MES
MODEL ENGINEERING SOLUTIONS

2021 | MES TRAINING PROGRAM

ISO 26262 (FUNCTIONAL SAFETY)
AGILE MODEL-BASED SOFTWARE DEVELOPMENT
ARCHITECTURES IN SIMULINK & STATEFLOW
MES SUMMER SCHOOL: INTRODUCTION TO MODEL-BASED DEVELOPMENT
TOOL TRAININGS FOR MXAM, MTEST & MQC
QUALITY ASSURANCE OF EMBEDDED SOFTWARE
MODELING GUIDELINES
TOOL CLASSIFICATION & QUALIFICATION
ISO 26262 DEPLOYMENT SERVICES
TESTING MODELS

Live Online Training Classes | On-site Training Classes in China, Germany, India, U.S. | For Your Company Online or In-house

PREFACE

You are holding the new MES trainings brochure in your hands. In our training program for 2021 you will find specific training classes and coaching services covering a broad range of topics such as functional safety, ISO 26262, Simulink, software models, model testing, modeling guidelines, and tool qualification. We also offer tool training classes for current and future users of MXAM and MTest, and we have finalized the dates for the MES Summer School on Introduction to Model-Based Software Development taking place in 2021.

Also included in our latest brochure are consulting packages for the optimization of your development processes for model-based development and workshops to help you select the most optimal guidelines for static model analysis.

These unprecedented times have seen the majority of companies switching to online formats. We at MES have been using online channels and video conferencing as a means of communicating with our international clients for several years already. Our trainers are well versed in holding online webinars, training classes, and workshops. Thankfully, that meant that the transition to offering all our training classes online was a smooth one for us. Now, taking part in a training class is easier than ever before and you won't miss out on anything. Regardless of where you are in the world, you can still benefit from our experienced trainers at the MES headquarters in Berlin. What's more, we are excited to offer you our online training classes at a discounted rate.

All our fixed training dates for the following months can be found at **www.model-engineers.com/trainings**. You can also access the dates via the links and QR codes in this brochure. If none of the published dates suits you, please do not hesitate to contact us! We will find a solution, for example an in-house or online training class for your company or an additional date to suit your needs. Senior Manager Marketing & Trainings, Björn Kunze is at your service to assist you with any questions relating to our trainings. For his contact details, please see **page 39**.

We look forward to welcoming you to our training classes – whether online, on-site at your company or in one of our training locations in China, Germany, India, or the U.S.

DR. HARTMUT POHLHEIM
Managing Director
December 2020

CONTENT

MODEL-BASED DEVELOPMENT OF EMBEDDED SOFTWARE IN COMPLIANCE WITH ISO 26262

CHALLENGES AND EFFECTIVE SOLUTIONS - 2 days

This training class describes how to develop and safeguard safety-critical embedded software in serial projects with Simulink in compliance with ISO 26262 (part 6). Beginning with a general overview of the ISO standard, we proceed by focusing on the ISO 26262 requirements that are specifically relevant to model-based development. We address the impact the standard has had on model-based development with Simulink, as well as the requirements for model and software architecture in safety-critical software. We also look at modeling guidelines and testing before wrapping up the class by assessing ISO 26262 readiness of controller functions. All theoretical knowledge is supplemented by means of several practical examples, which you can take straight back to your desk.

TARGET AUDIENCE

This training class is designed for developers, testers, project managers, and quality managers, whose focus is model-based development of safety-critical embedded software using MATLAB/Simulink.

HIGHLIGHTS

- Developing safety-critical software in compliance with ISO 26262
- All content updated for ISO 26262:2018
- Impact of ISO 26262 on development of embedded software with Simulink
- Model architectures for safety-critical software
- Safeguarding ISO 26262-compliant models with modeling guidelines and complexity metrics
- ISO 26262-compliant testing for model-based SW development
- Tool qualification
- Prioritization of ISO 26262 requirements for process adaptation

> "This training provides an insightful and comprehensive walk-through of model-based design in compliance with ISO 26262, and how to best use model-based design to improve your project."
> Jared Key, Hella Aglaia Mobile Vision

A fee-based SAE Certificate of Competency can be obtained in this class by passing the evaluation test.

LANGUAGES: Available in English and German

FORMATS

ON-SITE
at one of our locations (page 37)

ONLINE
wherever you are

FOR YOUR COMPANY
online or in-house

EXTENDED OPTION: For company-specific training classes, we offer an optional third training day for more detailed hands-on sessions and additional model testing exercises.

COSTS AND CONDITIONS: See pages 38 - 39 or request your customized offer at **sales@model-engineers.com**

DATES: Fixed dates for this training class are published on the website.

BOOKING: www.model-engineers.com/mbd-iso26262

AGENDA

MODEL-BASED DEVELOPMENT OF EMBEDDED SOFTWARE IN COMPLIANCE WITH ISO 26262

DAY 1

Overview: Model-based software development with Simulink
- Foundations of model-based development
- Overview of development and quality assurance activities
- Characteristics of ISO 26262-compliant development

Safety-related software development in compliance with ISO 26262
- Impact on the development process
- Hazard analysis and risk assessment, ASIL determination
- Strategies for safety concepts – deriving software safety requirements
- ASIL decomposition
- Safety Of The Intended Functionality (SOTIF)

Hands-on: Safety requirements

ISO 26262-compliant development process
- Reference workflow
- Process phases and work products
- Process manuals and developer guides
- Similarities to ASPICE 3 requirements

Implementing software architectures in models
- Basics of software architecture
- Expected properties of an ISO 26262-compliant software architecture
- Software architecture in models
- Principles for layered models
- Interface handling in models
- Simulink design patterns for safety-critical software

Analysis and evaluation of model architecture
- Model structure analysis
- Introduction to complexity metrics
- Calculating model complexity
- Measures to reduce model complexity
- Identification of ineffective interfaces and model clones

Hands-on: Analysis, evaluation and refactoring of model architecture

DAY 2

Ensuring model quality with modeling guidelines
- Overview of modeling guidelines
- General modeling guidelines for MISRA- and ISO 26262-compliant modeling
- Specific guidelines on improving code generator application
- Automatic checking of modeling guidelines

Hands-on: Ensuring model quality with modeling guidelines

Tool qualification in compliance with ISO 26262
- Foundations of tool qualification
- Determination of the tool confidence level
- Qualification methods

Hands-on: Tool qualification kit

Ensuring model quality with model testing
- ISO 26262 requirements in the testing process
- Test goals on different testing levels
- Regression testing and back-to-back testing, MiL – SiL – PiL
- Model and code coverage
- Automatic test evaluation with test assessments

Hands-on: Model testing project

Overview and priorities for process adaptation in compliance with ISO 26262
- Quality monitoring of development projects, software verification report
- Prioritizing ISO 26262 requirements for model-based development
- Assessing effort and benefits of ISO 26262 requirements
- Available methods and tools for process tailoring

Hands-on: Quality monitoring project

Evaluation test to qualify for the SAE Certificate of Competency (optional)

INTRODUCTION TO MODEL-BASED DEVELOPMENT AND QUALITY ASSURANCE OF EMBEDDED SOFTWARE - 3 days

This training class provides a practical overview of developing and safeguarding embedded software on the basis of Simulink and code generators like Embedded Coder and TargetLink within the framework of serial projects. The training class takes participants through all process steps from designing and creating the simulation model in Simulink and Stateflow to generating production code. Model quality assurance consists of verifying the model and software architecture, safeguarding the modeling guidelines, as well as checking for functional compliance with requirements in the model test. The efficient requirements-based test specification is implemented for the created models and applied in MiL and SiL tests. Functional accuracy is verified by the evaluation of regression and back-to-back tests. You will learn how to follow all the steps in practical exercises using the MES Test Manager (MTest), the MES Model Examiner (MXAM), and the MES Quality Commander (MQC).

TARGET AUDIENCE

This training class is for novices to model-based development of embedded software based on Simulink and Embedded Coder or TargetLink, including developers, testers, quality managers, project managers, and team leaders. Only basic modeling knowledge of Simulink and Stateflow is required.

HIGHLIGHTS

- Model-based development with Simulink and Stateflow
- Developing safety-critical software in compliance with ISO 26262
- Code generation from Simulink models
- Model quality analysis and evaluation
- Modeling guidelines
- Model testing and test implementation techniques
- A comprehensive example covering all development stages

"A resounding thumbs up for this workshop! The speakers displayed a high level of specialist knowledge and presented the subject in a clearly comprehensible and methodical way."
Participant from Continental Automotive

LANGUAGES: Available in English and German

FORMATS

ON-SITE
at one of our locations (page 37)

ONLINE
wherever you are

FOR YOUR COMPANY
online or in-house

COSTS AND CONDITIONS: See pages 38 - 39 or request your customized offer at **sales@model-engineers.com**

DATES: Fixed dates for this training class are published on the website. You might also be interested in the MES Summer School in June, which has a similar topic aimed at the same target audience (see pages 8 - 13).

BOOKING: www.model-engineers.com/introduction-mbd

AGENDA

INTRODUCTION TO MODEL-BASED DEVELOPMENT AND QUALITY ASSURANCE OF EMBEDDED SOFTWARE

DAY 1

Overview: Model-based software development with Simulink
- Foundations of model-based development
- Overview of development and quality assurance activities
- Characteristics of ISO 26262-compliant development

Introduction to sample application
- Set up modeling environment
- Introduction to sample models

Modeling embedded software in Simulink
- Simulink modeling environment
- Composition and structure of environment and controller models
- Parametrization of Simulink models
- Continuous and discrete modeling

Hands-on: Simulink

Modeling embedded software with Stateflow
- Introduction to the concept of finite-state machines
- Stateflow modeling environment
- Stateflow design pattern
- Recommended best practices

Hands-on: Stateflow

Analysis and evaluation of model architecture
- Model structure analysis
- Introduction to complexity metrics
- Calculating model complexity
- Measures to reduce model complexity
- Identification of ineffective interfaces and model clones

Hands-on: Analysis, evaluation and refactoring of model architecture

DAY 2

Code generation via TargetLink/Embedded Coder development environment
- Principles of code generation
- Data dictionary
- Data types, classes, scaling, and fixed-point arithmetic
- Interfaces (signals and buses)

Integrating models and distributed modeling
- Advantages of model referencing and libraries
- Definition of distributed parameter files

Ensuring model quality with modeling guidelines
- Overview of modeling guidelines
- General modeling guidelines for MISRA- and ISO 26262-compliant modeling
- Specific guidelines on improving code generator application
- Automatic checking of modeling guidelines

Hands-on: Ensuring model quality with modeling guidelines

Ensuring model quality with model testing
- ISO 26262 requirements in the testing process
- Test goals on different testing levels
- Regression testing and back-to-back testing, MiL – SiL – PiL
- Model and code coverage
- Automatic test evaluation with test assessments

Hands-on: Model testing project

Systematic requirements-based test case creation
- Test cases: What are the typical basic elements?
- Definition of test groups and test sequences
- Specification functions and parameter handling
- Best practices for test specifications

Hands-on: Test specification with MTest

DAY 3

Automated test evaluation with test assessments
- Principles and objectives of test assessments
- Assessment generation from requirements (MARS)
- Benefits of formal requirements syntax

Hands-on: Formal requirements with MTest

Regression and back-to-back signal comparison
- Scope (MiL – SiL – PiL)
- Combination of back-to-back and regression testing

Hands-on: Signal comparison with MTest

Model and code coverage in the model test
- Model coverage for all MiL test platforms
- Code coverage for SiL/PiL test platforms

Hands-on: Increasing model/code coverage with MTest

Overview and priorities for process adaptation in compliance with ISO 26262
- Quality monitoring of development projects, software verification report
- Prioritizing ISO 26262 requirements for MBD
- Assessing effort and benefits of ISO 26262 requirements
- Available methods and tools for process tailoring

Hands-on: Quality monitoring project

MES SUMMER SCHOOL

5-DAY TRAINING CLASS ON INTRODUCTION TO MODEL-BASED SOFTWARE DEVELOPMENT

Model-based development of embedded systems is a mature technology used to create technical software applications with high quality and efficiency. The MES Summer School is a 5-day training class on "Introduction to Model-based Software Development of Embedded Systems." It gives a comprehensive introduction to this technology applied in the automotive and automation industry, among others. Starting from the elicitation and management of requirements through to the definition of architectures and the design of a model structure, the program provides an introduction to modeling. Particular attention will be paid to static and dynamic quality assurance methods to ensure that models from which high-quality software is sourced are suitable for safety-critical systems. By applying all relevant process steps during our hands-on sessions, you will face all the typical challenges of modeling safety-critical systems. This will prepare you for the application of relevant process steps to your own projects. The small training group size allowing individual supervision, the experienced training team, and a relaxed atmosphere will enable you to learn all that is necessary for safeguarding your safety-critical embedded software. To complete the picture, we will present recommendations of applicable standards in the field such as IEC 61508, ISO 26262, and ASPICE. The MES Summer School provides an easy entry to and a comprehensive overview of model-based development of embedded systems. You will learn to make use of all steps in practical exercises using the MES Test Manager (MTest), MES Model Examiner (MXAM), MES Model & Refactor (MoRe), and MES Quality Commander (MQC).

☆ THE ALL-INCLUSIVE-COURSE:

- Five days of introduction and overview on MBD including hands-on
- Training materials
- SAE Certificate of Competency (optional)
- Lunch and refreshments included
- Special location in lively Berlin
- Leisure program and 2x dinner included: Get to know the city of Berlin!
- Accommodation and breakfast in the stylish Michelberger Hotel (optional)

MES SUMMER SCHOOL: 5-DAY TRAINING CLASS ON INTRODUCTION TO MODEL-BASED SOFTWARE DEVELOPMENT

TARGET AUDIENCE

This training class is targeted at beginners to model-based development, including developers, testers, quality managers, project managers, and team leaders. The focus is on model-based development of safety-critical embedded software using MATLAB/Simulink in combination with Embedded Coder or dSPACE TargetLink. Only basic knowledge of modeling with Simulink and Stateflow is required.

HIGHLIGHTS

- Introduction to model-based development of embedded software in line with Simulink toolchains
- Comprehensive development process, including requirements elicitation, architectural design, function development, and implementation, as well as target integration
- Full coverage of quality assurance activities required for safety-critical systems: Modeling guidelines, model testing, test implementation techniques, and more
- Hands-on experience with real-world models and tools
- Alignment with relevant standards, especially ISO 26262 (functional safety) and ASPICE

A fee-based SAE Certificate of Competency can be obtained in this class by passing the evaluation test.

LANGUAGE: English

FORMATS

ON-SITE
Special location: Michelberger Hotel, Warschauer Str. 39 - 40, 10243 Berlin, Germany

COSTS AND CONDITIONS: See pages 38 - 39 or request your customized offer at **sales@model-engineers.com**

DATES: June 14 - 18, 2021

BOOKING: www.model-engineers.com/summer-school

LEISURE PROGRAM

We will organize a leisure program on three evenings for the participants of the MES Summer School. As part of the leisure program, we will spend an evening getting to know the Berlin neighborhood, enjoy two dinners at renowned eateries, and visit the Berlin TV Tower. An authentic experience!

ACCOMMODATION

We recommend staying in the hotel where the training class will take place, the Michelberger Hotel. When registering, you can order your hotel room, available from Sunday, June 13, 2021 to Friday, June 18, 2021 (4 or 5 nights). The price for one single room including breakfast is € 136 plus VAT (where applicable) per night. Michelberger Hotel is not just any hotel; it is an exceptional location bursting with creativity right in the heart of Berlin's hip Friedrichshain-Kreuzberg district.

AGENDA

MES SUMMER SCHOOL

DAY 1: 9 a.m. to 5 p.m. + leisure program in the evening

Welcome and introduction round
- Participant experience and expectations
- Introduction to the class

Overview: Model-based software development with Simulink
- Foundations of model-based development
- Overview of development and quality assurance activities
- Characteristics of ISO 26262-compliant development

Introduction to sample application
- Set up modeling environment
- Introduction to sample models

Principles of requirements management
- Definitions and classification in the model-based development process
- Requirement types and attributes
- Requirement specifications vs. functional specifications
- Hierarchy of specifications and requirements

Writing good requirements
- Determination of system under development
- Structuring specifications
- Features of "good" requirements
- Types of requirement patterns
- Requirements traceability

Hands-on: Writing requirements
- Creating requirements
- Peer review of stated requirements

Modeling embedded software in Simulink
- Simulink modeling environment
- Composition and structure of environment and controller models
- Parametrization of Simulink models
- Continuous and discrete modeling

Hands-on: Simulink
- Creating a Simulink model

DAY 2: 9 a.m. to 6 p.m. + leisure program in the evening

Safety-related software development in compliance with ISO 26262
- Impact on the development process
- Hazard analysis and risk assessment, ASIL determination
- Strategies for safety concepts – deriving software safety requirements
- ASIL decomposition
- Safety Of The Intended Functionality (SOTIF)

Hands-on: Safety requirements

Modeling embedded software with Stateflow
- Introduction to the concept of finite-state machines
- Stateflow modeling environment
- Stateflow design patterns
- Recommended best practices

Hands-on: Stateflow
- Creating a Stateflow chart

Implementing software architectures in models
- Basics of software architecture
- Expected properties of an ISO 26262-compliant software architecture
- Software architecture in models
- Principles for layered models
- Interface handling in models
- Simulink design patterns for safety-critical software

Analysis and evaluation of model architecture
- Model structure analysis
- Introduction to complexity metrics
- Calculating model complexity
- Measures to reduce model complexity
- Identification of ineffective interfaces and model clones

Hands-on: Analysis, evaluation and refactoring of model architecture

Refactoring Simulink models and their structures
- Modeling styles facilitating refactoring
- Basic refactoring operations for Simulink and Stateflow
- Complex refactoring operations

Hands-on: Model refactoring with MoRe

Un:School

DAY 3: 9 a.m. to 6 p.m.

ISO 26262-compliant development process
- Reference workflow
- Process phases and work products
- Process manuals and developer guides
- Similarities to ASPICE 3 requirements

Integrating models and distributed modeling
- Advantages of model referencing and libraries
- Definition of distributed parameter files

Ensuring model quality with modeling guidelines
- Overview of modeling guidelines
- General modeling guidelines for MISRA- and ISO 26262-compliant modeling
- Specific guidelines on improving code generator application
- Automatic checking of modeling guidelines

Hands-on: Ensuring model quality with modeling guidelines

Ensuring model quality with model testing
- ISO 26262 requirements in the testing process
- Test goals on different testing levels
- Regression testing and back-to-back testing, MiL – SiL – PiL
- Automatic test evaluation with test assessments

Systematic requirements-based test case creation
- Test cases: What are the typical basic elements?
- Definition of test groups and test sequences
- Specification functions and parameter handling
- Best practices for test specifications

Hands-on: Scripting of test cases with MTest
- Creating test sequences
- Executing test sequences
- Using parameters for efficient modification of test sequences

DAY 4: 9 a.m. to 5 p.m. + leisure program in the evening

Automated test evaluation with test assessments
- Principles and objectives of test assessments
- Assessment generation from requirements (MARS)
- Benefits of formal requirements syntax

Hands-on: Formal requirements with MTest
- Creating typical formal requirements
- Generating and executing test assessments
- Workflow with generated assessments

Regression and back-to-back signal comparison
- Scope (MiL – SiL – PiL)
- Combination of back-to-back and regression testing

Hands-on: Signal comparison with MTest
- Configuring and executing a test evaluation
- Definition of tolerances
- Documenting test evaluation results in reports and catalogs
- Converting output signals into reference signals

Un:School

Code generation via TargetLink/Embedded Coder development environment
- Principles of code generation
- Data dictionary
- Data types, classes, scaling, and fixed-point arithmetic
- Interfaces (signals and buses)

Tool qualification in compliance with ISO 26262
- Foundations of tool qualification
- Determination of the tool confidence level
- Qualification methods

Hands-on: Tool qualification kit

History of model-based development and future challenges

DAY 5: 9 a.m. to 4 p.m.

Model and code coverage in the model test
- Model coverage for all MiL test platforms
- Code coverage for SiL/PiL test platforms

Hands-on: Increasing model/code coverage with MTest
- Interpretation and evaluation of coverage reports
- Increasing model/code coverage through structure-based test cases

Overview and priorities for process adaptation in compliance with ISO 26262
- Quality monitoring of development projects, software verification report
- Prioritizing ISO 26262 requirements for model-based development
- Assessing effort and benefits of ISO 26262 requirements
- Available methods and tools for process tailoring

Hands-on: Quality monitoring project
- Assessing the quality of the test objects
- Efficient workflow in case of modified requirements
- Overview of development and project quality

Summary and overall assessment of achievements during the MES Summer School

Evaluation test to qualify for the SAE Certificate of Competency (optional)

Wrap up of the event

MES WEBINARS AND VIDEOS

1 hour

Our webinars and videos are perfect for you if you want to learn something quickly, online, and free of charge. In each webinar, we inform you about tools, applications, and concepts to optimize model-based software development. Most of our webinars are approximately one hour long. You can either participate in a live, online webinar or stream them free of charge and watch them at your leisure. In the live, online webinars you have the chance to exchange ideas directly with our experts on fixed dates. Alternatively, our webinar recordings, how-to videos, and feature videos are available 24/7 on the videos page of our website.

TARGET AUDIENCE

Our webinars are for anybody who wants to get a first overview of new topics.

SELECTED TOPICS
- Agile Model-Based Software Development & Agile Model Testing
- ISO 26262 in 10 Steps
- Test Automation Made Easy
- MES Tool Highlights: Release Update News in Brief
- Refactoring Simulink Models: 6 Secrets Revealed
- What in the world is SOTIF?
- Software Quality at a Glance - Is that Even Possible?
- 10 Challenges in Model-based Software Development
- Model-based Design and Verification According to ISO 26262: Automated
- Modeling Guidelines for Simulink: Detailed Design & Software Architecture Considerations
- Guidelines are a Modeler's Best Friend

LANGUAGES: Available in English or Chinese

COSTS: Free of charge

DATES: Fixed dates for new live, online webinars can be viewed here: **www.model-engineers.com/webinars**

VIDEO PAGE: Recordings of previous webinars and more videos are available at: **www.model-engineers.com/videos**

ISO 26262 PROCESS DEPLOYMENT SERVICE

FROM ANALYZING EXISTING DEVELOPMENT PROCESSES TO IMPLEMENTING AN ISO 26262-COMPLIANT DEVELOPMENT

The main goal of the MES Process Deployment Service is the complete coverage of the ISO 26262 standard in model-based development. Achieving this goal requires a well-defined and cost-effective development and a V&V process that relies on the best practices of the automotive industry. The process deployment's objective is to further customer competencies in model-based development, regardless of where they currently stand. ISO 26262 provides important recommendations for software development. MES supports its customers in efficiently implementing these recommendations in all relevant phases of software development. The MES ISO 26262 Process Deployment Service creates or adds to existing process and development documentation, and is adapted to customer requirements.

TARGET AUDIENCE

This consulting package is targeted at OEMs and suppliers that are facing the challenge of implementing the ISO 26262 standard into all of their model-based development process activities.

HIGHLIGHTS

- Guidance for your ISO 26262- and ASPICE-compliant software development process
- Deriving safety requirements
- Best practices for model-based software development of leading car manufacturers and suppliers worldwide
- Includes designing software architecture, designing and implementing safety functions in models, guideline compliance, testing and managing model complexity, quality assurance of models for safety-relevant applications
- Consulting by MES consultants who are highly specialized in model-based development processes for safety-critical software development and who are experienced in company-wide introduction and implementation of ISO 26262-compliant development processes

LANGUAGES: Available in English and German

FORMATS

FOR YOUR COMPANY
online or in-house

COSTS AND CONDITIONS: Please request your customized offer for your consulting package at **sales@model-engineers.com**

BOOKING: www.model-engineers.com/development-process

THE FIVE STAGES OF THE MES ISO 26262 DEPLOYMENT SERVICE

THE MES PROCESS DEPLOYMENT SERVICE CONSISTS OF FIVE LEVELS, EACH ONE BUILDING ON THE LAST

1. ANALYZING EXISTING PROCESSES, METHODS, AND TOOLS

In the analysis stage, MES works closely together with the customer in order to identify missing or insufficient activities and work products. Examples of tasks carried out in the analysis stage are:

- Reviewing the current development process and toolchain
- Conducting a structured ISO 26262 gap analysis to identify missing development or safe-guarding activities
- Developing and prioritizing a roadmap for defining and implementing an ISO 26262-compliant development process

2. DEVELOPING A PROCESS MANUAL

In this stage, processes and methods are developed together with the team and other stakeholders. The process documentation describes the required activities and work products in detail. Clear definitions state (1) what to do, (2) when to do it, and (3) what the expected result of each individual process step is (e.g. criteria for success and quality goals). A process manual documents the determined process and typically consists of the following descriptions:

- Graphical process maps that provide an overview of the activities to be carried out
- Comprehensive definition including goals, prerequisites, and inputs for each process step
- Definition of work products
- Definition of roles and tools involved in the individual activities
- Goals and criteria for success of each process step

3. CREATING DEVELOPER MANUALS

The process manual is supplemented with a set of developer manuals, which explains how to use methods and tools for software development and quality assurance. The developer manual captures how to design and achieve embedded software of the highest quality. Examples of topics are:

- General pattern for automotive control function design with Simulink
- Model structures for safety-critical software
- Use of data dictionaries or parameter libraries
- Model interface design
- Application-specific modeling patterns, also for AUTOSAR software development
- Use of libraries and referenced models
- Development of larger models with software variants
- Best practices for reducing resource usage of the generated code
- Modeling for the traceability of requirements

4. IMPLEMENTING ISO 26262-COMPLIANT DEVELOPMENT

Using the available process manual as a basis, MES shows customers how to use enhanced and customized reference workflows for series production projects.

- Team member training of how to use the new processes on the basis of process and developer manuals
- Support in applying the process manuals in series production projects
- Assessing the successful implementation of the new process
- Assistance in optimizing the new process
- Improvement of the process and development manuals in accordance with new requirements

5. DEVELOPMENT SUPPORT

In the last stage, MES assists projects with production relevance via independent development services.

- Ongoing management and developer support in applying the process to existing series production projects
- Service provision, including safety management/analysis, modeling, code generation, etc.

AGILE MODEL-BASED SOFTWARE DEVELOPMENT

2 days

Model-based software development has become state of the art for automotive embedded applications. Toolchains have been established, and methods and procedures have been defined to address the strong requirements of functional safety standards. Best practices within general software development, however, propose to overcome strict waterfall process models and promote agile methods in order to address real-world challenges, such as late changes or vague requirements. These real-world scenarios exist in automotive software development, and agile methods will also be beneficial here. This training class introduces the basic principles of agile methods and elaborate on their instantiation in model-based development. The class assists participants in gaining first-hand experience in agile methods, and participants will apply some of these methods in live sessions.

TARGET AUDIENCE

This training class is targeted at modelers, developers, testers, quality managers, project managers, and team leaders, who want to familiarize themselves with agile methods and how agile methods comply with model-based development of embedded software based on MATLAB/Simulink and similar.

HIGHLIGHTS

- Principles of model-based development with Simulink/Stateflow
- Core concepts of agile methods like Kanban or Scrum
- Foundations of agility in model-based development
- Elements of continuous quality assurance
- Approaches to continuous integration
- Agility as viewed by either: ISO 26262 or ASPICE
- Interactive parts that properly reflect real team situations

"This training class addresses the most important aspects of model-based software development, goes into sufficient depth, and provides best practices for everyday life. A compact and complete know-how package for anyone who works in the field of MBD."
Sandra Seibold, Jungheinrich

LANGUAGES: Available in English and German

FORMATS

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at one of our locations (page 37)

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DATES: Fixed dates for this training class are published on the website.

BOOKING: www.model-engineers.com/agile-mbd

AGENDA

AGILE MODEL-BASED SOFTWARE DEVELOPMENT

DAY 1

Introduction: Agile approaches to model-based software development

- Motivation for model-based software development
- Why agile? Agile Manifesto and principles
- Myths and more (interactive)
- Typical approaches to agility: Kanban, Scrum, etc.

Overview: Model-based development and quality assurance with Simulink

- Basic concepts of model-based development
- Overview of development and safeguarding activities
- Boundary conditions for safety-critical systems
- Samples of quality assurance methods such as static and dynamic model analysis

Core elements of Scrum and Kanban

- Development objectives in Scrum
- Roles and timing in a Scrum team
- Scrum quality gates: Definition of Ready (DoR), Definition of Done (DoD)
- Principles of Kanban

Hands-on: Agile principles in a nutshell

DAY 2

Model decomposition and architecture

- Distributed modeling
- Implementing software architectures in models
- Analysis and evaluation of model structure
- Version control

Hands-on: Analysis of model structure

Refactoring Simulink models and their structure

- Modeling styles facilitating refactoring
- Basic refactoring operations for Simulink
- Complex refactoring operations

Hands-on: Using a model refactoring tool

Continuous integration and quality monitoring in model-based development

- Basic concepts of continuous integration
- Definition of integration jobs
- Jenkins as a state-of-the-art platform
- MES tool plugins for Jenkins, and the use of the MES Quality Commander as a quality dashboard
- Challenges regarding a continuous integration for model-based development
- Experience report: Validation suite for the MES Model Examiner

Using visualizations to enter the agile world

- Getting an overview of visualizations

Hands-on: Creating a Kanban board

ARCHITECTURES IN SIMULINK & STATEFLOW

HOW TO MANAGE LARGE SOFTWARE MODELS

2 days

Models are the core artifacts in software development. Over time – within a single development project or even across multiple evolution steps – models grow as they capture more and more functionality. As a result, models become hard to maintain, barely understandable, and the risk of errors increases due to unexpected behavior. The technical debt of the model demands proper countermeasures. This training class addresses deficits caused by large Simulink & Stateflow models and shows ways to overcome their risks.

TARGET AUDIENCE

This training class is targeted at modelers, developers, testers, quality managers, project managers, and team leaders, whose focus is model-based development of embedded software based on MATLAB/Simulink for serial projects.

HIGHLIGHTS

- Basic concepts of software architectures
- Assessing architectural design principles in models
- Refactoring Simulink models
- Layered application architectures
- Representing architectures in models

> "The seminars provide insight and ideas on how to approach handling large software projects in a systematic way with useful suggestions and quantitative metrics."
> Pawel Malysz, FCA US

LANGUAGES: Available in English and German

FORMATS

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COSTS AND CONDITIONS: See pages 38 - 39 or request your customized offer at **sales@model-engineers.com**

DATES: Fixed dates for this training class are published on the website.

BOOKING: **www.model-engineers.com/simulink-stateflow-architectures**

AGENDA

ARCHITECTURES IN SIMULINK & STATEFLOW – HOW TO MANAGE LARGE SOFTWARE MODELS

DAY 1

Overview: Model-based development and quality assurance with Simulink

- Foundations of model-based development
- Overview of development and quality assurance activities
- Characteristics of ISO 26262-compliant development

Analysis and evaluation of model structure

- Introduction to complexity metrics
- Calculating model complexity
- Countermeasures to overly complex models
- Assessing coherence in models
- Software architecture and model structure of the sample application

Software architecture

- Basics of software architectures
- Expected properties of an ISO 26262-compliant software architecture
- Principles of software unit design

Implementing software architectures in models

- Software architecture in models
- Principles for layered models
- Interface handling in models

Integrating models and distributed modeling

- Advantages of model referencing and libraries
- Defining distributed parameter files

Hands-on: Improving model structures

DAY 2

Refactoring Simulink models and their structures

- Modeling styles facilitating refactoring
- Basic refactoring operations for Simulink
- Complex refactoring operations

Hands-on: Model refactoring

Refactoring Stateflow charts

- Challenges of Stateflow semantics
- A safe modeling style for Stateflow
- Sample refactoring rules

Hands-on: Refactoring participant models

Regression testing of models

- Test goals on different testing levels
- Safeguarding functional properties of model and code
- Regression testing and back-to-back testing, MiL – SiL – PiL
- Automatic test evaluation with test assessments

Process concerns regarding refactoring

- Roles and responsibilities of software architect, software developer, and test engineer
- Distinction between architecture design (top-down approach) and architecture improvement (bottom-up approach) of emerging architectures
- Refactoring in agile settings
- Refactoring legacy models

TESTING MODELS THE RIGHT WAY

FROM REQUIREMENTS TO MODEL TESTING

2 days

This training class provides a comprehensive overview of the principles, processes, and objectives of model testing – from requirements to model tests. We offer step-by-step guidance from creating requirements-based test specifications, through testing TargetLink and/or Embedded Coder models, to automated test evaluation based on test assessments and back-to-back/regression tests. In particular, we will emphasize ISO 26262-compliant test management and explain the test process for MiL and SiL, as well as tracing requirements to test specifications and test assessments. You will learn all process steps through hands-on practical exercises using Simulink and TargetLink or Embedded Coder models. During the training, we will use the MES Test Manager (MTest) as a model test framework in practical exercises. However, this training is suitable for anybody who wants to learn how to test models the right way – no matter which tool you want to use.

TARGET AUDIENCE

This training class is aimed at developers, testers, test managers, and quality managers who focus on model-based development of embedded software based on MATLAB/Simulink and related to TargetLink/Embedded Coder. If you are interested in a more detailed tool training using the MES Test Manager (MTest), please have a look at the training on page 30.

HIGHLIGHTS

- Test objectives and workflow
- Test management
- Test specification
- Testing TargetLink/Embedded Coder models
- Regression and back-to-back testing
- Automated test evaluation with test assessments
- Model and code coverage
- Insight into test progress and test quality

"The best to learn about both – the theory and practice of testing."
Participant from Valeo Siemens

LANGUAGES: Available in English and German

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DATES: Fixed dates for this training class are published on the website.

BOOKING: **www.model-engineers.com/testing-models**

AGENDA

TESTING MODELS THE RIGHT WAY – FROM REQUIREMENTS TO MODEL TESTING

DAY 1

Introduction to model testing
- Objectives, workflow, and process steps of model testing
- Test specification methods
- Test evaluation methods
- Test documentation
- Tracing requirements in model testing

Introduction to sample application
- Setup of testing environment
- Introduction to sample models

Systematic requirements-based specification of test sequences
- Test cases: What are the typical basic elements?
- Definition of test groups and test sequences with MTCD
- Specification functions and parameter handling
- Best practices for test specifications

Hands-on: Systematic requirements-based test specification
- Creating test sequences
- Executing test sequences
- Using parameters for efficient modification of test sequences
- Importing measurement data for testing (import of mat files)

Regression and back-to-back signal comparison
- Scope (MiL – SiL – PiL)
- Combination of back-to-back and regression testing

Hands-on: Signal comparison
- Configuring and executing a test evaluation
- Definition of tolerances
- Documenting test evaluation results in reports and catalogs
- Converting output signals into reference signals

DAY 2

Testing TargetLink and Embedded Coder models and model/code coverage
- Automated test bed creation and module testing for subsystems
- Advanced support of code generation in model testing
- Model coverage for all MiL test platforms
- Code coverage for SiL/PiL test platforms

Hands-on: Increasing model/code coverage
- Automatic test execution for MiL/SiL/PiL
- Interpretation and evaluation of coverage reports
- Increasing model/code coverage through structure-based test cases
- Logging internal signals

Introduction to test evaluation with test assessments
- Principles and objectives of test assessments
- Structure and content of test assessments

Assessment generation from requirements
- Types of requirement patterns
- Benefits of a formal requirements syntax

Hands-on: Formal requirements and assessment generation
- Writing typical formal requirements
- Generating and executing test assessments
- Workflow with generated assessments

Hands-on: Functional test evaluation with test assessments
- Writing typical assessments manually or extending assessments
- Test assessment evaluation in the assessment catalog
- Best practices for test assessments

Overview of results and progress of model test
- Judging the progress of a test project (tracing, coverage)
- Are requirements correctly implemented in the test object?
- Assessing the quality of test results (test catalog, test report)
- When is testing over? (test project protocol)

Hands-on: Overview of results and progress of model test
- Efficient workflow in case of modified requirements
- Modifying test specifications and test assessments after requirement changes
- Review of test specifications and test assessments

ISO 26262 TOOL CLASSIFICATION AND QUALIFICATION

1 day

As part of the release of ISO 26262 in 2011, requirements to establish confidence in the correct functioning of software tools used to develop safety-related automotive E/E systems came into effect. Eight years later, there are plenty of experiences and lessons learned from applying these requirements in day-to-day engineering. However, implementing ISO 26262 tool classification and qualification remains a challenge for many automotive organizations and consumes significant resources. Starting with a systematic introduction to the tool classification and qualification requirements of ISO 26262-8, this 1-day class also reviews current industry best practices and discusses trends and lessons learned. In the hands-on session, you will familiarize yourself with the structure and content of an exemplary ISO 26262 classification kit for a model-based development tool and gain hands-on experience in customizing a kit to your organization's specific needs.

TARGET AUDIENCE

This training class is targeted at automotive professionals (functional safety engineers, software project leads, software engineers, engineering managers, and quality managers) involved with the development of safety-related automotive E/E systems.

HIGHLIGHTS

- Gaining confidence in the correct functioning of software tools
- ISO 26262 tool classification and qualification approach
- Best practices and trends
- Importance of templates
- Make or buy? Costs incurred by the activities to gain confidence in the use of software tools
- Tool classification and qualification kits – Streamlining the classification/qualification of COTS tools
- ISO classification kit hands-on

LANGUAGES: Available in English and German

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This training class will be brought to you by samoconsult GmbH.

DATES: Fixed dates for this training class are published on the website.

BOOKING: www.model-engineers.com/qualification-iso26262

AGENDA

ISO 26262 TOOL CLASSIFICATION AND QUALIFICATION

DAY 1

Motivation
- Why tool classification and qualification (practice-based examples)
- Pros and cons of tool usage
- Gaining confidence in the use of software tools

ISO 26262 tool classification and qualification approach
- Foundations
- Tool classification planning
- The 2-step approach
  1. Tool classification
  2. Tool qualification
- Review activities

Implementing the ISO 26262 tool classification and qualification approach
- Classifying individual tools vs. toolchains
- What about all my scripts?
- Sharing work between tool vendors and tool users
- Tool classification and qualification kits
- Certified tools
- Templates and tool support

Tool classification and qualification effort
- Effort estimation
- Tool classification/qualification kits and services – Make or buy?

Tool classification kit hands-on session
- Content and structure of an ISO 26262 tool classification kit
- Activities to be done when using the kit in an automotive software development project

FUNCTIONAL SAFETY FOR AUTOMOTIVE PROFESSIONALS

2 days

ISO 26262 provides an internationally recognized reference for the development of safety-related automotive E/E systems. Developers of such systems need to understand and implement the standard's requirements pertaining to system, hardware, and software development. This training class provides a systematic introduction to key concepts of ISO 26262 and their practical application, covering the concept phase including hazard analysis and risk assessment (HARA) as well as the subsequent system, hardware, and software development phases.

TARGET AUDIENCE

This training class is targeted at automotive professionals (component and system engineers, engineering managers, quality, and project managers) involved with the development of safety-related automotive E/E systems, future functional safety engineers, and managers.

HIGHLIGHTS

- Safety 101 (harm, risk, risk reduction, fault, error, failure, hazard, failure classification)
- Scope of ISO 26262 (safety, functional safety, safety of the intended function)
- Item definition and hazard analysis and risk assessment (HARA), ASIL determination
- Refinement of safety requirements (safety goals, functional safety concept, technical safety concept, hardware safety requirements, software safety requirements, ASIL decomposition)
- Fundamentals of system, hardware, and software development in compliance with ISO 26262
- OEM – supplier relationships (development interface agreement, workshare)
- Functional safety management (safety plan, safety case, confirmation measures)

LANGUAGES: Available in English and German

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DATES: Fixed dates for this training class are published on the website.

BOOKING: www.model-engineers.com/functional-safety

AGENDA

FUNCTIONAL SAFETY FOR AUTOMOTIVE PROFESSIONALS

DAY 1

Safety fundamentals
- Intuitive notion of safety, harm, risk, and risk reduction
- How systems fail (faults, errors, failures, hazards)
- Systematic vs. random faults/failures
- Failures in hardware/software
- Dependent vs. independent failures
- Safety, functional safety, safety of the intended functionality (SOTIF)

ISO 26262 – Introduction
- Technical standards
- Functional safety standards (IEC 61508 and derivative standards)
- ISO 26262 overview
- Scope of ISO 26262
- ISO 26262 Safety Life Cycle

ISO 26262 – Concept phase
- Item definition
- Hazard analysis and risk assessment (HARA), determination of Automotive Safety Integrity Levels (ASIL)
- Safety goal determination
- Functional safety requirements/functional safety concept (FSC)
- ASIL decomposition
- Management of safety requirements

ISO 26262 – System development (I)
- Technical safety requirements/technical safety concept (TSC)
- Hardware Software Interface (HSI)

DAY 2

ISO 26262 – Hardware development
- Hardware safety requirements
- Hardware design
- Classification of hardware failures, hardware architectural metrics, diagnostic coverage
- Hardware integration and testing

ISO 26262 – Software development
- Software safety life cycle
- Software safety requirements
- Software design
- Software implementation
- Software integration and testing
- Verification of software safety requirements

ISO 26262 – System development (II)
- Hardware software integration and testing
- Safety validation
- Safety case, release for production

ISO 26262 – Functional safety management
- Safety plan
- Safety case
- Confirmation measures (confirmation reviews, safety audit, safety assessment)

ISO 26262 – Special topics
- Development Interface Agreement (DIA), workshare between OEMs and suppliers
- Confidence in the use of software tools (tool classification and qualification)

MXAM IN ACTION

BEST PRACTICES FOR MODELING GUIDELINES AND ARCHITECTURAL DESIGN PRINCIPLES - 2 days

This training class will introduce you to fundamental aspects of working with modeling guidelines and to the static model analysis of MATLAB Simulink/Stateflow, TargetLink, and Embedded Coder models. Furthermore, you will learn how to create MISRA- and ISO 26262-compliant models using proven modeling standards and best practices. The spotlight will be placed on how you can best integrate the MES Model Examiner (MXAM) into your process. Via several hands-on sessions, you will have the chance to practice reliably deploying guidelines with MXAM and ensure guideline compliance. Participants will discover a good workflow for analyzing and correcting models, justifying deviations in preparation for a review, as well as adapting and integrating MXAM into user-specified development environments. What's more, you will find out how to perform a structure and complexity analysis of a model. The resulting metrics serve as the basis for assessing the architecture, complexity, and size of a model.

TARGET AUDIENCE

This training class is targeted at anyone who wants to learn how to use the MES Model Examiner (MXAM) professionally. The class is for function developers, testers, test managers, and quality managers who focus on model-based development of embedded software based on MATLAB/Simulink and related to Embedded Coder/TargetLink. Share your experiences and discuss with other tool users.

HIGHLIGHTS

- Presentation of proven modeling guidelines
- Automated guideline checking and correction with MXAM
- Review of guideline violations and accounting for discrepancies
- Creating custom guideline documents in MXAM
- Toolchain and continuous integration
- Assessing architectural design principles
- Complexity analysis of models

"The trainers are a well-established team with a lot of expertise. It is a pleasure to listen, to participate and the training encourages to improve your own modelling continuously."
Participant from Volkswagen

LANGUAGES: Available in English and German

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BOOKING: www.model-engineers.com/mxam-training

AGENDA

MXAM IN ACTION – BEST PRACTICES FOR GUIDELINES AND ARCHITECTURAL DESIGN PRINCIPLES

DAY 1

Introduction to modeling guidelines and static model analysis
- Architectural design principles in model-based design
- Model quality through static guideline checking
- The purpose of guidelines and metrics
- Standard guideline documents

Implementing software architecture in models
- Basics of software architecture
- Expected properties of an ISO 26262-compliant software architecture
- Software architecture in models

Analysis and evaluation of model architecture with MXAM
- Model structure analysis
- Introduction to complexity metrics
- Calculating model complexity
- Measures to reduce model complexity
- Identification of ineffective interfaces and model clones

Hands-on: Model architecture analysis
- Analyzing and evaluating model metrics
- Identifying complex subsystems, ineffective interfaces, and clones
- Refactoring of model structure

Guideline analysis with MXAM
- General workflow
- Structure and use of the user interface
- Reporting: overview, result navigation, model linking, auto repair, re-run, annotations, and export

Hands-on: General workflow
- Performing guideline analyses
- Repairing guideline violations
- Justifying guideline violations
- Saving and exporting reports

Presentation of guidelines for key aspects of modeling
- Selected guidelines for Simulink, Stateflow, and TargetLink with topics such as layout, naming conventions, dataflow, typing, and scaling

Hands-on: Applying standard guidelines
- Performing analyses of a demo model with the starter set in MXAM
- Evaluating and discussing specific findings

DAY 2

Basic configuration of an analysis with MXAM
- Creating a project with all analysis-relevant settings
- Creating a guideline document to define a set of guidelines
- Configuring global and check parameters for a customer-specific guideline analysis
- Creating an ignore-list to disregard model elements

Hands-on: Configuring a project
- Creating and configuring MXAM projects, ignore lists, guideline documents

Extensive configuration of an MXAM analysis
- Setting up projects for distributed development: reporting, annotations, artifacts
- Creating a user-defined guideline document: authoring, versioning, and central repository in library

Hands-on: Customizing MXAM
- Creating custom libraries
- Creating custom guidelines

Further modeling best practices
- ISO 26262 requirements that can be covered with modeling guidelines
- Other aspects: observance of ranges, compatibility of interfaces, etc.

Hands-on: Applying advanced guidelines
- Performing analyses of demo or customer models with an extended set
- Evaluating and discussing specific findings

Automating an MXAM analysis
- Exporting the current project settings into a MATLAB batch script
- Executing batch analyses via the MATLAB command line
- Various interfaces for continuous integration
- Performing analyses with the MES Jenkins Plugin
- Hook functions to customize the analysis

Hands-on: Creating batch analyses
- Creating, adjusting, and running MATLAB batch analyses for automated execution
- Integrating hook functions to meet toolchain-specific requirements

TESTING MODELS WITH MTEST

FROM REQUIREMENTS TO MODEL TESTING

3 days

This training class provides a comprehensive overview of the principles, processes, and objectives of model testing with the MES Test Manager (MTest) from requirements to model tests. We offer step-by-step guidance from creating requirements-based test specifications, through testing TargetLink and/or Embedded Coder models, to automated test evaluation based on test assessments and back-to-back/regression tests. In particular, we will emphasize ISO 26262-compliant test management and explain the test process for MiL and SiL, as well as tracing requirements to test specifications and test assessments. You will learn all process steps by means of hands-on practical exercises using Simulink and TargetLink or Embedded Coder models and MTest as a model test framework. This training class includes lots of hands-on sessions with MTest.

TARGET AUDIENCE

This training class is aimed at developers and testers, who want to learn how to use the MTest for testing. Experience with model-based development of embedded software based on MATLAB/Simulink related to TargetLink/Embedded Coder is advantageous. Share your experiences and discuss with other users of the MES Test Manager (MTest).

HIGHLIGHTS

- Test objectives and workflow
- Test management
- Test specification with MTCD
- Testing TargetLink/Embedded Coder models
- Regression and back-to-back testing
- Automated test evaluation with test assessments
- Model and code coverage
- Insight into test progress and test quality
- Several hands-on sessions with MTest

LANGUAGES: Available in English and German

COSTS AND CONDITIONS: See pages 38 - 39 or request your customized offer at **sales@model-engineers.com**

DATES: Fixed dates for this training class are published on the website.

BOOKING: www.model-engineers.com/mtest-training

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AGENDA TESTING MODELS WITH MTEST – FROM REQUIREMENTS TO MODEL TESTING

DAY 1

Introduction to model testing
- Objectives, workflow, and process steps of model testing
- Test specification methods
- Test evaluation methods
- Test documentation
- Tracing requirements in model testing
- Setting up the work environment for the workshop

Introduction to sample models
- Setup of testing environment
- Introduction to sample models
- Introduction to customer models
- Walk-through (MTest)

Systematic requirements-based specification of test sequences
- Definition of test groups and test sequences with MTCD
- Specification functions in MTCD (functions, synchronous, asynchronous)
- Parameter handling with MTCD
- Specification of test cases using variation
- Best practices for test specifications

Hands-on: Test specification
- In-depth work based on practical exercises
- Joint creation of test specifications
- Executing test sequences
- Using parameters for modifying test sequences efficiently

DAY 2

Testing TargetLink and Embedded Coder models and model/code coverage
- Automated test bed creation and module testing for subsystems
- Advanced support of code generation in model testing
- Model coverage for all MiL test platforms
- Code coverage for SiL/PiL test platforms

Hands-on: Increasing model/code coverage
- Automatic test execution for MiL/SiL/PiL
- Interpretation and evaluation of coverage reports
- Increasing model/code coverage through structure-based test cases
- Logging internal signals

Back-to-back and regression comparison
- Area of application (MiL vs. SiL vs. PiL, model simulation vs. measurement data)
- Combination of test assessments and back-to-back/ regression testing
- Conversion of output signals into reference signals

Hands-on: Test evaluation
- Execution and documentation of test evaluation in report
- Definition of tolerances (amplitude and time)

Introduction to automated test evaluation with test assessments
- Principles and objectives of test assessments
- Structure and content of test assessments

Assessment generation from requirements (MARS)
- Types of requirement patterns
- Benefits of a formal requirements syntax
- Assessment generation

DAY 3

Requirements-based test case creation and generation
- How does the equivalence class method work and how can it help?
- Creating test sequences with the classification tree method
- Boundary value testing
- Generation of test sequences from formal requirements

Hands-on: Requirements-based test case generation
- Automated stimulation and evaluation
- Inspection of coverage and trigger behavior

MTest and Continuous Integration
- Workflow of test projects using CI
- MES Jenkins Plugin
- Demo: MTest and Jenkins

Hands-on: Complete setup of test project
- Create test project
- Select test object and corresponding requirements
- Formalize requirements
- Create test sequences and simulate
- Create test assessments and evaluate
- Inspect model/code coverage and write further test sequences
- Perform back-to-back test and configure tolerances

Result and progress overview
- Where can I see the progress of my test project? (tracing, coverage, project integrity)
- Are the requirements correctly implemented in the test object? (assessment catalog)
- What is the quality of test results? (test catalog, test report)
- When am I done testing?

Hands-on: Results and progress
- What is the efficient workflow after requirement modifications?
- Modifying test specifications and test assessments after requirements changes
- Review of test specifications and test assessments

MQC IN ACTION

ISO 250XX FOR SOFTWARE PRODUCT QUALITY

1 day

Quality monitoring is a major challenge. This training class provides all relevant basics for the consistent and continuous assessment of product quality of embedded systems. Firstly, their quality depends on the application of suitable processes and secondly, on the implementation of specific quality assurance measures. Using the MES Quality Commander (MQC), participants will learn how to quantify the success of individual measures and how the results of these measurements continuously influence product quality.

We will explain the concepts of ISO 250XX and demonstrate how to use continuous quality evaluation through specific model-based software development processes and toolchain examples with the help of MQC. We will establish key aspects pertaining to core development standards such as ISO 26262 and show how continuous quality monitoring helps to implement these standards.

TARGET AUDIENCE

This training class is targeted at quality managers and engineers, process managers, as well as developers, testing engineers, project, and team leaders who focus on the quality assurance of embedded software. Share your experiences and discuss with other tool users.

HIGHLIGHTS

- Basic concepts of software product quality in compliance with ISO 250XX
- Applying quality models for transparent and sustainable quality assessments
- Use cases for quality tracking
- Relevant aspects of ISO 26262 compliance

LANGUAGES: Available in English and German

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DATES: Fixed dates for this training class are published on the website.

BOOKING: www.model-engineers.com/mqc-training

AGENDA

MQC IN ACTION – ISO 250XX FOR SOFTWARE PRODUCT QUALITY

DAY 1

Overview: Introduction to software quality concepts
- Challenges of building systems for product quality monitoring
- Objectives and structure of the ISO 250XX group of product quality standards
- Basic concepts: measures and quality properties
- Introduction to relevant quality aspects

Basic elements of continuous quality assurance
- Dimensions of quality monitoring
- Handling the heterogeneity of artifacts
- Quality calculation
- Aggregation of quality by a quality model

Hands-on: Basic elements of continuous quality assurance
- Types of quality measurements functions
- Aggregation of quality functions

Quality assurance in model-based development of embedded software
- The standard process for model-based development
- Typical quality assurance procedures in model-based development
- Base practices for software development

Hands-on: Quality assurance in model-based development of embedded software

Constructing quality monitoring systems
- Structure of quality models
- Project structure and typical use cases

Hands-on: Constructing quality monitoring systems
- Constructing quality models
- Defining project structures

Milestones and targets
- Milestones in quality monitoring
- Targets for measures and quality
- Quality calculation for defined targets

Hands-on: Targets
- Definition of targets and milestones
- Evaluation of project quality using targets

Project-specific reporting
- Selection of specific measures or quality properties for reporting

Hands-on: Reporting
- Configuration of report pages
- Targets in reporting
- Tool pages

Continuous quality monitoring to achieve standard compliance
- Using quality monitoring for the controlled creation of a safety case in compliance with ISO 26262
- Verification of functional safety

MXAM GUIDELINE SELECTION & CONFIGURATION

2 days

The aim of this consulting package is to optimally integrate the MES Model Examiner (MXAM) in to the customer's toolchain and methodology. In particular, this optimization covers the automatic code generation with Embedded Coder or TargetLink and ensures compliance with standards like ISO 26262 and MISRA. MXAM is used to increase the overall maintainability and quality of models. This is achieved by applying public as well as company specific modeling guidelines to newly developed or legacy models. MXAM comes with a preselection of best practice guidelines. These guidelines have been proven in use by numerous serial projects. However, given the high number of available guidelines (600), the potential to specialize the guideline set is apparent. Additional guidelines can be selected to reflect the dedicated customer demand and settings. Consequently, the models will be streamlined to a particular toolchain and the customer's modeling style. In order to complete this task quickly, MES prepares and conducts a 2-day workshop for the selection of appropriate guidelines and checks with the customer on-site. Dedicated MES guideline experts determine the customer's particular constraints. They then interactively select and propose specific guidelines reflecting these constraints. Customer-specific modeling styles are considered and guidelines will be exemplarily evaluated based on the customer's models. As a result, the customers receives the perfect set of guidelines matching their unique needs in the shortest possible time. It is highly recommended that all developers take part in the selection workshop and share their experiences. This joint effort facilitates reaching a consensus and accepting the outcome.

TARGET AUDIENCE

This consulting package is targeted at users of MES Model Examiner (MXAM) who intend on customizing their set of modeling guidelines to their specific needs.

HIGHLIGHTS FROM THE AGENDA

- Brief introduction to static model analysis with MXAM
- Presentation of preselected modeling guidelines
- Assessment of guideline violations on sample models
- Determination of customer specific constraints on models and modeling styles
- Selection of guidelines according to the constraints
- Configuration of guidelines and checks
- Outcome: A customized guideline document and comprehensive configurations that are ready to use in existing and future projects

LANGUAGES: Available in English and German

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BOOKING: www.model-engineers.com/mxam-guidelines

ABOUT US

MODEL ENGINEERING SOLUTIONS

SOFTWARE QUALITY. IN CONTROL.

Model Engineering Solutions GmbH (MES) is a software company that offers solutions for the quality assurance of software projects. MES supports its customers in developing model-based embedded software that complies with industry standards such as IEC 61508, ISO 26262 or ASPICE.

Headquartered in Berlin (Germany), MES was founded in 2006. Dr. Hartmut Pohlheim, one of the most eminent experts in model-based development, has been the managing director of MES since 2008. With subsidiaries in the U.S. and China, international sales partners, and major industrial customers such as Bosch, Daimler, Ford, Geely, Stihl, and VW, MES maintains a strong worldwide presence. All but a few of the world's top-selling manufacturers and suppliers in the automotive industry rely on MES' solutions in their development environments.

MXAM, MTest, MoRe, and MQC are the four MES quality tools. Together they form a toolchain for the comprehensive quality assurance of all phases of the model-based software development process. With the MES Jenkins Plugin, the toolchain can also be used in a continuous integration environment. The main application is the MATLAB Simulink platform. The MES Test Center and the MES Academy's main service areas are quality assurance and the optimization of development processes.

MES is a dSPACE Strategic Partner, MathWorks, and ETAS product partner, and cooperates with SAE International.

SAMOCONSULT GMBH

SAFETY | MODELING | CONSULTING

Founded in 2007, samoconsult GmbH is a consulting and engineering firm recognized across industries for their comprehensive services in the areas of functional safety and model-based system/software engineering.

Automotive, railway, aerospace, and automation companies as well as software tool vendors turn to samoconsult for services and guidance related to functional safety. samoconsult is the choice of leading automotive OEMs and their suppliers when it comes to implementing and achieving compliance with ISO 26262. samoconsult experts have 10+ years of experience in tool classification and qualification gained from active engagement in standardization efforts (e.g. ISO 26262-8, DO-178/DO-330) as well as from the facilitation of tool qualifications and certifications across the world.

ABOUT THE TRAINERS

TOPICS

1. Model-based Development of Embedded Software in Compliance with ISO 26262
2. Introduction to Model-based Development and Quality Assurance of Embedded Software
3. MES Summer School
4. ISO 26262 Deployment Process Service
5. Agile Model-based Software Development
6. Architectures in Simulink & Stateflow
7. Testing Models the Right Way
8. ISO 26262 Tool Classification and Qualification
9. Functional Safety for Automotive Professionals
10. MXAM in Action
11. Testing Models with MTest
12. MQC in Action
13. MXAM Guideline Selection & Configuration

DR. MIRKO CONRAD

Mirko Conrad serves as Managing Director of samoconsult GmbH, an engineering and consulting firm recognized across industries for their comprehensive services in the area of functional safety. He lectures functional safety at the Technical Universities in Munich and Dresden and actively participated in the standardization of ISO 26262, ISO/PAS 21448 (SOTIF), DO-178C, and various MISRA guidelines. Mirko Conrad also has 10+ years of tool classification/qualification experience across industries and standards.

Topics: 8, 9

DR. JAN GRABOWSKI

Jan Grabowski is Head of Product at Model Engineering Solutions. With unwavering interest in ensuring the optimal support for our customers, he designs application scenarios and solution concepts for the MES software tools and services, and consults and assists customers worldwide. His expertise in quality assurance flows into the MES webinars and also into his role as speaker at conferences, and he happily shares his knowledge in MES training classes.

Topics: 1, 2, 6

MARTIN HILL

Martin Hill joined MES in 2013. He is Product Owner for the MES Test Manager (MTest) and is also responsible for projects in the fields of quality assurance, modeling, and model checking. He studied aerospace engineering and now focuses on model-based testing, as well as successfully managing test projects.

Topics: 2, 3, 7, 11

ABOUT THE TRAINERS

SOPHIA KOHLE

Sophia Kohle is Product Manager of the MES Model Examiner (MXAM). As part of her role, she defines the objectives for the development and advancement of the tool. She also supports customer projects in which company-specific features, guidelines, and checks are implemented in MXAM. Her commitment to quality led her and her team to confirm the tool's quality even further by having it classified and qualified by TÜV SÜD for its use in safety-related software development in compliance with ISO 26262, IEC 61508, and ISO 25119.

Topics: 1, 3, 5, 6, 10, 13

DR. HARTMUT POHLHEIM

Hartmut Pohlheim has been driving forward the quality assurance of software models for the automotive industry for more than 20 years. He holds a doctorate in technical cybernetics and automation engineering from the Technical University of Ilmenau and is considered one of the most distinguished experts in model-based software development. Since 2008 Hartmut Pohlheim has been Managing Director of Model Engineering Solutions (MES) and is responsible for technology development as Chief Technology Officer (CTO). He inspires customers with his effective solutions and expertize in quality assurance. Agile management is important to him and he cares a lot about his employees feeling valued and appreciated.

Topics: 1, 2, 3, 4, 6, 7, 11, 12

DR. SIMON RÖSEL

Simon Rösel has been a software engineer for the MES Model Examiner (MXAM) since 2017. He received his PhD in Mathematical Optimization at the Humboldt University of Berlin. The main focus of his work at MES is customer consultation in development projects. His additional responsibilities include the development of checks for automated guideline verification, e.g. in the context of ISO 26262, and support in research projects. He is particularly interested in the question of how models can be used efficiently in development processes.

Topics: 1, 4, 10, 13

LUKAS SCHAUS

Lukas Schaus studied computer engineering at the Technische Universität Berlin and is Software Engineer in the MES Test Manager (MTest) development team. His core focus lies in formal methods of software requirements specification and creating domain-specific languages (MARS and MTCD). He is an expert in using MTest, and he trains customers in how to best apply the tool in model testing.

Topics: 2, 3, 7, 11

ABOUT THE TRAINERS

KATJA SCHMIDT

Katja Schmidt joined MES in 2017 and works in model development and model testing in the MES Test Manager (MTest) development team. She brings her expertize in this area to MES's research projects and also to MES's training program as a trainer. She studied engineering science at the Technische Universität Berlin.

Topics: 2, 3, 7, 11

MELINA SIMICHANIDOU

Melina Simichanidou is a mathematician. After completing her Bachelor's degree at the Aristotle University of Thessaloniki, she successfully completed her Master's degree at the Technische Universität Berlin. She has been working as a software developer in the development team of the MES Model Examiner (MXAM) since 2017. Her main areas of focus are the development of checks in MXAM and customer support. She also shares her expertize in software development as a consultant and trainer in the training classes.

Topics: 1, 3, 4, 10, 13

KAI TESCHNER

Kai Teschner is a software engineer in the MES Test Manager (MTest) team. He joined MES in 2016 while he was studying electrical engineering with a focus on control engineering and modeling at the Technische Universität Berlin. In this way, he was able to gain first-hand experience in test projects regarding safety relevant software. After successfully completing his studies, he started working on developing the software of the test management tool MTest. As an MES Academy trainer, he shares his expertise in testing and developing safety critical software.

Topics: 1, 3, 7, 11

YUZHU YANG

Yuzhu Yang is Product Application Engineer of MES China. He supports the introduction of model checking and testing tools to Chinese customers and contributes to the product development process. With over seven years of software developing experience in safety-related systems, he assists customers in how to best use MES tools and how to implement them in the model-based software development practice. As an MES Academy trainer, he likes to share how to make the software development more efficient by using qualified tools and having a well-defined process.

Topics: 1, 10, 13

ON LOCATION OR ONLINE?

ON-SITE

We offer training classes on fixed dates at the following locations.

BERLIN, GERMANY

Model Engineering Solutions GmbH
Waldenserstraße 2 - 4, Entrance E
10551 Berlin, Germany
+49 30 20916463 0

BENGALURU, INDIA

DynaFusion Technologies Pvt. Ltd.
No. 214, 1st Floor, Bellary Road,
Sadashivnagar, Bengaluru - 560 080, India

STUTTGART, GERMANY

Wyndham Stuttgart Airport Messe
Flughafenstraße 51
70629 Stuttgart, Germany

SHANGHAI, CHINA

Model Engineering Solutions Ltd.
Building B, Nr. 1 Suhe
668 Hengfeng Road, Jing'an District,
Shanghai, 200070, China

WIXOM (DETROIT, MI), U.S

dSPACE Inc.
50131 Pontiac Trail,
Wixom, MI, U.S. 48393-2020

ONLINE

All our training classes are also available as online training classes. Join our training classes wherever you are without having to travel. Experienced trainers, interactive programs, all-digital materials, the use of high-end equipment and the latest online education solutions are guaranteed in our online classes.

FOR YOUR COMPANY

All our training classes are also available as training classes exclusively for your team or company. These training classes can take place either at your company or online. We tailor the contents, start times, and agenda to suit your specific processes and address your particular challenges.

TERMS & CONDITIONS, REGISTRATION, AND CONTACT FOR TRAINING CLASSES

valid from January 1, 2021

FEES, TERMS & CONDITIONS FOR TRAINING CLASSES PROVIDED BY MODEL ENGINEERING SOLUTIONS GMBH, GERMANY

All fees exclude VAT.

1-DAY TRAINING CLASS	€ 970
2-DAY TRAINING CLASS	€ 1,370
3-DAY TRAINING CLASS	€ 1,770
* MES SUMMER SCHOOL 2021	€ 2,370

* Plus € 136 per night for accommodation and breakfast at the Michelberger Hotel, if desired, available from June 13 until June 18, 2021

The prices for all training classes include training materials and a certificate of attendance. Refreshments and lunch are included for all training classes that do not take place online. The MES Summer School fee additionally includes dinner on two evenings and the participation in a leisure program. All fees are payable upon receipt of invoice prior to the training class.

During the class "Model-based Development of Embedded Software in Compliance with ISO 26262 – Challenges and Effective Solutions" and during the MES Summer School, participants have the option of attaining the SAE Certificate of Competency by passing an evaluation test. The costs for the SAE Certificate of Competency is € 400 plus VAT (where applicable).

NUMBER OF PARTICIPANTS

The number of training class participants is limited to a maximum of 12 for better individual supervision. The minimum number of participants required for a training class to run is two people.

REGISTRATION

Registration should be completed 14 days prior to the event. After the deadline, registrations are available on request.

PLEASE BOOK VIA www.model-engineers.com/trainings

DISCOUNTS

Discounts can be added up. Discounts do not apply to accommodation or the SAE certificate.

DISCOUNT FOR ALL ONLINE CLASSES	10%
EARLY BIRD DISCOUNT FOR REGISTRATIONS RECEIVED 30 DAYS PRIOR TO THE EVENT	10%
DISCOUNT WHEN REGISTERING MORE THAN ONE PARTICIPANT OR MORE THAN ONE TRAINING CLASS AT THE SAME TIME	25%
DISCOUNT FOR STUDENTS AND UNIVERSITY FACULTY MEMBERS	40%

CANCELLATION POLICY

Participation may be cancelled free of charge up to 21 days prior to the training class. For cancellations up to seven days prior to the relevant training class, the cancellation fee comprises 50% of the training fee plus VAT. 100% of the participation fee will be charged for all cancellations after this date or non-appearance on the day. Participants may find a replacement participant if desired. This change is free of charge. If a training class cannot take place as scheduled, MES will give a full refund of the price paid.

FEES, TERMS & CONDITIONS PROVIDED BY THIRD PARTIES (TRAINING CLASSES OUTSIDE GERMANY)

For the training classes provided by dSPACE, Inc. (Detroit, MI, U.S.), fees, terms, and conditions of dSPACE, Inc. apply. For more information and to register please visit:
www.dspace.com/en/inc/home/support/suptrain/iso26262/modelbaseddev.cfm

For the training classes provided by Dynafusion Technologies Pvt. Ltd. (Bengaluru, India), fees, terms, and conditions of DynaFusion Technologies Pvt. Ltd. apply. For more information and to register please visit:
www.dynafusiontech.com

For the training classes provided by Model Engineering Solutions Ltd. (Shanghai, China), fees, terms, and conditions of Model Engineering Solutions Ltd. apply. For more information and to register please visit:
www.model-engineers.com/zh-CN/training-class-registration

TRAINING CLASSES FOR YOUR COMPANY OR TEAM

EXCLUSIVE TRAINING CLASSES (ONLINE OR ON-SITE)	from **€ 3,950** plus VAT

The fees for company-exclusive training classes varies depending on the topic, location, number of trainers, and the amount of days. For your personal offer, please contact **sales@model-engineers.com**

CONTACT

For all information on our training program, additional dates, and quotations, please feel free to contact:

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