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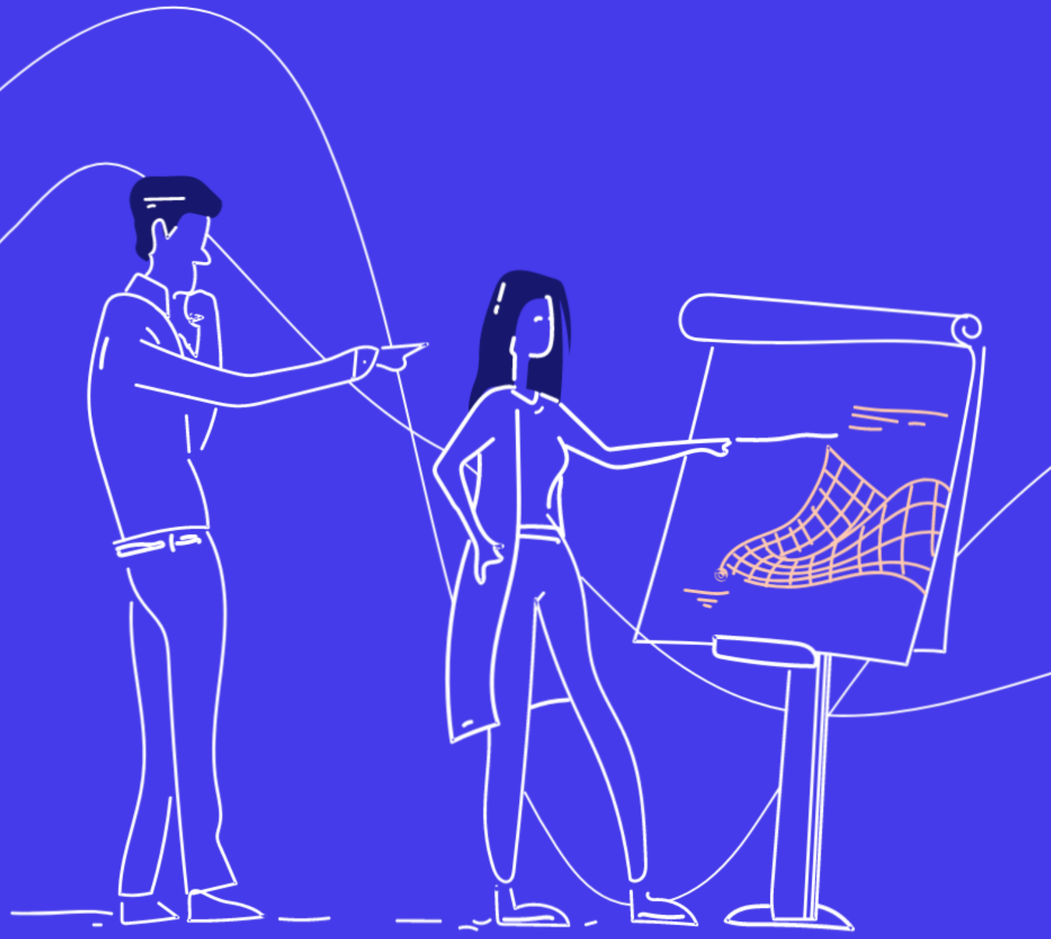
Electrification Curriculum



Gamax Laboratory Solutions helps you overcome your complex engineering challenges. We help a broad spectrum of industries to accelerate the innovation process in the field of R&D. As the sole authorized regional representative for Eastern Europe since 1996, we provide over two decades of expertise with Mathworks, Comsol, and Speedgoat products, software, and training. We offer consultation in project planning and design, research, virtual prototyping, testing, and go to market simulations.

The Value of an Experienced Training Expert

Gamax Laboratory Solutions
Public Trainings

Core Model-Based Engineering Platform

- MATLAB Essentials for Simulink (1 Day)
- **Simulink Fundamentals (2 Days)**
- Stateflow for Logic-Driven System Modeling (2 Days)

Power Systems & Control

- Control System Design with MATLAB and Simulink (2 Days)
- Modeling Physical Systems with Simscape (1 Day)
- Power Electronics Control Design with Simulink and Simscape (1 Day)
- Modeling Electrical Power Systems with Simscape (1 Day)

Battery Modeling

- Battery Modeling and Algorithm Development with Simulink (2 Days)

Architecting, Managing, Testing & Implementation

- Simulink Model Management and Architecture (2 Days)
- Simulation-Based Testing with Simulink (1 Day)
- Embedded Coder for Production Code Generation (3 Days)
- Polyspace for C/C++ Code Verification (3 Days)
- Real-Time Testing with Simulink Real-Time and Speedgoat Hardware (2 Days)

MATLAB Essentials for Simulink

This one-day course provides an introduction to the MATLAB® technical computing environment including topics most useful for Simulink workflows. No prior programming experience or knowledge of MATLAB is assumed. Themes of modeling, visualization, and programming are explored throughout the course.

Topics included:

- Working with the MATLAB user interface
- Working with vectors and matrices
- Visualizing data
- Working with data files
- Automating commands with scripts
- Writing programs with branching and loops
- Writing functions

Prerequisites

Undergraduate-level mathematics and experience with basic computer operations

Detailed course outline »

TOPICS

Day 1

- Exploring the MATLAB Environment
- Scripting with MATLAB Commands
- Working with Data in MATLAB
- Controlling Flow and Creating Functions

Simulink Fundamentals

This two-day course provides a comprehensive introduction to the Simulink environment. It demonstrates how to create, modify Simulink models, improve simulation accuracy and speed and create reusable model components using subsystems, model references and libraries.

Prerequisites

MATLAB Fundamentals

Detailed course outline »

TOPICS

Day 1

- Creating and Simulating a Model
- Modeling Programming Constructs
- Modeling Discrete Systems
- Modeling Continuous Systems

Day 2

- Solver Selection
- Developing Model Hierarchy
- Modeling Conditionally Executed Algorithms
- Combining Models into Diagrams
- Creating Libraries

Stateflow for Logic-Driven System Modeling

This two-day course shows how to model and simulate decision logic using Stateflow. The course focuses on how to employ flow charts, state machines, truth tables, state transition tables and component-based modeling in Simulink designs.

Prerequisites

MATLAB Fundamentals and
Simulink Fundamentals

Detailed course outline »

TOPICS

Day 1

- Modeling Flow Charts
- Modeling State Machines
- Hierarchical State Diagrams
- Parallel State Diagrams

Day 2

- Using Events in State Diagrams
- Calling Functions from Stateflow
- Truth Tables and State Transition Tables
- Component-Based Modeling in Stateflow

Control System Design with MATLAB and Simulink

This two-day course provides a general understanding of how to accelerate the design process for closed-loop control systems using MATLAB and Simulink.

Topics included: control system design overview, system modeling, identification and analysis, control design and controller implementation.

Prerequisites

MATLAB Fundamentals and Simulink Fundamentals or equivalent experience using MATLAB and Simulink. Also, an understanding of terminology and concepts related to common control systems.

Detailed course outline »

TOPICS

Day 1

- Control System Design Overview
- Model Representations
- System Identification
- Parameter Estimation
- System Analysis

Day 2

- Linearization
- PID Control in Simulink
- Classical Control Design
- Response Optimization
- Controller Implementation

Modeling Physical Systems with Simscape

This one-day course discusses how to model systems in several physical domains such as electrical, mechanical, and hydraulic. This course focuses on interpreting Simscape diagrams, combining them with Simulink models, modeling energy transfer between different physical domains, and creating userdefined Simscape components.

Prerequisites

MATLAB Fundamentals and Simulink Fundamentals

Detailed course outline »

TOPICS

Day 1

- Introduction to Simscape and the Physical Network Approach
- Working with Simscape Components
- Connecting Physical Domains
- Combining Simscape Models and Simulink Models
- Creating Custom Components with the Simscape Language

Power Electronics Control Design with Simulink and Simscape

This one-day course focuses on modeling and controlling power electronic systems in the Simulink environment using Simscape Electrical. Themes of DC power electronic systems, converter model fidelity, linearization and control, three-phase power electronic systems, and motor control are explored throughout the course.

Prerequisites

MATLAB Fundamentals, Simulink for System and Algorithm Modeling, and Modeling Physical Systems with Simscape

Detailed course outline »

TOPICS

Day 1

- Introduction to Power Electronics
- Converter Model Fidelity
- Linearization and Control
- Modeling Three-Phase Power Electronic Systems
- Motor Control

Modeling Electrical Power Systems with Simscape

This one-day course discusses how to model electrical power systems in the Simulink environment using the Simscape Electrical Specialized Power Systems library. This course focuses on creating three-phase systems with passive elements and with electrical machines, analyzing and controlling electrical power systems, modeling power electronic components and speeding up simulation of electrical models.

Prerequisites

MATLAB Fundamentals, Simulink Fundamentals, and Modeling Physical Systems with Simscape

Detailed course outline »

TOPICS

Day 1

- Introduction to Three-Phase Systems
- Three-Phase Systems with Electrical Machines
- Controlling Electrical Machines
- Power Electronics

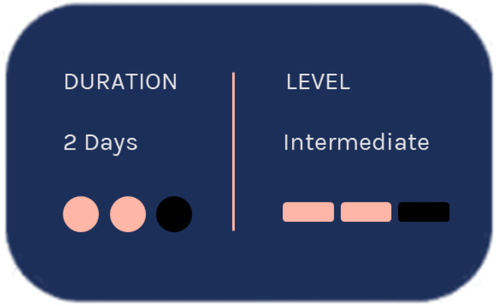
Battery Modeling and Algorithm Development with Simulink

This two-day course focuses on modeling battery packs using Simscape™ and designing key control functionalities of battery management system using Stateflow®.

Prerequisites

Fundamental knowledge of Simulink, Stateflow and Simscape.

Detailed course outline »



TOPICS

Day 1

- Getting Started with a Battery Cell
- Cell Characterization
- Battery Pack Modeling

Day 2

- Battery Management System
- State of Charge Estimation
- Fault Monitoring and Current Limit Computation
- Appendix A: Kalman Filter and Extended Kalman Filter

Simulink Model Management and Architecture

This two-day course describes techniques for applying ModelBased Design in a common design workflow. It provides guidance on managing and sharing Simulink models when working in a large-scale project environment. This course is intended for intermediate or advanced Simulink users.

Prerequisites

MATLAB Fundamentals and Simulink Fundamentals. This course is intended for intermediate or advanced Simulink users.

Detailed course outline »

TOPICS

Day 1

- Model-Based Design
- Requirements Linking and Interface Control
- Model Architecture
- Project Management

Day 2

- Data Management
- Data Customization
- Modeling Standards
- Reporting

Simulation-Based Testing with Simulink

This one-day course describes techniques for testing Simulink model behavior against system requirements using Simulink Test, Simulink Requirements, and Simulink Coverage. This course focuses on verification and validation, developing test cases, analyzing test results and creating repeatable groups of tests.

Prerequisites

MATLAB Fundamentals and
Simulink Fundamentals

Detailed course outline »

TOPICS

Day 1

- Verification and Validation in Model-Based Design
- Developing Test Cases
- Analyzing Test Results
- Building Test Suites

Embedded Coder for Production Code Generation

This three-day course describes techniques for generating, validating, and customizing embedded code using Embedded Coder.

Topics include: Generated code structure and execution; Code generation options and optimalizations; Integrating generated code with external code; Generating code for multirate systems; Customizing generated code and data.

Prerequisites

- Simulink Fundamentals (or Simulink Fundamentals for Automotive Applications or Simulink Fundamentals for Aerospace Applications)
- Knowledge of C programming language.

Detailed course outline »

TOPICS

Day 1

- Generating Embedded Code
- Optimizing Generated Code
- Integrating Generated Code with External Code
- Controlling Function Prototypes

Day 2

- Customizing Data Characteristics in Simulink®
- Customizing Data Characteristics Using Data Objects
- Creating Storage Classes
- Customizing Generated Code Architecture
- Model Referencing and Bus Objects

Day 3

- Scheduling Generated Code Execution
- Testing Generated Code on Target Hardware
- Deploying Generated Code
- Integrating Device Drivers
- Improving Code Efficiency and Compliance

Polyspace for C/C++ Code Verification

This two-day course discusses the use of Polyspace Code Prover to prove code correctness, improve software quality metrics, and ensure product integrity. This course describes techniques for creating a verification project, reviewing and understanding verification results, emulating target execution environments, handling missing functions and data, managing unproven code, applying MISRA-C rules and reporting analysis results.

Prerequisites

Strong knowledge of C or C++

Detailed course outline »

TOPICS

Day 1

- Polyspace Workflow Overview
- Polyspace Bug Finder Analysis
- Analyzing Polyspace Code Prover Results
- Code Verification Checks

Day 2

- Managing Polyspace Code Prover Verifications and Results
- Adding Precision to Polyspace Code Prover Verifications
- Integration Analysis
- Application Analysis

Day 3

- (optional, available with private training only)
- Hands-On Instruction (Optional)

Real-Time Testing with Simulink Real-Time and Speedgoat Hardware

This two-day course focuses on real-time testing workflows using Simulink Real-Time and Speedgoat real-time target computers.

Topics include: Converting desktop-based simulation applications into real-time applications; Conducting rapid control prototyping with physical device under control; Creating interactive interfaces and formal test suites, Using standard communication protocols; Ptimizing real-time applications and hardware-in-the-loop testing.

Prerequisites

- Simulink Fundamentals (or Simulink Fundamentals for Automotive Applications or Simulink Fundamentals for Aerospace Applications)
- Knowledge of Simscape ™ preferred

Detailed course outline »

TOPICS

Day 1

- Workflow Overview
- Developing Real-Time Applications
- Building Interactive Interfaces

Day 2

- Automating Real-Time Tests
- Using Communications Protocols
- Optimizing Plant Models for Real-Time Execution
- Hardware-in-the-Loop Testing

The Value of an Experienced Training Expert

Our training courses are developed by MathWorks' team of training engineers with exclusive product knowledge gained from working closely with product developers. They acquire significant hands-on experience by using new products months before they are released and are always current on new capabilities.

Learn Relevant Skills

Each course contains a set of learning objectives designed to help participants quickly master necessary skills. Our hands-on approach allows participants to practice, apply, and evaluate their knowledge in the classroom.

Receive Expert Instruction

Our training employs industry-accepted best practices for adult learning and technical instruction, and has developed course content that facilitates a “Presentation, Practice, Test” approach to learning. All training engineers have been selected based on their theoretical knowledge, technical education, experience, and teaching ability.

Increase Team Success Rates

According to post-training surveys, teams who receive 40 hours of training meet project objectives three times as often as those who receive 30 hours or less. This increase in training time raises the likelihood of meeting objectives by 90%.

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Expand your knowledge