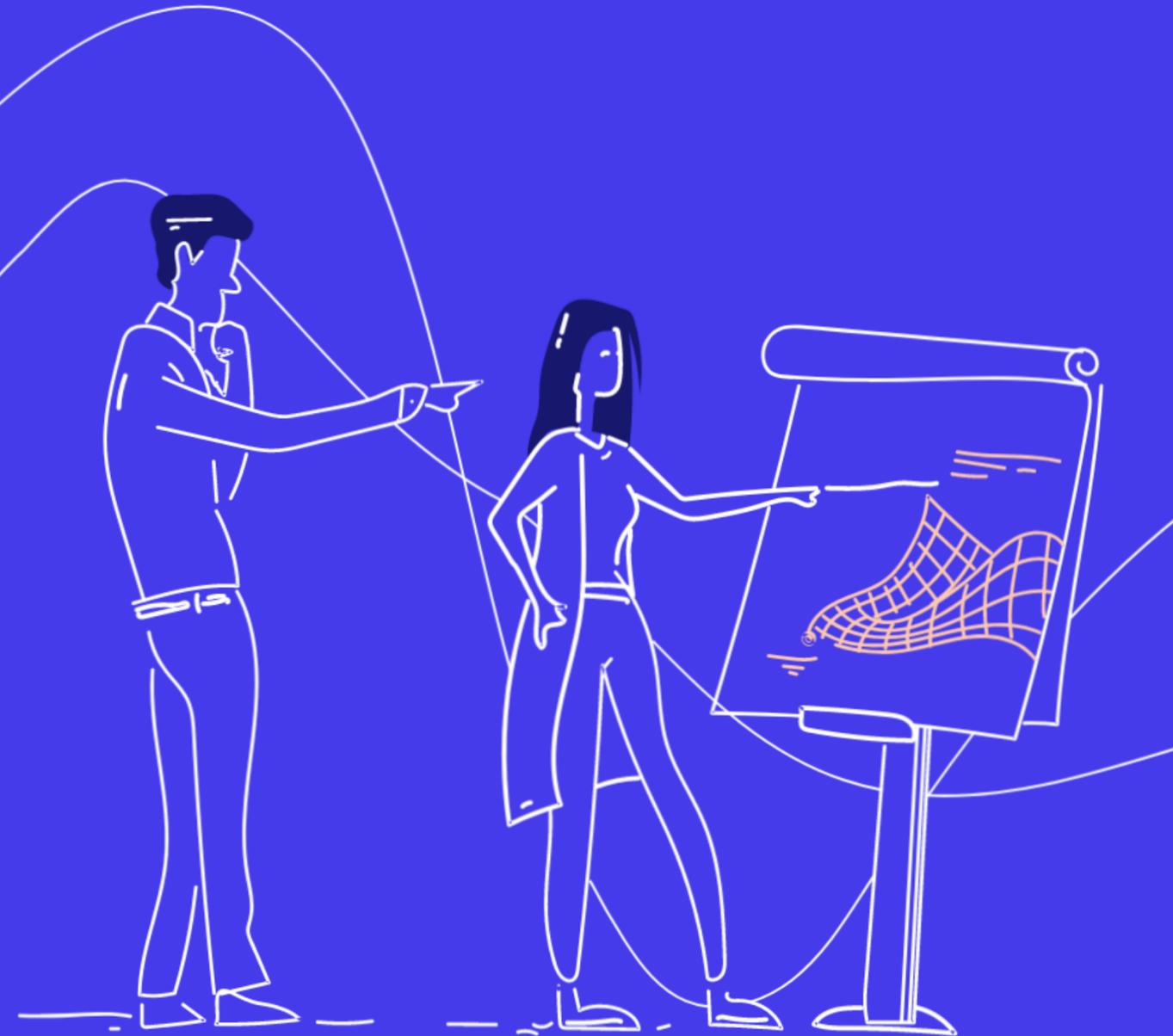




# Control System Design with MATLAB and Simulink



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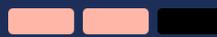
# Control System Design with MATLAB and Simulink

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.

DURATION	LEVEL
2 Days	Medium
	

### 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

# Control System Design Overview

OBJECTIVE: Provide an overview of the control system design process and introduce how MATLAB and Simulink fit into that process. The details of each step in the design process are covered in later chapters.

- Defining a control design workflow
- Linearizing a model
- Finding system characteristics
- Setting controller requirements
- Tuning controllers
- Testing controllers

# Model Representations

OBJECTIVE: Discuss the various formats used for representing system models. Also highlights the pros and cons of each format.

- Model representations overview
- LTI objects
- Simulink models

# System Identification

OBJECTIVE: Illustrate how to estimate system models based on measured data.

- System identification overview
- Data importing and preprocessing
- Model estimation
- Model validation

## Parameter Estimation

OBJECTIVE: Use measured data to estimate the values of a Simulink model's parameters.

- Parameter estimation overview
- Model preparation
- Estimation process
- Parameter estimation tips

## System Analysis

OBJECTIVE: Outline the different analysis tools and functions available for understanding system behavior - such as system resonances, transient response, etc.

- System analysis functions
- Linear System Analyzer
- DC motor analysis
- Automation of analysis tasks
- Open loop analysis

## Linearization

OBJECTIVE: Discuss techniques for linearizing a Simulink model and validating the linearization results.

- Linearization workflow
- Operating points
- Linearization functions
- Frequency response estimation

## PID Control in Simulink

OBJECTIVE: Use Simulink to model and tune PID controllers.

- PID Workflow
- Model setup
- PID Controller block
- Automatic tuning
- Additional PID features

## Classical Control Design

OBJECTIVE: Use classical control design techniques to develop system controllers. Common control techniques are covered, such as PID and lead/lag controllers.

- Open-loop tuning
- Closed-loop analysis
- PID control
- Lead-lag control

# Response Optimization

OBJECTIVE: Use optimization techniques to tune model parameters based on design requirements and parameter uncertainty.

- Optimizing model response
- Performing sensitivity analysis
- Optimizing with parameter uncertainty

# Controller Implementation

OBJECTIVE: Discuss steps that might be needed to effectively implement a controller on a real system.

- Identifying physical and practical limitations of controllers
- Discretizing a controller
- Preparing a controller for code generation
- Converting to fixed-point data types



**Expand your  
knowledge**

