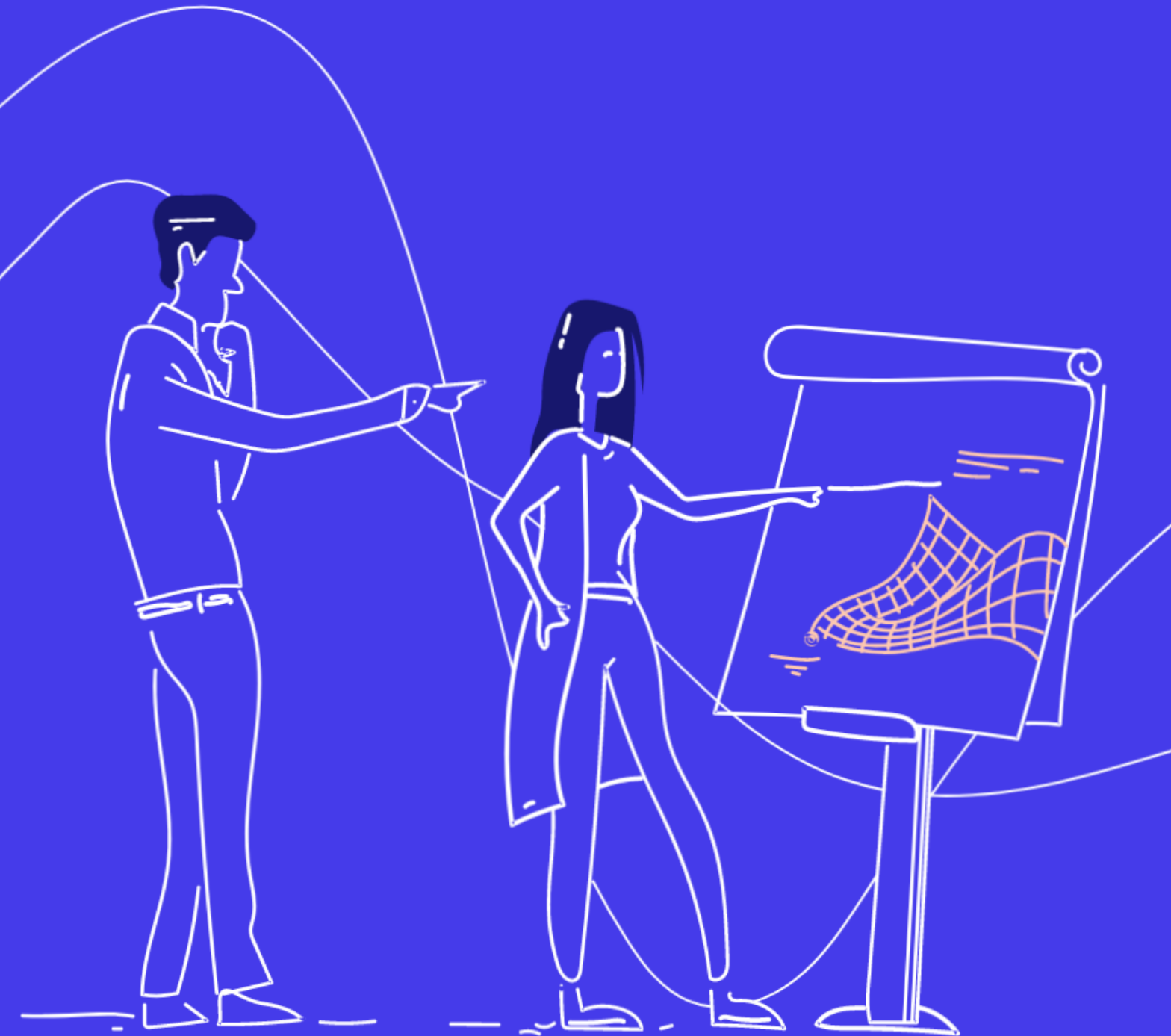# Designing 3D Scenes and Scenarios with RoadRunner

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.

Designing 3D Scenes and Scenarios with RoadRunner

This two-day course provides hands-on experience with designing 3D scenes and scenarios for simulating and testing automated driving systems. You will acquire skills in creating detailed road networks and apply these techniques to reconstruct a real-world scene based on map data. Furthermore, you will learn how to create dynamic scenarios including vehicles and pedestrians. You will also export scenes and scenarios into common formats used by automated driving simulators.

Prerequisites

Experience with basic computer operations.

DURATION

2 Days

LEVEL

Medium

TOPICS

Day 1

- Working with the User Interface
- Roads
- Lanes
- Junctions
- Terrains and Props
- Geo-Specific Scene Design

Day 2

- Working with OpenDRIVE Data
- Building a Scene from SD and HD Maps
- Designing and Simulating Scenarios
- Creating Scenario Variations

Working with the User Interface

OBJECTIVE: Navigate the RoadRunner interface and maneuver inside a scene.

- Navigating the RoadRunner interface and layout
- Maneuvering inside a RoadRunner scene using camera controls
- Selecting and moving objects in a scene
- Measuring distance between scene elements

Roads

OBJECTIVE: Create, connect, and customize road segments and road networks.

- Creating, chopping, and joining road segments
- Modifying road shape and vertical and cross-section profile
- Changing road superelevation and speed limits
- Creating on-ramps, off-ramps, and road splits

Lanes

OBJECTIVE: Create and modify lanes, lane markings, and other road stencil markings.

- Adding driving lanes, curbs, sidewalks, and parking spaces
- Customizing lane properties, such as width and travel direction
- Adding, editing, and customizing lane markings
- Saving road styles with customized lanes for reuse

Junctions

Terrains and Props

Geo-Specific Scene Design

OBJECTIVE: Connect roads through junctions, add traffic lights, and define allowed vehicle maneuvers.

OBJECTIVE: Add surfaces and 3D props, such as trees and buildings.

OBJECTIVE: Construct a scene that accurately represents a real-world location by using GIS assets.

- Creating and customizing junctions
- Defining a set of maneuvers in a junction, such as permitted turns
- Signalizing a junction by inserting traffic lights
- Adding crosswalks for pedestrians

- Creating a surface of a specific material, such as grass, asphalt, or sand
- Adding props such as traffic signs, buildings, and trees
- Adding groups of props along a road or within a surface, such as a group of trees
- Customizing text and symbols on traffic signs
- Importing custom props made in other object-modeling tools

- Importing aerial imagery as a reference for creating roads and surfaces
- Incorporating elevation data to add height information
- Working with point cloud data
- Using vector data, such as OpenStreetMap®

Working with OpenDRIVE Data

OBJECTIVE: Create a scene from imported OpenDRIVE data and export a RoadRunner scene for use with external simulators.

- Exporting the scene to OpenDRIVE file format
- Importing OpenDRIVE data
- Mapping OpenDRIVE data to RoadRunner assets
- Exporting to other file formats, such as .fbx, for use with external simulators

Building a Scene from SD and HD Maps

OBJECTIVE: Automate road network recreation using SD and HD maps.

- Creating a road network from selected roads or regions of SD maps
- Creating a road network from selected roads, routes, or regions of HD maps
- Troubleshooting import and build issues
- Configuring assets to use for rendering scene elements like signs

Designing and Simulating Scenarios

OBJECTIVE: Design scenarios by adding actors, specifying trajectories, and defining scenario logic.

- Adding vehicles and other actors to a scene
- Defining and editing trajectories
- Using scenario logic to define action sequences and interactions between actors
- Simulating and validating scenarios in RoadRunner
- Exporting to the OpenSCENARIO standard

Creating Scenario Variations

OBJECTIVE: Relocate scenarios to other scenes and create scenario variations by changing variables using MATLAB.

- Ways to create variations in RoadRunner
- Adding anchors to a scenario and defining relative constraints
- Relocating a scenario to a different scene
- Programmatic interaction with RoadRunner
- Changing scenario variables programmatically with MATLAB
- Exporting programmatically to the OpenSCENARIO standard

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