



Course Title:

Simulink for Analog Mixed-Signal Design

Course Purpose:

This two-day course, targeted toward new users of Simulink, uses basic modeling techniques and tools to demonstrate how to develop Simulink block diagrams for mixed signal applications.

Topics include:

- Using the Simulink interface
- Modeling discrete dynamic systems
- Modeling mixed-signal (hybrid) systems
- Developing custom blocks and libraries
- Modeling condition-based systems
- Performing measurements using built in blocks
- Using test benches to test mixed signal systems
- Using control design techniques for bode plot analysis and linearization
- Automating Simulink tasks

Pre-requisites:

- MATLAB Fundamentals and basic knowledge of digital signal processing and mixed signal design



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

Teaching method

The course combines lectures, demonstrations, and practical exercises in MATLAB & Simulink, 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>



Day 1:

Creating and Simulating a Model

Objective: Explore the Simulink interface and block libraries. Build a simple model and analyze the simulation results.

- Creating and editing a Simulink model
- Defining system inputs and outputs
- Simulating models and analyzing results

Modeling Discrete Dynamic Systems

Objective: Model discrete dynamic systems and visualize frame-based signals using a scope.

- Modeling a discrete system with basic blocks
- Finding sample times of block outputs
- Using frames in your model
- Using buffers
- Viewing frame-based signals
- Behavior of delay blocks with frame-based signals
- Using the discrete filter block
- Designing analog and decimation/interpolation filters

Modeling Logical Constructs

Objective: Model logical expressions. See how zero-crossing detection is used in Simulink and model simple logic in Simulink using MATLAB code.

- Modeling logical expressions
- Modeling conditional signal routing
- Understanding zero-crossing detection
- Modeling with the MATLAB Function block

Mixed-Signal Models

Objective: Model mixed-signal systems.

- What is a mixed-signal model?
- Modeling an ADC with aperture jitter and nonlinearity
- Case study: Modeling TI's ADS62P29 ADC
- Modeling a PLL with phase noise and other impairments
- Using blocks from the Mixed-Signal Blockset

עמוד מס' 2

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Day 2:

Simulink Solvers

Objective: Choose the right solver for a Simulink model.

- Understanding the Simulink solver
- Solving simple models
- Solving models with discrete and continuous states
- Solving models with multiple rates
- Fixed-step and variable-step solvers
- Choosing a continuous-state system solver
- Handling zero crossings
- Handling algebraic loops
- Case study: Solver profiler for PLL simulation

Subsystems and Libraries

Objective: Create custom blocks in Simulink, apply masks, and develop custom libraries.

- Creating subsystems
- Understanding virtual and atomic subsystems
- Modeling condition-driven systems with enabled subsystems
- Modeling condition-driven systems with triggered subsystems
- Using a subsystem as a model component
- Masking subsystems
- Creating custom block libraries
- Working with and modifying library blocks
- Adding custom libraries to the Simulink Library Browser
- Creating configurable subsystems

Testbenches and Measurements

Objective: Perform spectral analysis in Simulink, use testbenches from the Mixed-Signal Blockset to evaluate performance.

- Performing spectral analysis with the Spectrum Scope block
- Choosing spectral analysis parameters
- Using the logic analyzer
- Measuring Phase Noise, INL, DNL, Jitter
- Using testbenches from the Mixed Signal Blockset

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Control Design Analysis

Objective: Create Bode plots, perform linearization, use the Control System Designer app, control and run Simulink models from the MATLAB command line.

- Creating and analyzing bode plots
- Performing Linearization
- Using the Control System Designer
- Automating test runs
- Checking and modifying parameter settings
- Finding blocks with specific parameter values
- Constructing and modifying block diagrams

עמוד מס' 4

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