

# Model Based Design for Automotive Systems

Model Based Design course for systems and component engineers using MATLAB®

This five day course is designed to train engineers to use MATLAB® with Simulink® and Stateflow® in the design of body control systems. By learning how to use the tool along with design and verification techniques engineers can become more productive in their specific area of work. The course will also cover examples of automotive applications and design methods, using real-world examples from the trainee's own discipline where possible.

Our experience of training tells us that simply throwing new concepts at candidates is not enough to enable them to use the concepts competently. Our course is designed to consolidate learning by actively involving candidates as the course progresses. Demonstrating relevant field applications will allow candidates to relate the material learned to their own applications.

## Objectives

The course objective is to provide candidates with the ability to operate the MATLAB®, Simulink® and Stateflow® tools competently, understand the modelling languages, learn techniques for design and verification using the tools and apply them to automotive systems applications.

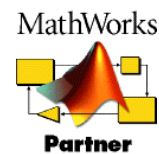
## Candidate Pre-requisites

Ideally candidates should have the following:

- An appreciation of software engineering
- Experience of reading or writing functional specifications
- Experience of automotive systems or component development

## Highlights

- Created specifically for automotive systems & component engineers
- Includes worked examples from the trainee's own area of expertise
- Delivered on-site at the customer's facility (optionally available off-site)
- Contains training material approved by The MathWorks Inc. (Days 1, 2 & 3).



## Course Schedule

### Day 1 - MATLAB® introduction for automotive systems development and test

**Fundamentals** - An introduction to the basic concepts upon which MATLAB® operates; Using the MATLAB® environment, Matrices, Matrix Math, Data types, Variables, Strings, Structures, Function calls.

**Graphics** - Using the graphing and plotting capabilities of MATLAB® to visualise data; 2D plots, Figure Control, Annotation, Logarithmic Plots, 3D plots, Surfaces.

**Programming** - Writing scripts, Functions, Specifying arguments, Variable arguments, program flow control, Sub-functions, Argument error checking, Function Documentation, Workspace variables, debugging.

### Day 2 - Simulink® introduction for automotive systems with diagnostics and networks

Simulink® environment, signals, sub-systems, simulation parameters, Source stimuli, Measurement and observation, Libraries, Sample rates, Call-backs, Algebraic loops and states, integration, differentiation, Zero crossings, Transfer functions, Masked Subsystems, Creating library functions, Simulation, Rapid prototyping.

### Day 3 - Stateflow® introduction for automotive body control systems

State machines, States, Transitions, Conditions, Events, State actions, transition actions, condition actions, Junctions, Data objects, Inputs and outputs, Update methods, interfacing with Simulink®, Flowcharts, Machine hierarchy, concurrent states, History, Implicit events, Temporal logic, Debugging

### Day 4 - Modelling Techniques and Application

**Modelling Techniques** - This session will introduce methods of design using the MATLAB® suite, providing engineers with the basics of design that will be put into practice during the course of the day.

**'Throw one at us' session** - Candidates are invited to present a relevant control application problem for our course representatives to solve. Candidates will see the development from problem to solution of a system with direct and immediate relevance. This demonstrates the speed of model based design and gives engineers ideas on how to tackle specific problems. (Course representatives reserve the right to decline large applications).

**System Design** - This session will take engineers through the process of developing a body control application based on a set of requirements. It is a practical session that will help consolidate the tool training, familiarise engineers with using the tools, develop design skills.

### Day 5 - Design Verification

**Test concepts** - Unit tests, black & white box testing, Integration testing, System testing, Regression testing, Requirements derived tests, Developing the specification.

**Test Code Development** - Translating the specification, Exercising the model, Examining the output, Advancing time, Setting input values, Finding Events, Threshold Crossings, Tolerances, System walkthrough.

**Test session** - In this session the engineers will develop test scripts that verify a body control application against its requirements.

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