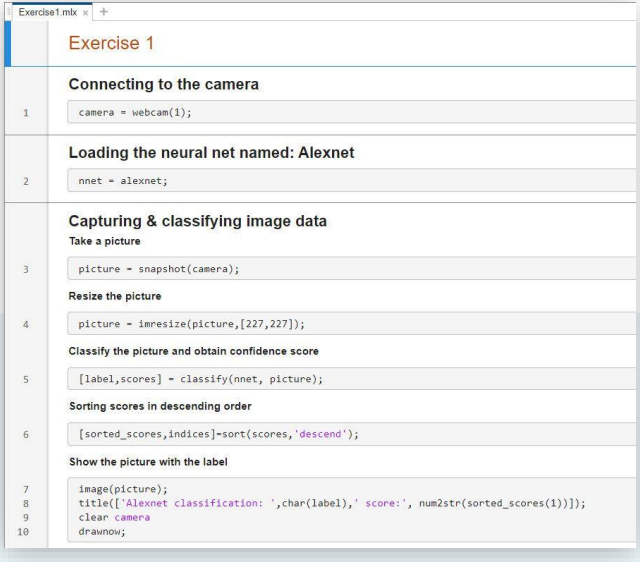
Arizona State University: AI and IoT for First-Year Students

Artificial Intelligence

Internet of Things

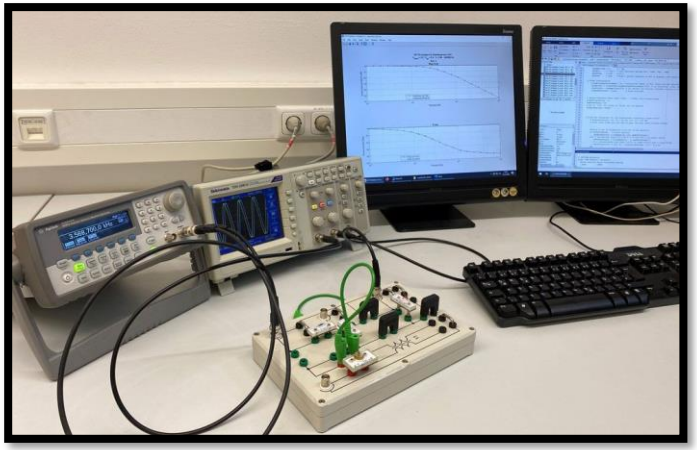


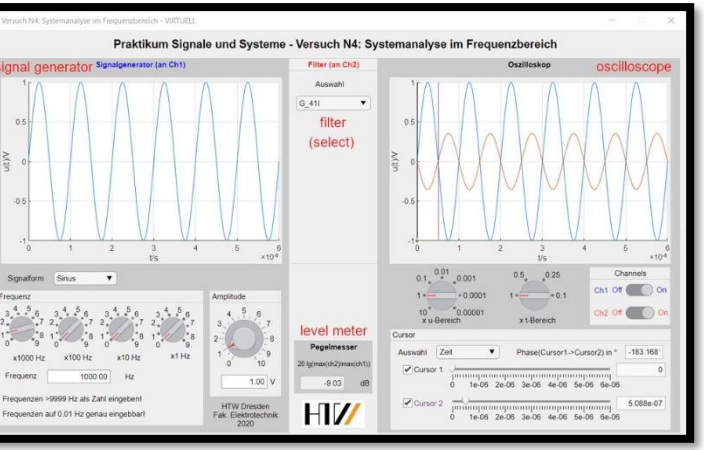
"When I started teaching Introduction to Engineering, there were just a handful of female students. Today, about a quarter of the class is female. Activities like the deep learning and IoT module, which seems appealing to female students, are likely to encourage them to continue in the engineering program."

- Chao Wang, PhD, Arizona State University

MathWorks

HTW Dresden:
Converting a Physical Lab to a Virtual Teaching Lab





App created to simulate signal generator, oscilloscope, and tunable filters

Used as a standalone virtual lab and extension of the physical laboratory

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Self-Paced Courses

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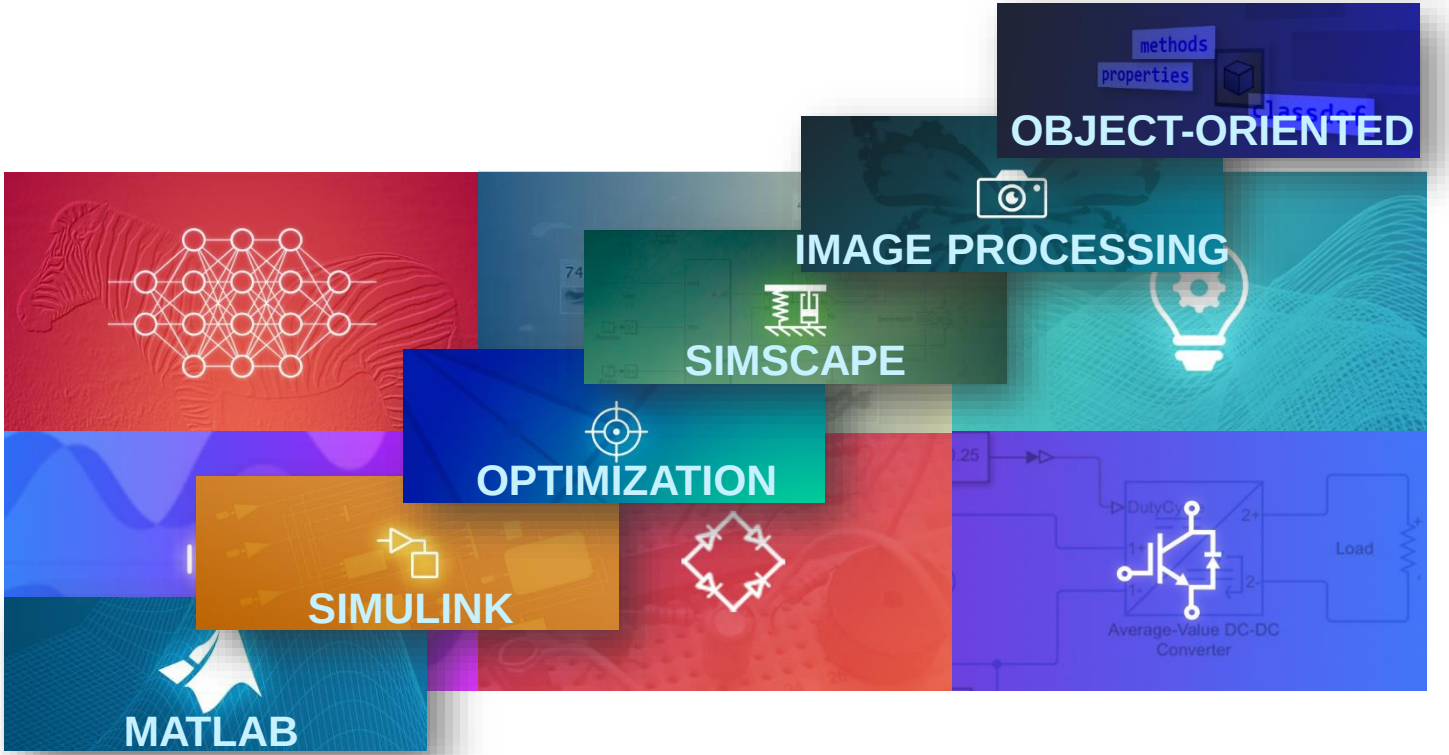
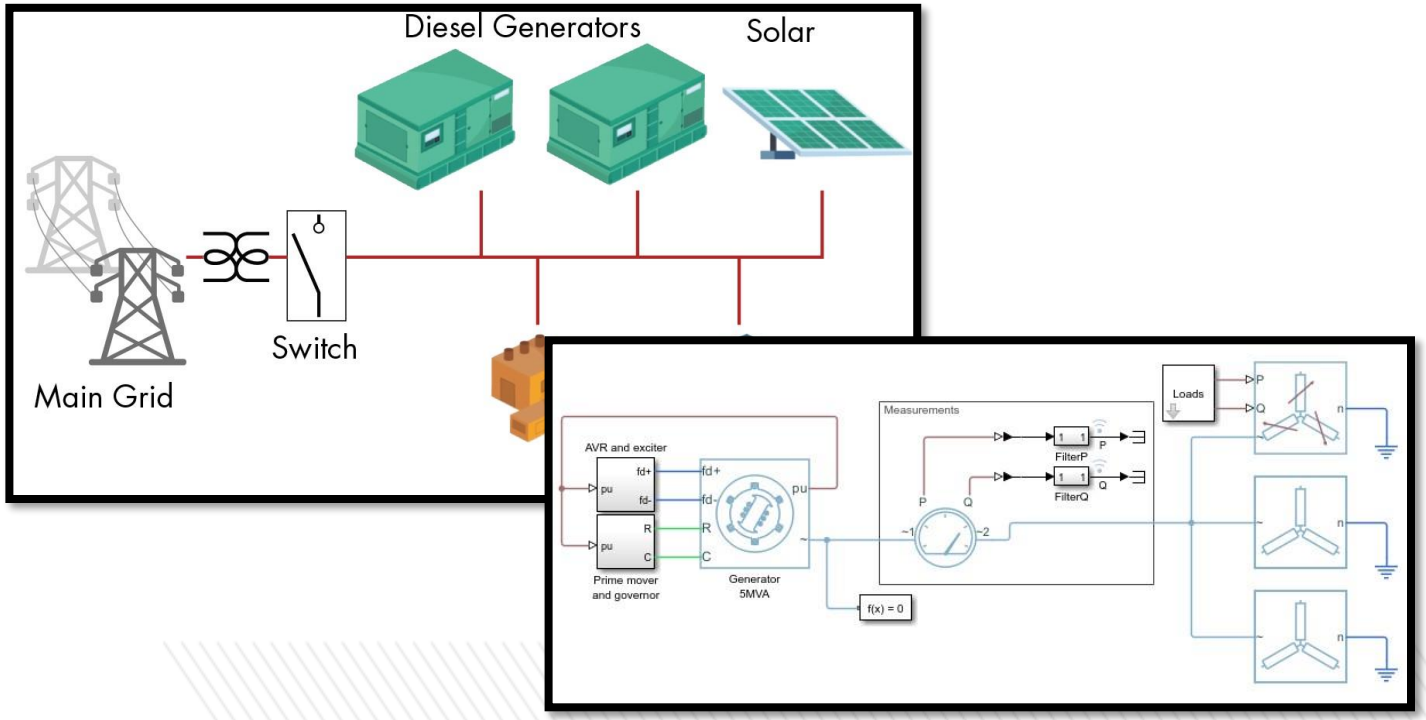
Teaching Using Self Paced Online Courses



MathWorks

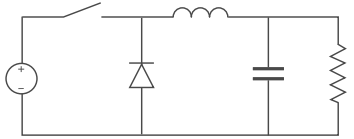
Power Systems Simulation Onramp

Learn how to progressively build and validate power systems using Simscape Electrical



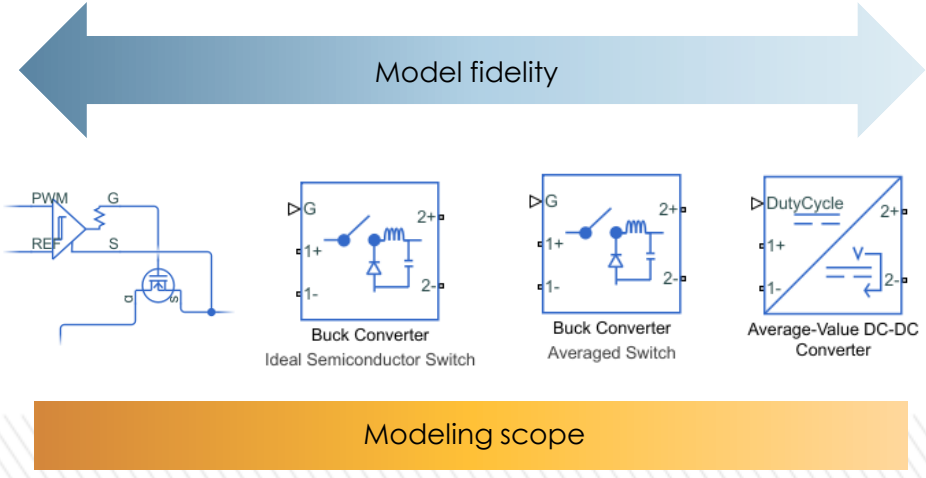
MathWorks

Power Electronics Simulation Onramp



Short course on the basics of simulating power converters in Simscape Electrical

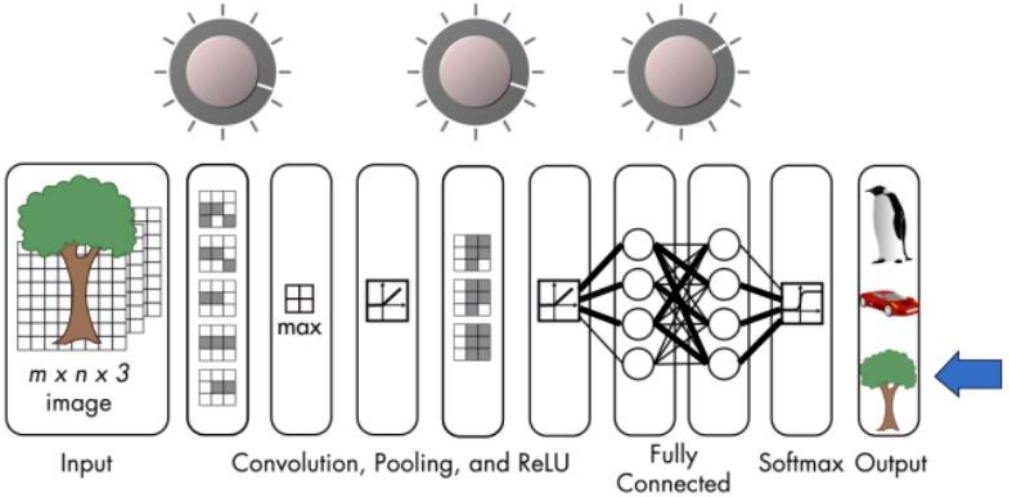
- **Simulate buck converter**
- **Model converter fidelity for speed**
- **Implement closed-loop voltage control**



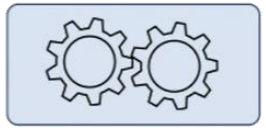
Deep Learning Onramp

Learn the basics of deep learning in 2 hours

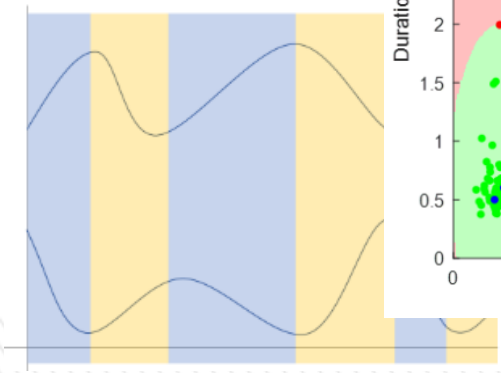
- Convolutional neural networks
- Working with pre-trained networks
- Transfer learning
- Evaluating network performance

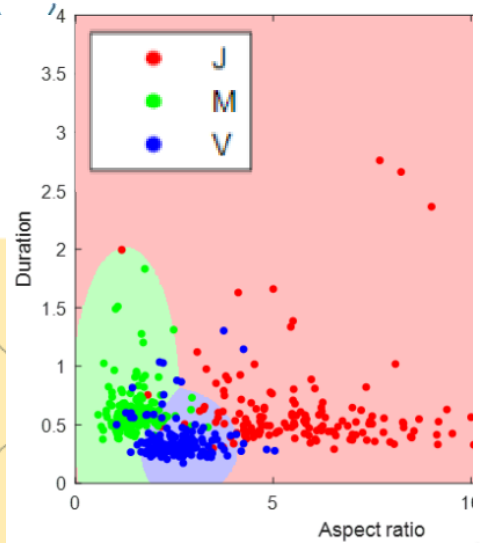


Machine Learning Onramp



- Overview of classification workflow
- Importing data using datastores
- Engineering features
- Automating feature extraction
- Training and evaluating models





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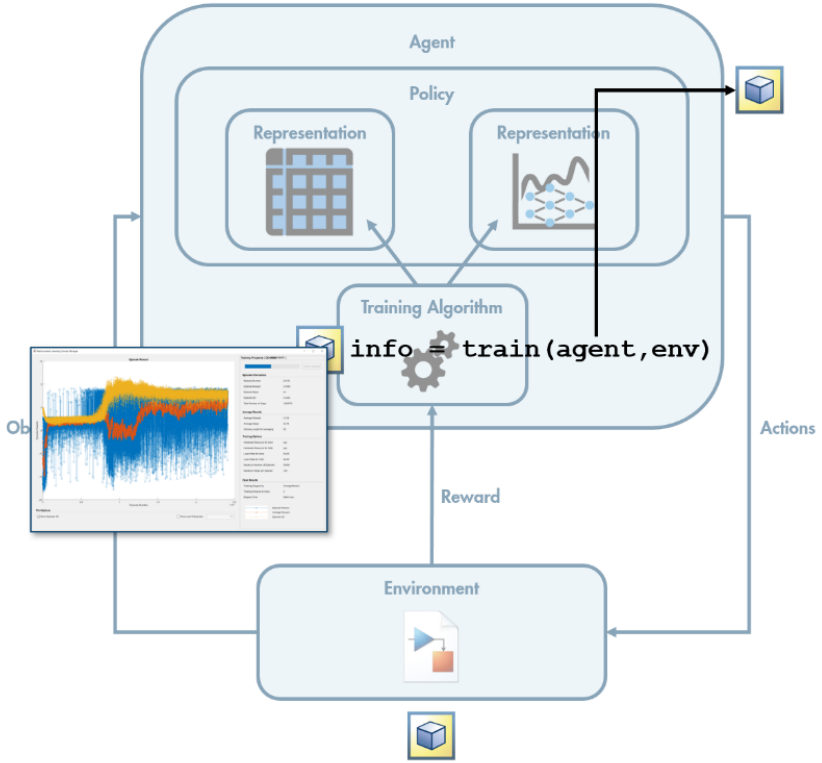
Reinforcement Learning Onramp

- Simulating with a pretrained agent
- Defining environments and agents
- Creating neural networks
- Training agents



Power Electronics

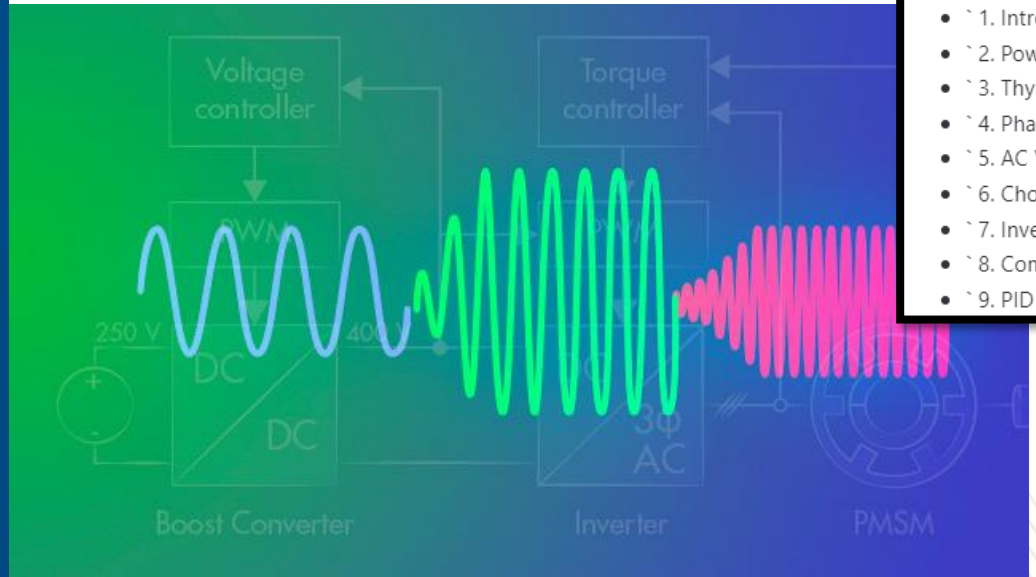
MATLAB® & SIMULINK®

Power Electronics Course Teaching Modules

Contents

The structure of the repository is as follows:

- `Learning Outcomes
- `Course Structure
- `Pre-Requisites:
- `List of Exercises
- ` 1. Introduction to Power Electronics
- ` 2. Power Semiconductor Device Characterisitics
- ` 3. Thyristor Firing Circuits
- ` 4. Phase Controlled Converters (AC-DC)
- ` 5. AC Voltage Controllers (AC-AC)
- ` 6. Choppers (DC-DC)
- ` 7. Inverters (DC-AC)
- ` 8. Commutation Circuits
- ` 9. PID Control



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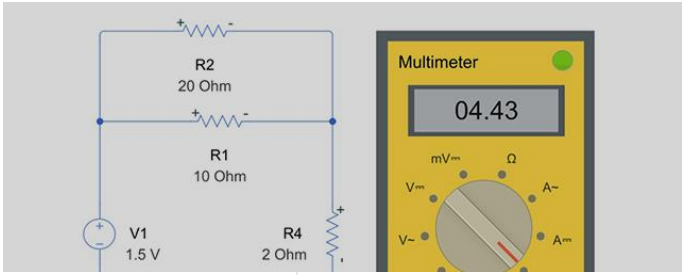
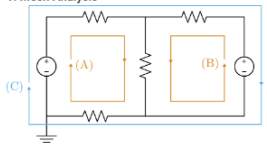
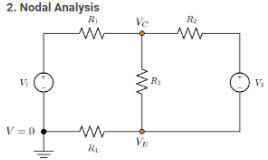
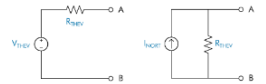
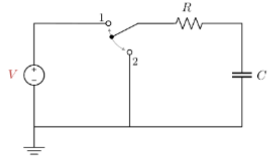
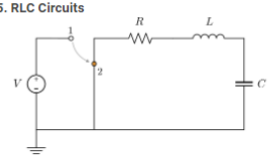
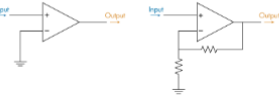
DC Circuits Virtual Analysis Lab



Module	Learning Goals
1. Mesh Analysis 	• Use mesh analysis to compute currents through a linear circuit. • Solve the matrix form of circuit equations in MATLAB. • Model and analyze linear circuits in Simscape.
2. Nodal Analysis 	• Use nodal analysis to compute voltages. • Solve the matrix form of circuit equations in MATLAB. • Model and analyze linear circuits in Simscape.
3. Thevenin and Norton Equivalent Circuits 	• Explain Thevenin and Norton equivalent circuits. • Solve for Thevenin and Norton equivalents. • Compare circuits to their Thevenin and Norton equivalents.
4. RC Circuits 	• Simulate charging and discharging RC circuits. • Plot solutions of RC circuit differential equations. • Measure the time constant of an RC circuit.
5. RLC Circuits 	• Compare the response of first and second order circuits. • Analyze a second order RLC circuit differential equation. • Solve for the natural frequency and damping in an RLC circuit. • Compare underdamped, overdamped, and critically damped circuits.
6. Op Amps 	• Describe the open-loop behavior of an op amp. • Compare ideal and non-ideal op amp behavior. • Analyze negative feedback op amp circuits. • Design circuits using combinations of basic op amp circuits.

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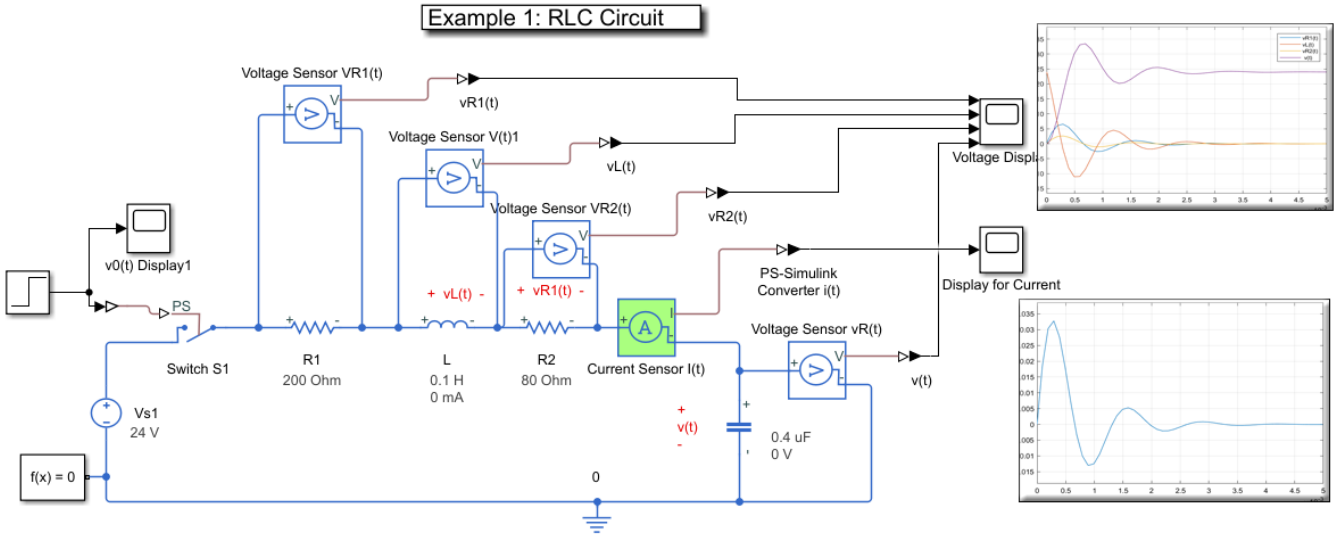
Electrical Circuits Virtual Lab



- Node Analysis
- Mesh Analysis
- Amplifier Circuits
- RC, RL, RLC Circuits
- Op-Amps
- Transfer Functions

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Power Systems

MATLAB® & SIMULINK®

3-Phase Power Video Series

Build up your engineering knowledge on the design, analysis, and operation of 3-phase electrical power systems.

Fundamentals of 3-Phase Electricity
Learn the fundamentals of 3-phase electricity and how balance
phase power.

Star (Wye) and Delta-Connected Loads
Learn about Star (Wye) and Delta-Connected Loads in 3-phase
between line measurements and phase measurements for both

Star-Star and Star-Delta Transformers
Learn about Star-Star and Star-Delta transformers in 3-phase po
between primary and secondary voltage magnitude and phase

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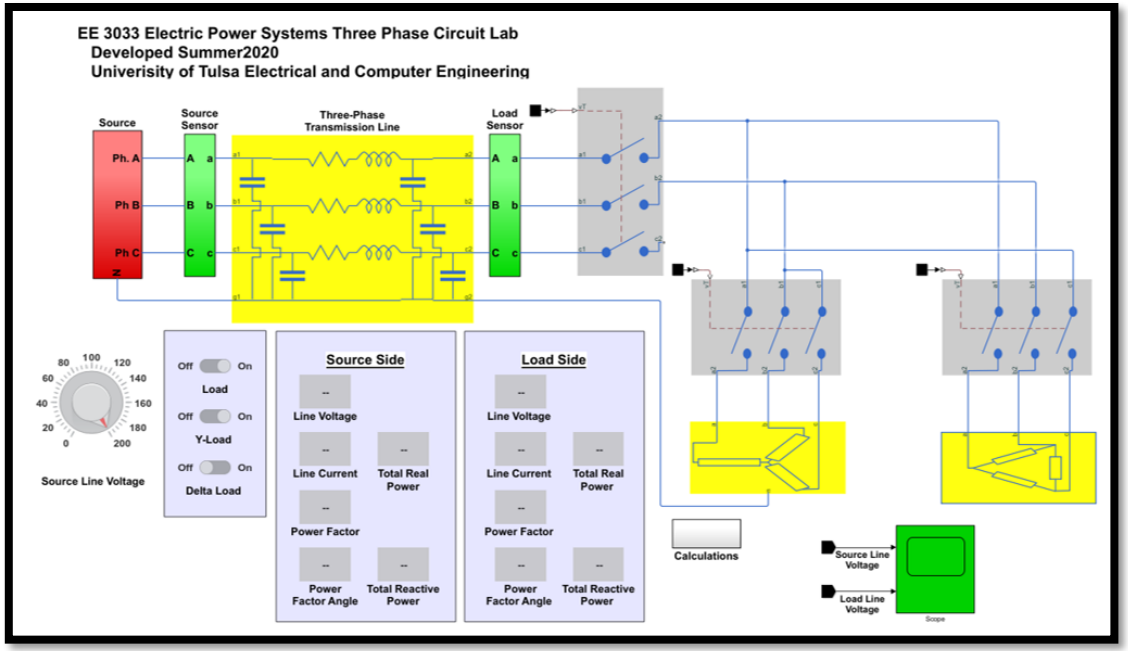
Virtual Electrical Machine & Power Labs



- Circuits
- Power systems
- Transformers
- DC Motors
- Synchronous Motors
- Induction Motors

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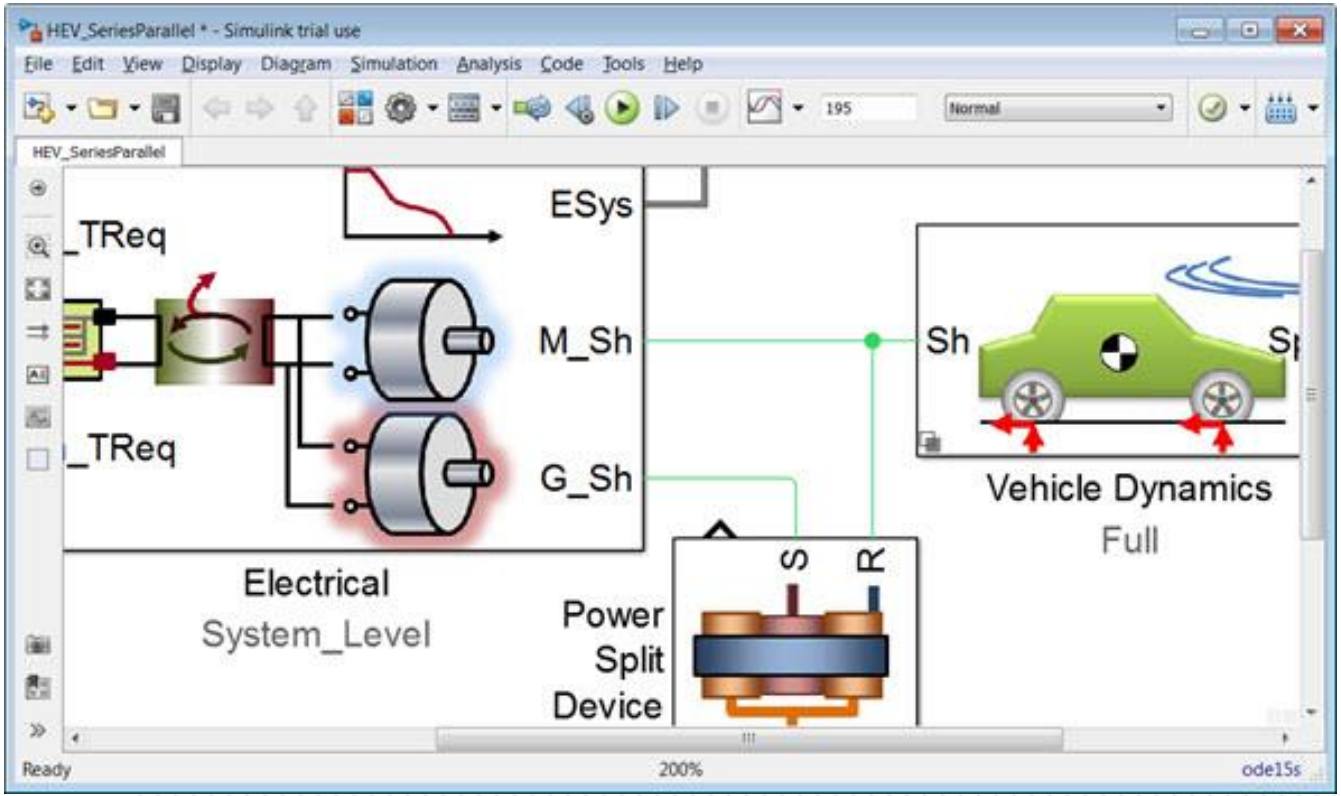
Hybrid-Electric Vehicle Model in Simulink



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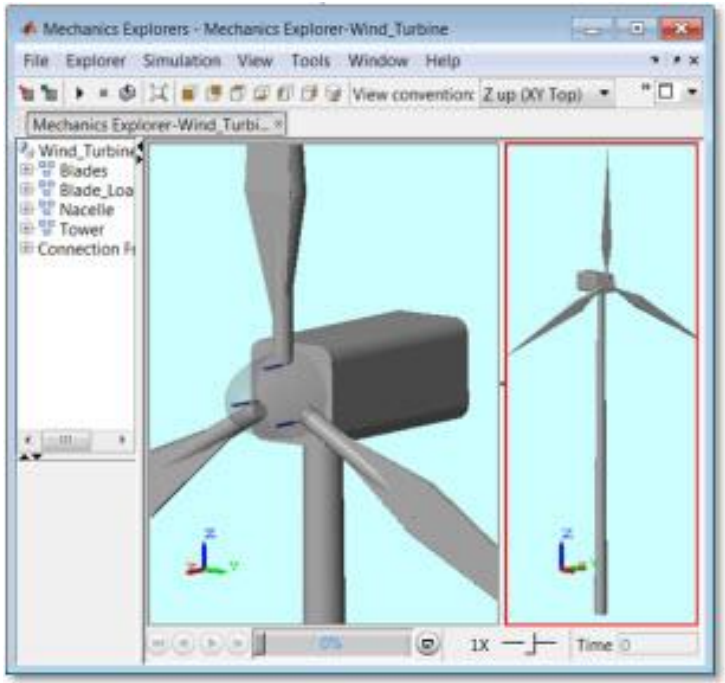
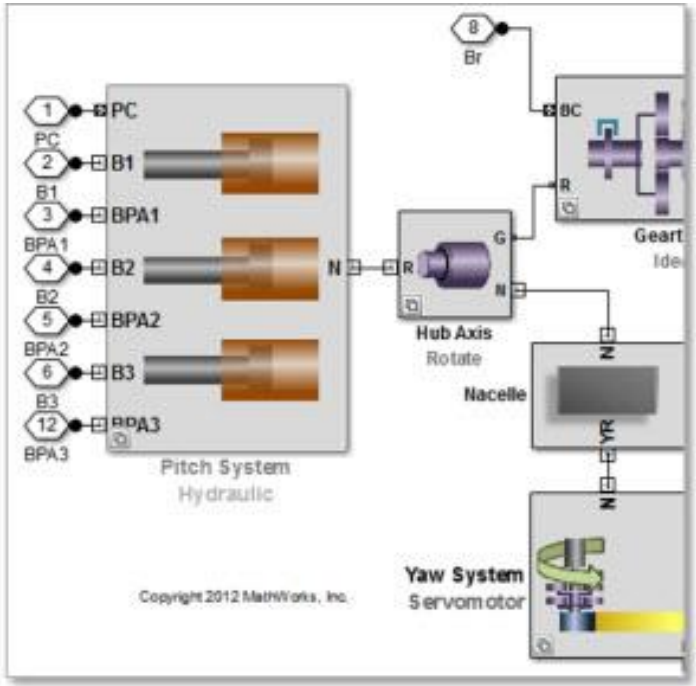
Renewable Energy

MATLAB® & SIMULINK®

Wind Turbine Model





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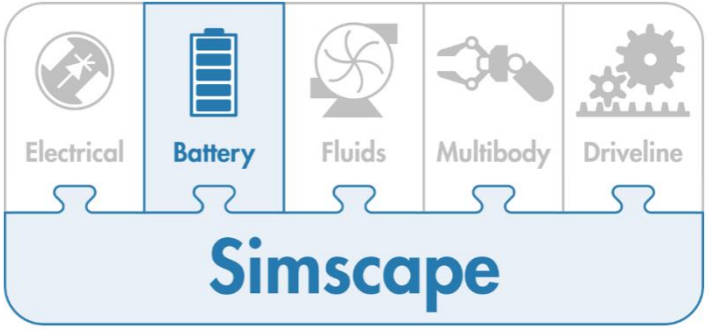
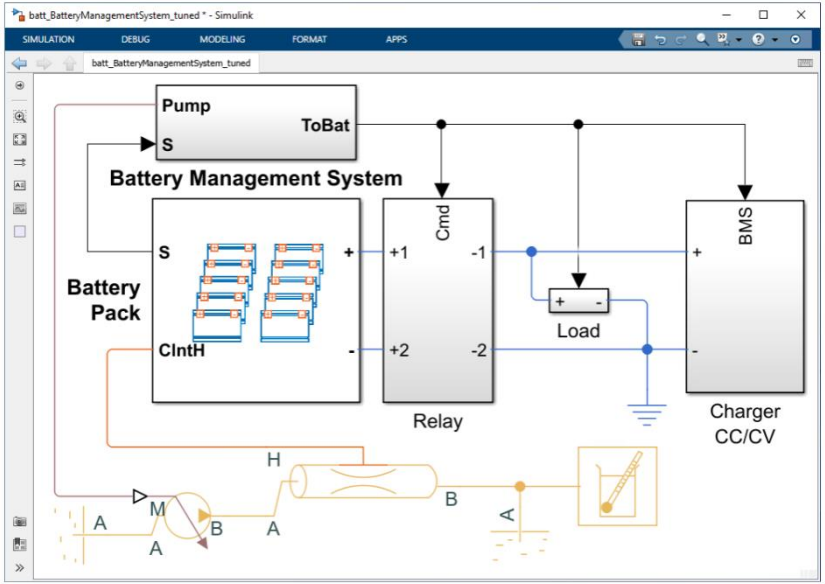
Battery Management



Design and simulate battery and energy storage systems

- Electrothermal cell behavior
- Battery pack design
- Battery management systems



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AI in Electrification

MATLAB® & SIMULINK®

Teaching Tools

Self-Paced Courses

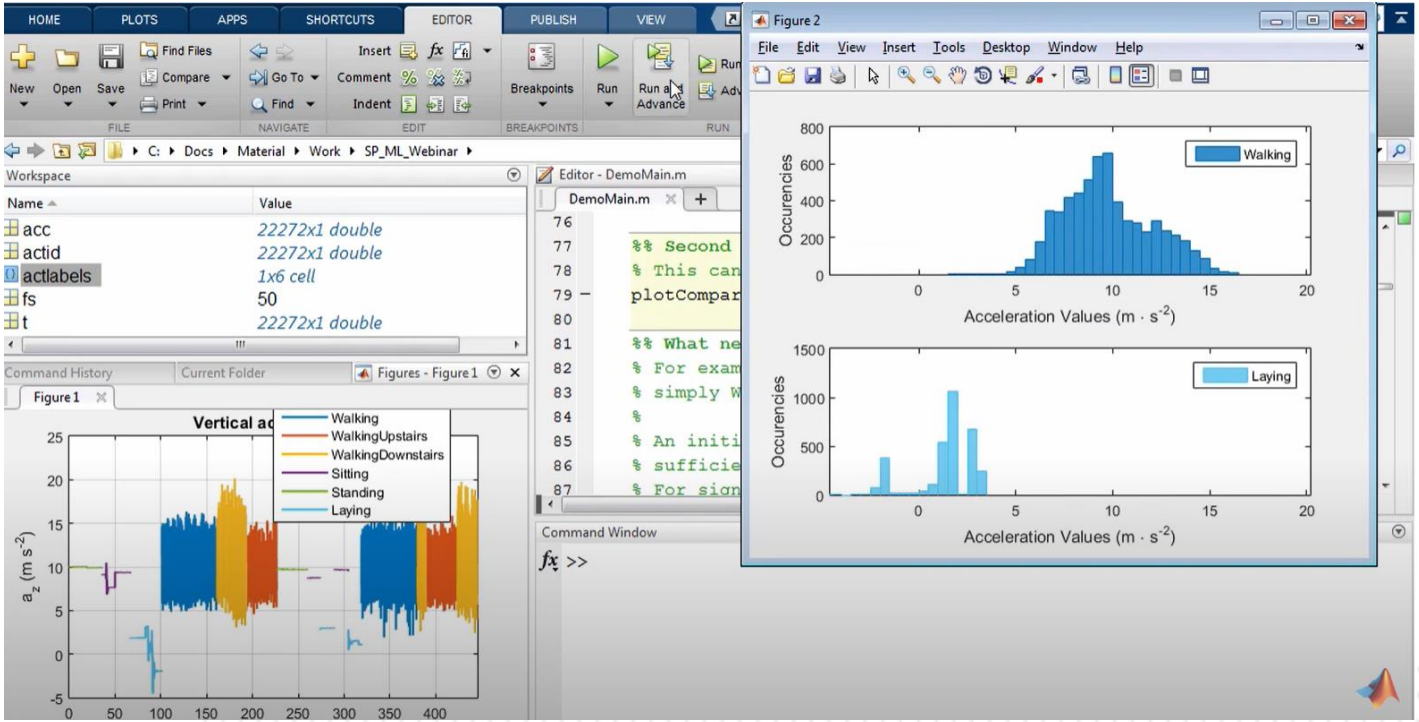
Power Electronics

Power Systems

Renewable Energy

› AI in Electrification

Signal Processing and Machine Learning Techniques for Sensor Data Analytics



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Mercedes Benz Simulates Hardware Sensors with Deep Neural Networks