



## Course Title:

### **Control System Design with MATLAB and Simulink**

## Course Purpose:

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 include:

- Control system design overview
- System modeling
- System analysis
- Control design
- Controller implementation

## Pre- requisites:

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



- ✓ 2 training days
- ✓ Hours: 09:00-17:00
- ✓ Total training hours: 16

## Teaching method:

The course combines lectures, demonstrations and practical exercises in MATLAB, using original training books from MathWorks. The course is in Hebrew, but the training materials are in English.

עמוד מס' 1

### **Training Center Systematics - Contact information:**

**Phone number:** 03-7660111 Ext: 6 **Email:** training@systematics.co.il

**Website:** <http://www.systematics.co.il/mathworks>



## **Course Objective:**

### **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

עמוד מס' 2

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- 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 Templates

### 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

עמוד מס' 3


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- Discretizing a controller
- Preparing a controller for code generation
- Converting to fixed-point data types



עמוד מס' 4

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