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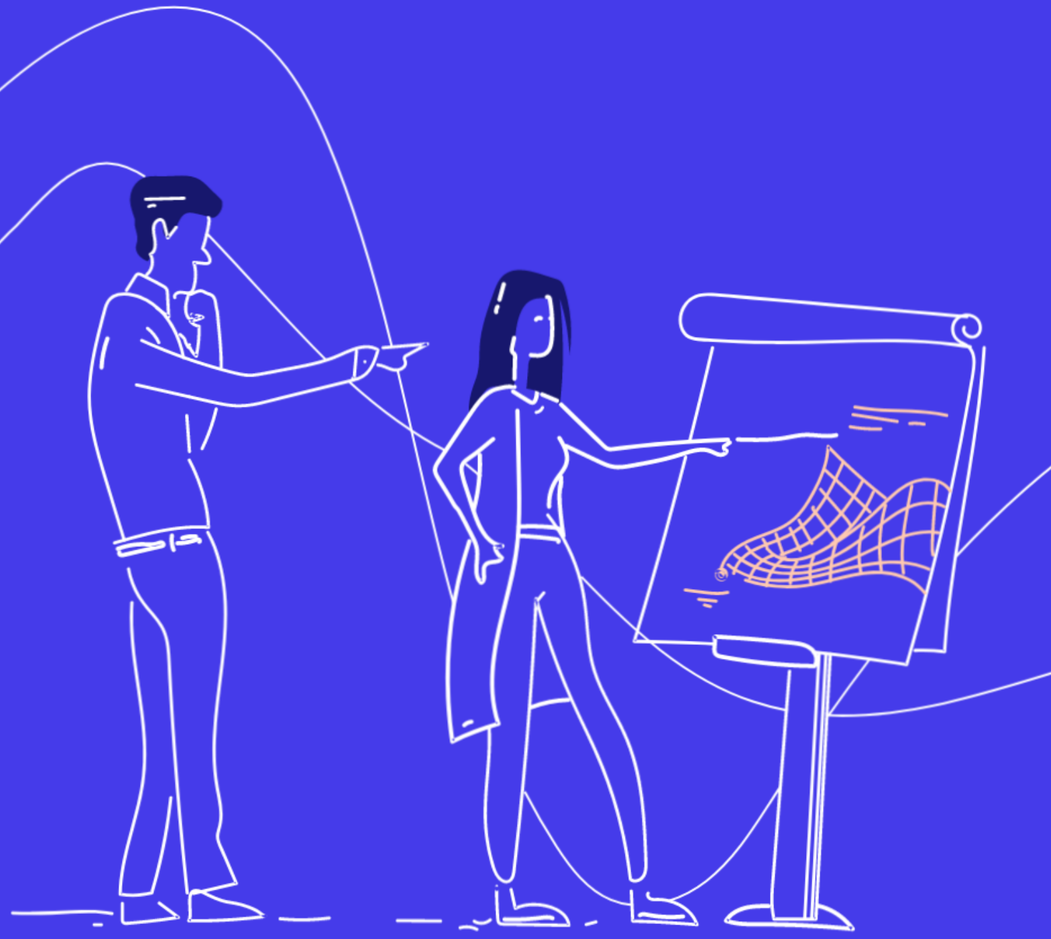
Modeling Radar Systems with MATLAB



SciEngineer's training courses are designed to help organizations and individuals close skills gaps, keep up-to-date with the industry-accepted best practices and achieve the greatest value from MathWorks® and COMSOL® Products.

Modeling Radar Systems with MATLAB

This two-day course provides a comprehensive introduction to radar system design and modeling with a focus on Radar Toolbox™ and Phased Array System Toolbox™.

Prerequisites

Basic radar knowledge and experience using MATLAB®

TOPICS

Day 1

- Working with Radar Toolbox
- Radar Systems Engineering
- Radar Scenario Authoring
- Radar Modeling and Simulation
- Radar Signal and Data Processing

Day 2

- Antenna Array Design
- Spatial Signal Processing
- Radar Environment Modeling
- Antenna Patterns and Mutual Coupling
- Waveform Libraries for Multifunction Radar

Working with Radar Toolbox

OBJECTIVE: Understand course themes, including an overview of a radar system model that will be developed at different levels of fidelity as the course progresses.

- Introduction to the products listed above with a focus on Radar Toolbox
- Introduction to a radar design workflow
- Introduction to a search and track radar model, which will serve as the course example

Radar Systems Engineering

OBJECTIVE: Understand how to use the Radar Designer app to characterize, analyze, and evaluate radar system requirements.

- Evaluate the radar equation and evaluate performance against system-level metrics
- Calculate system gains and losses, transmit power, maximum range, SNR, and other key radar design parameters
- Analyze detection performance over a range of environmental conditions
- Explore signal and data processing engineering trade-offs to ensure requirements are addressed
- Plot SNR vs. range on a stoplight chart
- Generate MATLAB code from app

Radar Scenario Authoring

OBJECTIVE: Understand how to use Radar Toolbox to create a realistic scenario that can be used to evaluate a preliminary radar system design and to also drive system-level simulations.

- Model motion, orientation, and SNR of radar platforms and targets
- Create and record a radar scenario containing platforms and emitters
- Plot ground truth trajectories, object detections, and power levels in a radar scenario

Radar Modeling and Simulation

OBJECTIVE: Translate a preliminary radar design into a statistical model. Learn to generate detections, clustered detections, and tracks from the model. Implement workflow to move to a signal-level model directly from the statistical model.

- Translate preliminary design into statistical model parameters
- Run statistical model to generate detections and tracks
- Use radar transceiver to move from statistical model to signal-level model
- Validate results between different modeling abstraction levels

Radar Signal and Data Processing

OBJECTIVE: Generate detections from signal-level simulations. Estimate received signal parameters including direction-of arrival, range, angle, and Doppler response. Configure a multi-object tracker and perform adaptive tracking.

- Radar signal and data processing overview
- Obtain properties of received signals such as matched filter response, stretch processor response, direction of arrival, range, angle, and Doppler response
- Implement a constant false alarm rate (CFAR) detection algorithm
- Create, delete, and manage tracks for multiple objects. Obtain object positions and velocities.

Antenna Array Design

OBJECTIVE: Design and analyze phased array antennas.

- Generate radiation patterns for linear, planar, and conformal phased array antennas using the Sensor Array Analyzer app
- Design arrays using subarray architectures
- Synthesize an array to match a known pattern
- Model transmit and receive signals through antenna arrays

Spatial Signal Processing

OBJECTIVE: Integrate beamforming and Direction of Arrival (DOA) estimation to improve desired signal strength and reduce the impact of interference sources.

- Parameter estimate angle, Doppler
- Model narrowband and wideband beamformers
- Implement direction of arrival estimation

Radar Environment Modeling

OBJECTIVE: Learn how to extend the fidelity of the signal-level model across the range of radar system and scenario components.

- Model point targets and backscatter targets with angle-dependent RCS
- Model free space, atmospheric and two-ray propagation, clutter, and jammers interferences
- Radar altimeter

Antenna Patterns and Mutual Coupling

OBJECTIVE: Learn how to generate antenna patterns and model mutual coupling in an array.

- Generate antenna patterns using Antenna Designer app and Antenna Array Designer app
- Model arrays with custom elements
- Compute mutual coupling in small, medium, and large arrays

Waveform Libraries for Multifunction Radar

OBJECTIVE: Select waveform parameters and build an agile waveform library.

- Use Pulse Waveform Analyzer app to design radar waveforms
- Build library of waveforms which can be used in a multifunction radar
- Implement PRF, frequency, and beam steering agile models

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Expand your knowledge