Automotive Solution Center for Simulation

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ONLINE CERTIFICATE COURSE

SIMULATION OF AUTOMATED VEHICLES

EDITION 2024

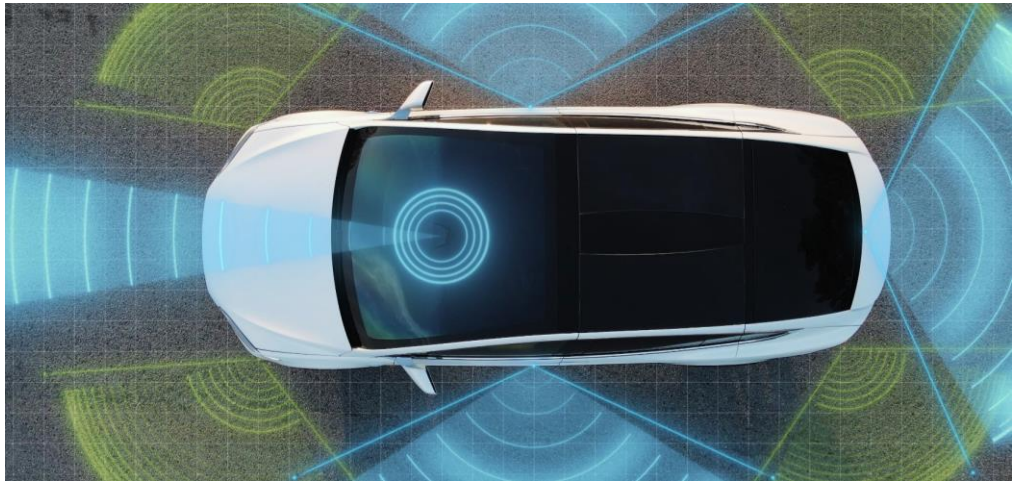
SIMULATION OF AUTOMATED VEHICLES

ONLINE CERTIFICATE COURSE

Automotive Solution Center for Simulation

MOTIVATION

Simulation is a key technology for developing, verifying, and validating the behavior of highly automated vehicles in a variety of scenarios, environments, system configurations, and driver characteristics. More and more engineers are using this powerful technology in their daily work to solve multidimensional and interdisciplinary problems. The increasing product complexity of Software-Defined Vehicles (SDV) and their mapping to Digital Twins (DT) also leads to deep supply chains in the simulation domain. Navigating this data ecosystem requires not only an understanding of the technology itself, but more importantly, the ability to confidently evaluate simulation models, methods, and processes, understand their limitations, and optimize the relationship between business impact and resources used.



WHAT WILL YOU GAIN ?

The **application-oriented certificate course** is designed to approach simulation-driven development of highly automated and self-driving cars from both a latest and a future technology perspective. In our online course we use a combination of live expert lectures with hands-on exercises to cover everything from creating realistic digital 3D-environments, sensor and ADAS technologies, driving functions through to validation and certification of automated vehicles. The course builds on standardization projects such as ASAM OpenX and covers open-source software approaches to simplify participants' entry into the technology area. Unlock new career opportunities, expand your knowledge and benefit from interdisciplinary and up-to-date expertise convened by our 20+ top-class lecturers.

IS THIS COURSE FOR ME?

The certificate course is aimed at applicants with a basic understanding of virtual vehicle development and automated systems. The course is suitable for **professionals, career changers or committed newcomers** who want to gain further qualifications in the field of ADAS and AD simulation. The course provides participants with a broad and application-oriented knowledge base.

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CERTIFCATE COURSE AT A GLANCE

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MODULES

A - SIMULATION ECOSYSTEM & 3D ENVIRONMENTS

B – SENSORS

C - SCENARIOS & DRIVING FUNCTIONS

D - VIRTUAL TEST & CERTIFICATION

STUDY MODE

Certificate Course (Modules A-D)
part-time 10 months course
~120 live and interactive online training hours (Microsoft Teams)

Single Module (A,B,C or D)
part-time 2 months course
~30 live online training hours (Microsoft Teams)

Video recordings available for participants after each training session.

DEGREE

- **Diploma of Advanced Studies**
  (Certificate Course modules A-D)
- **Diploma of Basis Studies Studies**
  (single module A or B or C or D)

Issuer of Certificate:
Steinbeis Center for Management & Technlogy GmbH

EXAMINATION MODE

Certificate Course: one online case presentation (20min) per module (four total) + one written scientific / transfer paper (~ 10 DIN-A4 pages)

Single Module: one online case presentation (20min)

The examination mode is only required for obtaining the certificate. Without the examination mode, the participant receives a confirmation of participation by ASCS.

REQUIREMENTS FOR ADMISSION

University entrance qualification or professional qualification

LECTURE LANGUAGE

English

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STUDY FEES

Automotive Solution Center for Simulation

CONDITIONS

CERTIFICATE COURSE
Modules A-D

6.400 €* + VAT for members of asc(s e.V.

8.000 €*+ VAT regular

* including an onsite ticket for the 10th Symposium Driving Simulation on November 2024 in Stuttgart, GER

all tickets include 12-month access to training material

SINGLE MODULE

2.000 € + VAT for members of asc(s e.V.

2.400 € + VAT regular

MODULES

A - SIMULATION ECOSYSTEM & 3D ENVIRONMENTS

B - SENSORS

C - SCENARIOS & DRIVING FUNCTIONS

D - VIRTUAL TEST & CERTIFICATION

SPECIAL CONDITIONS

- **40% discount** on the above prices for employees of **academic institutions and non-profit organizations**
- for employees from lecturer companies / institutions and multiple company participants we offer special prices - please contact us (training@asc-s.de)
- special offer: book one certificate course (Modules A-D) and distribute the individual modules to up to four different employees
- flexible payment options: invoicing possible in 2023 or 2024

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CONTENT MODULE A & B AT A GLANCE

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MODULE A - OVERVIEW & VIRTUAL 3D ENVIRONMENTS

11 April 2024 | 3 p.m. - 5 p.m. CET
A0 - Kick-off

11 April 2024 | 2 p.m. - 6 p.m. CET — slide 7
A1 - Overview Simulation Ecosystem
Lutz Morich (frE3 innovations), Christopher Wiegand (dSpace GmbH)

12 April 2024 | 2 p.m. - 6 p.m. CET — slides 8/9
A2 - Simulation Environment
Dr. Martin Obstbaum,Karl Schreiner (TWT GmbH),
Stephan Kussmaul (Triangraphics GmbH)
extended content 2024

18 April 2024 | 2 p.m. - 6 p.m. CET — slide 10
A3 - Mobile Mapping & Data Processing
Dr. Gunnar Gräfe (3D Mapping Solutions GmbH)

19 April 2024 | 2 p.m. - 6 p.m. CEST — slide 11
A4 - Data Analysis & HD Maps
Florian Günther, Dr. Gunnar Gräfe (3D Mapping Solutions GmbH)

25 April 2024 | 2 p.m. - 5 p.m. CEST — slide 12
A5 - City Models
Maximilian Sindram (virtualcitysystems GmbH)

26 April 2024 | 2 p.m. - 6 p.m. CEST — slide 13
A6 - Material Models / OpenMaterial
Dr. Ludwig Friedmann (BMW AG)

13 June 2024 | 2 p.m. - 4 p.m. CEST
A7 - Case Presentations & Discussion
Participants + Module Lecturers

MODULE B - SENSOR SIMULATION

16 May 2024 | 2 p.m. - 6 p.m. CEST — slide 14
B1 - Sensor Basics
Jürgen Wille (FrontMod GmbH)

17 May 2024 | 2 p.m. - 6 p.m. CEST — slide 15
B2 - Sensor Fusion & Integration
Jürgen Wille (FrontMod GmbH)

6 June 2024 | 2 p.m. - 6 p.m. CEST — slide 16
B3 - Sensor Simulation
Jürgen Wille (FrontMod GmbH)

7 June 2024 | 2 p.m. - 6 p.m. CEST — slide 17
B4 - FMI + OSI Standard
Pierre Mai (PMSF IT Consulting)

20 June 2024 | 2 p.m. - 6 p.m. CEST — slide 18
B5 - Sensor Model Validation
Dr. Clemens Linnhoff, Dr. Philipp Rosenberger (Persival GmbH)

21 June 2024 | 2 p.m. - 6 p.m. CEST — slide 19
B6 - SiL Simulation (Component)
Dr. Hardi Hungar (DLR e.V.)

5 July 2024 | 2 p.m. - 6 p.m. CEST — slide 20
B7 - Environmental Effect Modeling for Sensors Behavior Models in a Closed Loop Simulation
Prof. Stefan-Alexander Schneider (HS Kempten)

19 July 2024 | 2 p.m. - 5 p.m. CEST
B8 - Case Presentations & Discussion4
Participants + Module Lecturers

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CONTENT MODULE C & D AT A GLANCE

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MODULE C - SCENARIOS & DRIVING FUNCTIONS

12 September 2024 | 2 p.m. - 5 p.m. CEST — slide 21
C1 - Scenario Design
Dr. Martin Fischer (DLR e.V.)

13 September 2024 | 2 p.m. - 6 p.m. CEST — slide 22
C2 - Traffic Simulation / Agent Models
Dr. Alexander Ahlert, Dr. Pascal Piecha (IPG Automotive GmbH)

26 September 2024 | 2 p.m. - 6 p.m. CEST — slide 23
C3 - ADAS Simulation
Christopher Wiegand (dSpace GmbH)

27 September 2024 | 2 p.m. - 6 p.m. CEST — slide 24
C4 - System Structure and Parameterization (SSP) Standard
Peter Lobner (eXXcellent solutions GmbH)

10 October 2024 | 2 p.m. - 6 p.m. CEST — slide 25
C5 - Co-Simulation
Dr. Martin Benedikt (Virtual Vehicle Research GmbH)

11 October 2024 | 2 p.m. - 6 p.m. CEST — slide 26
C6 - AV Software
Prof. Daniel Watzenig / Markus Schratter (Virtual Vehicle Research GmbH)

18 October 2024 | 2 p.m. - 6 p.m. CEST — slide 27
C7 - Artificial Intelligence for Automated Driving new 2024
Prof. Dr. Johannes Betz (Technical University Munich)

4 November 2024 | 2 p.m. - 5 p.m. CET
C8 - Case Presentations & Discussion
Participants + Module Lecturers

MODULE D - VIRTUAL TEST & CERTIFICATION

24 October 2024 | 2 p.m. - 6 p.m. CET — slide 28
D1 - Automotive Test Strategies & Simulation-based V&V
Jann-Eve Stavesand (dSpace GmbH)

25 October 2024 / 14 November 2024 | 2 p.m. - 5 p.m. CET — slides 29/30
D2 / D3 - Driving Simulator Technologies I +II
Dr. Jens Häcker (Simulation Systems Consulting)

15 November 2024 | 2 p.m. - 6 p.m. CET — slide 31
D4 - Test vs. Simulation
Dr. Hardi Hungar (DLR e.V.)

28 November 2024 | 2 p.m. - 6 p.m. CET — slide 32
D5 - Functional Safety
Dr. Hardi Hungar (DLR e.V.)

29 November 2024 | 2 p.m. - 6 p.m. CEST — slide 33
D6 - Credible Simulation
Dr. Martin Benedikt (Virtual Vehicle Research GmbH)

12 December 2024 | 2 p.m. - 6 p.m. CEST — slides 34/35
D7 / D8 - Distributed Ledger Technologies I +II
Carlo van Driesten (BMW AG),
Prof. Florian Matthes (Technical University Munich)

17 January 2025 | 2 p.m. - 5 p.m. CET
D9 - Case Presentations & Discussion
Participants + Module Lecturers

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A1 - OVERVIEW SIMULATION ECOSYSTEM

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CONTENT

MOTIVATION (THE "WHY" OF THIS COURSE):
- Three Reasons why the market entry of autonomous driving functions could fail ...
- Something has changed ...

OVERVIEW AND CONNECTIONS TO ELEMENTS OF THE CERTIFICATE COURSE :
- Different perspectives on “Simulation of automated vehicles”
- How to deal with the challenge (processes, methods and tools)
- The important role of the Operational Design Domain (ODD) for development, training, simulation, verification and validation.

OVERVIEW ON ECOSYSTEM:
- Sharing is caring
- Roles and responsibilities
- Network and traceability

SOME HARD AND SOFT FACTS
- Standardization
- Coopetition

LECTURER

LUTZ MORICH
frE3 innovations

Lutz Morich studied mechanical engineering at RWTH Aachen University and began his professional career as a trainee in technical development at AUDI AG. 16 years of experience in managing projects and organizational units in management positions. Since 2017 he has been responsible for "Processes, Methods and Tools of the Virtual Disciplinary Environment" and several R&D projects with cooperation partners from industry, science and municipalities that deal with interdisciplinary and technical questions of automated traffic.

A2 - SIMULATION ENVIRONMENT

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CONTENT (TWT GmbH)

GENERAL
- Dynamic vs static (ground truth), Scene Maps vs Scenario
- Buildings, Tress, Roads, etc..
- Driving behaviour, maneuvers, pedstrians, bycicle, other traffic participants,...

DATA & FORMATS
- GIS Formats, OpenDRIVE, OpenSCENARIO

MATERIALS
- PBR and lighting
- Sensor material definition, segmentation

METAINFORMATION, TAGS & CODES
- Materials, Collision Volumes etc.
- OSM attributes,...

SCENE MAP FEATURES
- Road generation
- Traffic signals, markings, decals, road furniture,...
- Bridges, tunnels, underpasses,...
- Buildings, vegetation, waterways

MODELLING
- Quality Parameters: poly-count, textures, LODs
- Sensor Modelling rules

TARGET PLATFORMS
- Unreal Engine / Game engines, automotive platforms

USE-CASES & CORNER CASES
- Brake assistant / Lane assistant

LECTURERS

DR. MARTIN OBSTBAUM
TWT GmbH

Martin Obstbaum has studied physics at the university of Regensburg and holds a PhD from the institute of experimental and applied physics of the university of Regensburg. As head of systems engineering & computer graphics at TWT GmbH Science & Innovation Dr. Obstbaum explores together with his team the systematic design of virtual testing architectures and simulation technologies. In order to bring autonomous driving into a safe operating future on our streets one focus of topics is to simulate the decisions of autonomous cars based on sensors and perception algorithms using modern Computer Graphics Engines like UNREAL to generate photo- and phyisics-realistic 3D simulation environments. To this end continuous research of 3D computer graphics technologies and innovative algorithms as well as the integration of different data and information models is conducted.

KARL SCHREINER
TWT GmbH

Studied applied informatics and working now for about 4 years at TWT as a software developer in the field of autonomous driving and virtual validation of driver assistance systems. Areas of activity range from complex environment creation to software and hardware-in-the-loop testing and sensor simulation using virtual environments. Responsible as the product owner and part of the development of the tool Tronis®, that is based on the open-source gaming engine Unreal Engine which paves the way towards a realistic environment, vehicle and driver simulation.

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A2 - SIMULATION ENVIRONMENT

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CONTENT (Triangraphics GmbH)

GIS DATA
- What is GIS data
- Projections
- Types

GIS DATA INPUT FORMATS
- Raster, Vector
- 3d models, textures and materials
- Sources

VECTOR DATA
- Types and attributes
- Editing and usage

3D SCENE MAP FROM GIS DATA
- Static mesh vs height map
- Generation rules
- Ground textures, objects, features, roads and junctions
- LOD and level streaming

METADATA
- Object type, sensor material

TOOLS

LECTURERS

Stephan Kussmaul
Triangraphics GmbH

Stephan Kussmaul is Diplom Ingenieur for Media Technology and has a technical background with a focus on computer graphics and software development. He is co-founder of TrianGraphics GmbH, a company focusing on 3D content creation and developing modeling tools for the automotive and simulation industries. Today, Stephan is deeply involved in the development process of TrianGraphics' products, as well as in various research projects for generating digital twins.

A3 - MOBILE MAPPING & DATA PROCESSING

Automotive Solution Center for Simulation

CONTENT

MOBILE MAPPING

- Mobile Mapping Technology and Systems
  - Position and Orientation Systems (IMU, GPS, Odometer)
  - Multi-Sensor-Systems
    - High-end surveying laser scanners
    - Photogrammetric cameras
    - Panoramic cameras
    - Radar and other Sensors
  - System Calibration
  - System Quality Control
  - System performance and accuracy certificate
- Mapping of any kind of roads (Road networks, Race Tracks, proving grounds)

DATA PROCESSING

- Post-processing and quality management (GPS !)
- Scanner and image data processing
- Homogenization
- Examples

LECTURER

DR. GUNNAR GRÄFE
3D Mapping Solutions GmbH

As founder of 3D Mapping Solutions, Dr.-Ing. Gunnar Gräfe focuses on the research & development of multi-sensor mobile mapping systems equipped with positioning technology, calibrated cameras and high-resolution laser scanners and the software applications to process and analyze the acquired data. Key areas are kinematic measurements of all types of traffic networks, provision of reference information for advanced driver assistance systems and developing of basic data for driving simulator applications. Gunnar Gräfe studied Geodesy at the University of Federal Armed Forces (FAF) Munich. After working as scientific assistant and teaching officer at the University FAF/ Munich, he founded Mobile Mapping S&S GmbH. In 2007, this led to the formation of 3D Mapping Solutions GmbH, where he has been Managing Director since then.

A4 - DATA ANALYSIS & HD MAPS

Automotive Solution Center for Simulation

CONTENT

DATA ANALYSIS
- Objects & Signals
  - Object data catalogues
  - Object and signal attributes
  - Object data extraction
    - based on scanner point clouds
    - Photogrammetric signal measurements

ULTRA HD MAP
- Result: as-built-plan
- Road logic and topology
- Exercise
  - RoadView 2 Signal classification
  - Road logic
- ASAM OpenDRIVE, ASAM OpenCRG
- 3D Visualization
- Quality management and data quality certificates
- Scenario extraction options and Road Data Collection
- Application software examples

LECTURERS

DR. GUNNAR GRÄFE
3D Mapping Solutions GmbH

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FLORIAN GÜNTHER
3D Mapping Solutions GmbH

Florian Günther is a project leader and training manager in the field of high-precision and high-resolution mapping of road networks at 3D Mapping Solutions GmbH since 2018. He studied Business Administration and Cartography|Geomedia at the University of Applied Sciences Munich. He graduated as B.Sc. in the field of computer animation and 3-dimensional LiDAR surveys about Bibracte at the European Archaeological Center, France. Since then, he was involved in data analysis and processing HD maps for worldwide automotive industry and research driven use-cases. At the department of HD Maps his current focus is on providing user-specific cases in advanced ADAS or test and validation applications for autonomous driving, such as the combination and integration of different formats like OpenDRIVE, GIS and 3d Modelling.

A5 - CITY MODELS

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CONTENT

URBAN INFORMATION MODELING
- Virtual 3D City Models
- CityGML motivation and overview

CITYGML DETAILS
- Modeling of buildings, streets, terrain models, other objects
- Multi-level modeling
- Geometric-topological modelling
- Spatio-semantic coherance
- Surface properties
- Implicit geometries
- Extension mechanisms

CITYGML APPLICATIONS FROM PRACTICE
- Urban information hub
- Urban simulation (environment and traffic)

CITYGML AND OPENDRIVE
- Principals of ODR Standard
- Differences in modeling paradigms
- Model transformation

LECTURER

MAXIMILIAN SINDRAM
virtualcitysystems GmbH

In his position as business development manager at virtual city systems, Maximilian Sindram focuses on spatial and semantic modeling, analysis, and visualization of 2D and 3D geodata. Key areas are urban information modelling, urban simulation, and smart cities. Maximilian Sindram studied geography at the Ludwig-Maximilians-University in Munich. After his studies he worked as a junior researcher at the ifo Institute in Munich on research related topics to GIS in economics before leaving in 2012 to join the Chair of Geoinformatics at TU Munich. Since January 2018 he has been working as Business Development Manager at virtual city systems. As a lecturer at TU Munich, he has been awarded the faculty's teaching prize several times. In addition to his professional tasks, Maximilian Sindram is involved in professional associations and standardization committees. Among others, his contribution to the modeling of the OpenDRIVE standard in ASAM e.V. and his profound knowledge of the OGC standard CityGML are worth mentioning.

A6 - MATERIAL MODELS / OpenMATERIAL

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CONTENT

BASICS OF AUTOMATED DRIVING
- Challenges
- Building Blocks
- Virtual Development

BASICS OF SENSORS AND PERCEPTION
- Challenges
- Sensor Modalities

SIMULATION-BASED DEVELOPMENT
- Environment Representation
- Software Architecture
- Standardization

OpenMATERIAL
- 3D Models and Materials
- Khronos glTF 2.0
- 3D Model Specification
- Material Models

LECTURER

DR. LUDWIG FRIEDMANN
BMW AG

Since 2018:
Solution Architect Simulation Autonomous Driving (BMW Group)
- Simulation architecture, 3D models and materials
- Distributed simulation frameworks
- Standardization

2016-2018:
Product Manager Software Development Tools/Methods (Audi AG)
- Simulation @ Autonomous Intelligent Driving GmbH
- Distributed simulation software
- Virtual environment and 3D models

2010-2016:
Research Associate/PhD Candidate (TUM)
- Flight simulation software
- Real-time simulation of rotorcraft downwash
- Multi-channel rendering

B1 - SENSOR BASICS

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CONTENT

ADAS SENSOR TECHNOLOGY
Sensor types and there application
- Ultrasonic sensors
- Camera sensors
- Radar sensors
- LIDAR sensors

SENSOR CHARACTERISTIC
- Sensor parameter
- Detection range
- Strength and weakness
- Environmental influence

ADAS ARCHITECTURE
- Sensor calibration
- Sensor data recording setup

LECTURER

JÜRGEN WILLE
FrontMod GmbH

Jürgen Wille studied precision engineering at FH Ulm and information technology at the University of Paderborn. He began his professional career as research associate at TU Berlin and the Fraunhofer Institute IZM. He joined Valeo GmbH in 2001 and worked in the field of hardware design and simulation methods over 17 years. Since 2006, he has been involved in the field of perception sensor model development and EMC verification. His focus was lying on ultrasonic and radar sensors and optimisation of sensor mounting positions inside virtual car models. He was involved in the European project "ENABLE-S3" and build up several sensor HIL tester to enable autonomous parking. Jürgen founded FrontMod GmbH in 2018. FrontMod is member of the ASC-S and develops sensor models for OSI standard.

B2 - SENSOR FUSION & INTEGRATION

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CONTENT

SENSOR INTEGRATION
- Integration methods
- Influence of mounting position

SENSOR FUSION
- Architecture
- Fusion stages
- Plausibility Checks
- Reliability

BEYOND SENSOR FUSION
- Connected car concepts
- Applications of autonomous driving

LECTURER

JÜRGEN WILLE
FrontMod GmbH

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B3 - SENSOR SIMULATION

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CONTENT

MODELING PLATFORMS
•Available tools
•Simulation methods

SENSOR REPRESENTATION & INTEGRATION
•Coordination systems
•Mounting point
•Modeling parameter
•Environment modeling parameter
•Detection Area

SENSOR BEHAVIOUR MODELING
•Functional
•Phenomenological
•Physical

SENSOR DATA
•Sensor processing chain
•File formats
•Interfaces

APPLICATIONS
•On-/Offline simulation
•Co-simulation
•Hardware-In-Loop (HIL)

LECTURER

JÜRGEN WILLE
FrontMod GmbH

Jürgen Wille studied precision engineering at FH Ulm and information technology at the University of Paderborn. He began his professional career as research associate at TU Berlin and the Fraunhofer Institute IZM. He joined Valeo GmbH in 2001 and worked in the field of hardware design and simulation methods over 17 years. Since 2006, he has been involved in the field of perception sensor model development and EMC verification. His focus was lying on ultrasonic and radar sensors and optimisation of sensor mounting positions inside virtual car models. He was involved in the European project "ENABLE-S3" and build up several sensor HIL tester to enable autonomous parking. Jürgen founded FrontMod GmbH in 2018. FrontMod is member of the ASC-S and develops sensor models for OSI standard.

B4 - FMI + OSI STANDARD

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CONTENT

INTRODUCTION TO THE FMI STANDARD, HISTORY, SCOPE AND VISION

- Use & benefit in the simulation process
- What is an FMU?
    - Contents and important concepts (FMU, Variables, Types, Kinds of FMUs, Multi-Platform, Additional Resources, ...)
- FMI 3.0 - new extensions and directions
    - (vECU, SE, ...)
- FMI in practice:
    - Tool-based FMU generation, Code-based FMU generation, FMU import
- FMI in Context:
    - Related resources, Organisations and Standards (SSP, OSI/OSMP, SmartSE Rec, MA)

INTRODUCTION TO OSI

- Use & benefit in (sensor) simulation process
- OSI Data Layer
- OSI Packaging Layer - OSMP
- OSI in practice:
    - OSI-based Sensor Modeling & Simulation
- OSI in Context:
    - Related Resources, Organisations and Standards (SSP, ASAM, OpenX)

•On-/Offline simulation
•Co-simulation
•Hardware-In-Loop (HIL)

LECTURER

PIERRE R. MAI
PMSF IT Consulting

As the founder and owner of PMSF IT Consulting focuses on the intersection between system development and simulation. One key area in the past decade has been the development and standardization of simulation and model interfaces for use in the automotive industry development processes. In this vein Pierre R. Mai is a member of the Modelica Association FMI and SSP, as well as founding member of the ASAM OSI and OpenSCENARIO standardization projects. In the past he coordinated the establishment of the ASAM Simulation Area and the transfer of the OpenX standards to ASAM in an interim capacity. Pierre R. Mai studied computer science at the Technical University Berlin with a focus on programming language design, implementation and constraint systems receiving his degree in 2002. Since then he has founded and lead a number of businesses in the simulation and technology domain, with a broad industrial and automotive customer base.

B5 - SENSOR MODEL VALIDATION

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CONTENT

HOLISTIC DEMONSTRATION FROM REQUIREMENTS TO SENSOR MODEL UNCERTAINTY QUANTIFICATION:

- Sensor effect ontology by Perception Sensor Collaborative Effect and Cause Tree (PerCollECT)
- Requirements for sensor models by Cause, Effect and Phenomenon Relevance Analysis (CEPRA)
    - Requirements for the ODD description
    - Possible SUTs to be tested with sensor models
    - Sensor hard- and software to be modeled incl. interface description
- Exemplary requirements for lidar modeling
- Implementation of an exemplary effect chain in a lidar sensor model
- Sensor Model validation
    - Metrics for sensor model validation
    - Model bias and model scattering error
    - Reference data accuracy
    - Epistemic vs. aleatory uncertainty
    - Replay-to-sim (Reference data as input)
- Inter- / extrapolation of sample validation results for model application
- Weather Effect Simulation and its Validation

LECTURERS

DR. CLEMENS LINNHOFF
Persival GmbH

Clemens Linnhoff is co-founder and CTO of Persival GmbH, which supports sensor manufacturers and OEMs in the specification, development and validation of perception sensor models. He recently finished his PhD thesis on "Analysis of Environmental Influences for Simulation of Active Perception Sensors".Until the end of 2022, he has been working for four years as a research associate at the Institute of Automotive Engineering at the Technical University of Darmstadt under the supervision of Prof. Hermann Winner. He was responsible for the development and validation of sensor models in the German research project "SET Level". Additionally, he was involved in the German project ViVID to pursue his work on modeling environmental influences in perception sensor data. He published 12 scientific papers in the field and 2 sensor data sets with adverse weather conditions. Together with his research group at TUD FZD, he started the PerCollECT initiative to collect and provide perception sensor cause-effect chains in a tree-like ontology. Furthermore, he is Sub-Library Maintainer (SLM) for all open source perception sensor models of the asc(s e.V. - ENVITED Open Source Model & Simulation Library.

DR. PHILIPP ROSENBERGER
Persival GmbH

Philipp Rosenberger is co-founder and CEO of Persival GmbH, which supports sensor manufacturers and OEMs in the specification, development and validation of perception sensor models. He recently finished his PhD thesis on "Metrics for Specification, Validation, and Uncertainty Prediction for Credibility in Simulation of Active Perception Sensor Systems".Until the end of 2022, he has been working for six years as a research assistant at the Institute of Automotive Engineering at the Technical University of Darmstadt under the supervision of Prof. Dr. rer. nat. Hermann Winner. In the European project "ENABLE-S3" he led the work package for simulation and stimulation and in the German project "PEGASUS" he was responsible for the development and validation of sensor models. Recently, he was involved in the German projects "SET Level" and "Verification & Validation Methods" to continue his work on model development and validation. He is also a founding member and part of the Change Control Board of the ASAM OSI standard.

B6 - SIL SIMULATION (COMPONENT)

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CONTENT

DEFINING THE FRAMEWORK AND ILLUSTRATION ON SAMPLE CASES

- Methodological frame of SiL simulation
  - Simulation problem definition
  - Process step
  - Simulation task definition
- Simulation preparation
  - Abstraction level (modeling level)
  - Simulation algorithmic
  - Tool requirements
  - Simulation setup
    - Tool and model selection
    - Tool instantiation
  - Result evaluation
    - Extraction of the contribution of the simulation

LECTURERS

DR. HARDI HUNGAR
DLR - Institute of Transportation Systems

Hardi Hungar received a PhD in computer science from the Christian Alberechts University in Kiel, and has the venia legendi (habilitation) at the Carl-von-Ossietzky University Oldenburg. For many years, he has worked on methods and tools for the development of dependable and safety-critical systems. These concerned mainly applications in the transportation domain. He has held various positions in academia, research and industry. In his current position, he leads the team on "Processes and Methods for Verification and Validation" at the Institute of Transportation System, which is one of the institutes of the German Aerospace Center (DLR). He is currently working mainly on methods for the verification and validation of highly automated vehicles. His focus areas include concepts and languages for defining test scenarios, algorithms and tools to perform exhaustive virtual tests, standard-conformant development, and safety argumentations.

B7 - ENVIRONMENTAL EFFECT MODELING FOR SENSORS BEHAVIOR MODELS IN A CLOSED LOOP SIMULATION

Automotive Solution Center for Simulation

CONTENT

SETUP OF A CLOSED LOOP SIMULATION FOR MOTION PLANING WITH

- 1. Environmental Modeling
- 2. Sensor Behaviour Models
- 3. Object Detection
- 4. Fusion
- 5. Path Tracing

on the basis of OSI, OpenDRIVE and OpenSCENARIO

LECTURERS

PROF. STEFAN-ALEXANDER SCHNEIDER
HS Kempten

Current position:

- Sponsored Professor from continental ADC at University of Applied Sciences for Advanced Driver
- Assistance Systems
- Visiting Professor at Shibaura Institute of Technologies, Tokyo, Japan
  Head of Master Course Advanced Driver Assistance Systems

Professional experience:

- BMW AG: Development, Numerical Simulation, Method Referend for Process, Method and Tool for Functional and Software Development for Modeling Multi-domain Physical Systems, in particular with the programming language Modelica, Functional Co-Simulation of Multi-Disciplinary Applications, Development and Qualification of the Method VASE for Safety-relevant Software Development, Modeling Standards and Manuals, BMW-Training Coach for Model-Based Software Development
- Axxom Software AG: Senior System Analyst, Customized Consulting and Solution Implementation, Design and Development of Mathematical Optimization Methods
- Infineon Technologies AG: Development Engineer, Field Memory Products, Department of Advanced Technology Software, Support of Development Departments through Project-specific Customization and Support of Commercial Software Programs
- Educational background: Promotion, Technical University of Munich, Department of Scientific Computing, Adaptive Soluction of Elliptic Partial Differential Equations by Hierarchical Tensor Product Finite Elements, Dr. rer. nat., applied and computational mathematics for ordinary and partial differential equations and fluid mechanics
- Diploma, Mathematics and Physics, Technical University of Munich

C1 - SCENARIO DESIGN

Automotive Solution Center for Simulation

CONTENT

Scenario Definition

- Terms
- Scenario Layers

Scenario Description

- Level of Detail (abstract, functional, logical, concrete)
- Description Languages (Overview & intensive explanation of OpenSCENARIO)

Scenario Examples

Practice Session on Scenario Design

Scenario Generation & Data Bases

- Statistical Data
- Recorded Data
- Artificial Scenarios

Special Scenario Challenges

- From Test Case to Scenario Description
- Different Scenarios for diff. XIL simulations
- Provoking dangerous/critical situations
- Multi Human-in-the-Loop scenarios

LECTURERS

Dr. Martin Fischer
DLR - Institute of Transportation Systems

Dr. Martin Fischer studied Electrical Engineering at the Hanover University and got his degree in 2003. In 2009 he graduated as Dr.-Ing. at the University of Braunschweig with his work on “Motion-cueing algorithms for moving-based simulators”. He works for the German Aerospace Centre - Institute of Transportation Systems as a researcher and he is leading the group “Human-Centered Simulation” in the department “Validation and Verification”. His research focuses on human-in-the-loop simulation methods and technologies.

C2 - TRAFFIC SIMULATION / AGENT MODELS

Automotive Solution Center for Simulation

CONTENT

INTRODUCTION
- Use cases
- Overview and classification
- Traffic simulation and agent models for ADAS/AD

SIMULATION ENVIRONMENT

BASICS OF EGO VEHICLE SIMULATION

TRAFFIC OBJECTS / AGENT MODELS

METHODS OF TRAFFIC GENERATION

TRAFFIC FOLLOWING MODELS
- Simplified approaches
- Human driver models

AI BASED MODELS & SOCIAL FORCES

MULTI-EGO SIMULATION

GENERATION OF TRAFFIC MODELS FROM MEASUREMENT DATA

STATE-OF-THE-ART, EXAMPLES & DEMOS

LECTURER

DR. ALEXANDER AHLERT
IPG Automotive GmbH

Alexander Ahlert received the M.Sc. degree in mechanical engineering from the Karlsruhe Institute of Technology in 2015. Afterwards he graduated as Dr.-Ing. at the Institute of Automotive Engineering Stuttgart at the University of Stuttgart in the field of vehicle dynamics, multi-body systems and control theory. At Porsche Engineering he was a systems engineer and effect chain responsible for predictive control driving functions and motion planning algorithms. Since 2020 he joined IPG Automotive GmbH as Branch Manager Stuttgart. He leads different teams in the areas of Test Systems and Engineering, Technical Support and Sales. His main interest and focus is on the topic of democratization of simulation and virtual test driving throughout the vehicle development process. Besides, he is a lecturer for vehicle technology at the Technical Academy Esslingen (TAE).

DR. PASCAL PIECHA
IPG Automotive GmbH

Pascal Piecha is Global Education & University Program Manager at IPG Automotive GmbH and works on Research and Development topics regarding simulation and virtual test driving together with Universities, Research Institutes and Students world-wide. He studied mechanical engineering with the focus on powertrain development at the Karlsruhe Institute of Technology (KIT) and received his M.Sc. in 2014. Working as a research assistant on the ECO-Powerdrive2 FFG project and covering the sustainable development of smaller powertrain systems (hand-held power-tools, motorcycles and more), he graduated as a Ph.D. in Technical Science from Graz University of Technology in 2019.

C3 - ADAS SIMULATION

Automotive Solution Center for Simulation

CONTENT

INTRODUCTION & OVERVIEW – ADAS/AD SYSTEMS MODELLING ASPECTS & TERMINOLOGY

- What is the Operational Design Domain?
- What is the Dynamic Driving Task?
- What is a Scenario?

SIMULATION MODELS, SIMULATORS & SYSTEM UNDER TEST

- System under Test: Requirements on simulations
- Simulators: SIL, HIL & DIL
- Simulation Models
- Sensor Models (e.g. fidelity levels for Radar Lidar, Camera and Ultra Sonic Sensor)
- Environment & Scenery
- Scenarios
- Traffic
- Vehicle Dynamics

INTERFACES
(e.g. FMU, OpenDrive, OpenScenario & OSI, Co-Simulations)

How to make sure simulations provide reliable results and can be used for validation?

LECTURERS

CHRISTOPHER WIEGAND
dSpace GmbH

Christopher Wiegand is Strategic Product Manager at dSPACE GmbH, where he is responsible for the business fields Modelling & Simulation and Scenario Generation & Library. He studied electrical engineering and received his Dipl.-Ing. degree from the University of Paderborn in 2007. He joined the Fraunhofer Institute and Sensor Technology Group of the University of Paderborn as a research engineer and received a doctor's degree in electrical engineering in 2012.

C4 - SYSTEM STRUCTURE AND PARAMETERIZATION (SSP) STANDARD

Automotive Solution Center for Simulation

CONTENT

INTRODUCTION

- Block introduction & agenda
- Challenges in development of complex simulation systems
- Challenges adressed by SSP

INTRODUCTION TO THE SSP STANDARD, HISTORY, SCOPE & VISION

SSP WALKTHROUGH
Creating a SSP model from scratch alongside the simulation process to explore the SSP core principles & concepts

SSP advanced principles & concepts

USE IN SPECIFIC CONTEXTS, OUTLOOK & POTENTIALS (OSI connectors, SSP4Traceability, ...)

LECTURERS

PETER LOBNER
eXXcellent solutions GmbH

Peter Lobner studied Computer Science at the University Ulm and graduated as Dipl. Inf. in 2011. He then started his career as a software engineer at eXXcellent solutions GmbH and has gained experience in the development of complex software solutions in different industry sectors like E-Learning, Energy and Automotive over more than 10 years. He is currently working as software architect and project manager in different projects. One is orchideo | easySSP, a cloud based model editor and simulator for the System Structure & Parameterization (SSP) Standard of the Modelica Association. Moreover, he is a member of Modelica's SSP working group and actively participating in evolving the standard further. His interests are focused mainly on the creation of innovative & collaborative SaaS solutions and agile leadership.

C5 - CO-SIMULATION

Automotive Solution Center for Simulation

CONTENT

INTRO SYSTEMSIMULATION
- Complicated and complex Systems
- System of Systems
- Need for distributed, modular Simulation
- Modular simulation within the VDP
- Examples

INTEGRATION CHALLENGES
- Standards (FMI, SSP, DCP, etc.)

NUMERICAL INTEGRATION
- Methods
- Examples

CO-SIMULATION PLATFORM USE BY PARTICIPANTS
- FMU development and provision
- FMU Integration
- Co-Simulation configuration)

LECTURERS

DR. MARTIN BENEDIKT
Virtual Vehicle Research GmbH

Description to follow

C6 - AV SOFTWARE

Automotive Solution Center for Simulation

CONTENT

AUTOMATED DRIVING SOFTWARE
- System architecture overview
- Different system levels
- Automated Driving stacks
    - Commercial solutions
    - Open-source solutions

DEMO AUTOMATED DRIVING SW STACK
- Introduction Autoware
- Autoware running on a research vehicle
- Demo 1: Lidar-based localization
- Demo 2: Path planning

LECTURERS

PROF. DANIEL WATZENIG
Virtual Vehicle Research GmbH

Daniel Watzenig received his M.Sc. degree in Electrical Engineering and the Ph.D. degree in Technical Science from Graz University of Technology, Austria, in 2002 and 2006, respectively. In 2009 he received the Venia Docendi (habilitation) for Electrical Measurement and Signal Processing. Since 2006 he has been Divisional Director and Scientific Head of the Automotive Electronics and Software Department of the Virtual Vehicle Research GmbH in Graz. In 2017 he has been appointed as Full Professor of Autonomous Driving at the Institute of Automation and Control, Graz University of Technology, Austria. He is founder and a team leader of the Autonomous Racing Graz Team, one of currently six teams of the global race series (Roborace). His research interests focus on sense & control of automated vehicles, signal processing, multi-sensor data fusion, uncertainty estimation and quantification, and robust optimization. He is author or co-author of over 200 peer-reviewed papers, book chapters, patents, and articles.

MARKUS SCHRATTER
Virtual Vehicle Research GmbH

Markus Schratter is a researcher in the field of automated driving. He studied Information and Computer Engineering at Graz University of Technology. In 2011, he joined Virtual Vehicle Research GmbH and was involved in different research projects. His main task is the development and integration of concepts into test vehicles. Currently, he writes his PhD thesis with the subject: How technology for highly automated driving can be used to improve active safety systems. In 2019, he joined Autonomous Racing Graz as technical lead and is in the racing team responsible for the architecture of the software stack and the integration of the different subsystems. His research interests are related to automated driving, robotics, sensors and the integration of complex/reliable systems.

C7 - ARTIFICIAL INTELLIGENCE FOR AUTOMATED DRIVING

Automotive Solution Center for Simulation

CONTENT

INTRODUCTION
- What is Intelligence – What is Artificial Intelligence
- Which categories and methods do we have in AI today?
- Machine Learning and Deep Learning

THEORY: AI APPLICATION IN AUTONOMOUS VEHICLES
- Scene Understanding: The World is a complex and Dynamic Place
- Object Detection with computer vision and Ai
- Understanding Neural Networks
- Understanding Deep Neural Networks: Convolutional Neural Networks

STATE OF THE ART RESEARCH
- Further AI applications in Autonomous Vehicles
- Vision Transformer

LECTURERS

PROF. DR. JOHANNES BETZ
Technical University Munich

Johannes Betz is Assistant Professor at the new research lab “Autonomous Vehicle Systems” in the Department of Mobility Systems Engineering at the TUM School of Engineering and Design (ED).

D1 - AUTOMOTIVE TEST STRATEGIES & SIMULATION-BASED V&V

Automotive Solution Center for Simulation

CONTENT

GENERAL OVERVIEW OF TEST STRATEGIES FOR THE SAFETY ARGUMENTATION AND HOMOLOGATION OF ADAS/AD

- Terms and Definitions - to understand the lectures content
- Automotive Industry Insights - Impact on Homologation
- Data-driven Development Enables Autonomous Driving
- Existing Standards and Current Research Activities
- A Blueprint for New AD/ADAS Test Strategies
- Use Cases Requirements Based Testing on Closed Loop HIL
    - Use Cases Requirements Based Test SIL
        - Use Cases Requirements Based Testing MIL
        - Use Cases Fault Injection on MIL
    - Use Cases Open Road Testing with a Scenario-based Approach
        - Use Cases Scenario-based Testing on Proving Grounds
        - Use Cases Hardware Reprocessing / Data Replay
        - Use Cases Vehicle in the Loop
        - Use Cases Driver in the Loop, Scenario-based
        - Use Cases Scenario-based SIL Closed Loop
- Artificial Intelligence impacting testing
- Possible new standards of testing

LECTURERS

TJANN-EVE STAVESAND
dSpace GmbH

Jann-Eve Stavesand heads dSPACE Consulting and supports customers worldwide on defining test strategies for complex E/E systems and on overcoming challenges in model-based development of safety-critical systems. He was involved in the development of ISO 26262:2018 with a focus on software and processes and is currently involved in the standardization of Safety Of The Intended Functionality (SOTIF). Here, too, the focus is on testing and quality assurance of the software and systems used, including the approval and homologation of these complex functions.

D2 - DRIVING SIMULATOR TECHNOLOGIES I

Automotive Solution Center for Simulation

CONTENT

INTRODUCTION: DIGITAL VALIDATION / VERIFICATION OF CHASSIS AND ASSISTANCE SYSTEMS

- From SiL/HiL to integration of the human in the simulation: Driver-in-the-Loop
- Applications: assistance systems, MMI, driver behavior, vehicle handling and dynamics assessment, vehicle safety, training

TECHNICAL ASPECTS OF DRIVING SIMULATORS

- Software framework
- Driving simulation: vehicle dynamics and models
- Road, environment, databases

TRAFFIC SIMULATION AND SCENARIO GENERATION

- imulator systems: visuals, motion, audio and vibration, cabin and controls

VISUAL SYSTEMS

- Historical development: flight simulation, first driving simulators
- Visual system performance and processing
- Projection, displays, cave, HMD
- Spatial perception: stereo systems

SIMULATOR MOTION SYSTEMS AND HUMAN PERCEPTION

- Mapping of vehicle motion into a simulator
- Motion perception and vection
- Motion cueing algorithms
- Technical implementation and example systems

LECTURERS

DR. JENS HÄCKER
Simulation Systems Consulting

Jens Haecker studied aerospace engineering and received his Dr.-Ing. degree from the University of Stuttgart in 2006. He joined Daimler AG in general research and advanced engineering and worked in simulation and testing of active chassis and steering systems and functional interfaces for autonomous driving. For the Daimler driving simulator at the Mercedes-Benz Technology Center he was responsible for mechatronics and further development of the motion platform and algorithms and represented Daimler as a member of the scientific committee of the Driving Simulation Association. He is a lecturer for control theory and simulation technologies in mechatronics at the Baden-Wuerttemberg Cooperative State University Stuttgart at Campus Horb. As founder of Simulation Systems Consulting he currently works as an engineering consultant providing services for specification and analysis of simulator systems, with special focus on technical and experimental aspects of human-in-the-loop simulation.

D3 - DRIVING SIMULATOR TECHNOLOGIES II

Automotive Solution Center for Simulation

CONTENT

VIRTUAL REALITY SYSTEMS AND APPLICATIONS

HUMAN IN THE CONTROL LOOP: HUMAN FACTORS

- Immersion and presence
- Perceptual fidelity in the design of virtual environments
- Validity of simulator experiences: driving behavior, perception of realism/hazard/risk
- Medical aspects: motion perception and kinetosis, physiological and psychological care
- Ethical aspects: test person as a “guinea pig”, high risk/accident situations

SCOPE OF SIMULATOR STUDIES AND EXAMPLE APPLICATIONS

- Driving simulator experiments for chassis development and vehicle handling/comfort
- Evaluation of assistance systems
- Case-study for autonomous driving

METHODOLOGY: DESIGN OF SIMULATOR EXPERIMENTS

- Conceptual design of a driving simulator experiment
- Criteria for test participants
- Data acquisition: subjective vs. objective data, measurements, questionnaires

  <li< li="" style="box-sizing: border-box;">>Statistics: sample size/distribution, demographic aspects, evaluation and interpretation
- Experimenter aspects: qualification, training, researcher bias, emergency training, after care
- Role of testing and preliminary experiment

LECTURERS

DR. JENS HÄCKER
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Jens Haecker studied aerospace engineering and received his Dr.-Ing. degree from the University of Stuttgart in 2006. He joined Daimler AG in general research and advanced engineering and worked in simulation and testing of active chassis and steering systems and functional interfaces for autonomous driving. For the Daimler driving simulator at the Mercedes-Benz Technology Center he was responsible for mechatronics and further development of the motion platform and algorithms and represented Daimler as a member of the scientific committee of the Driving Simulation Association. He is a lecturer for control theory and simulation technologies in mechatronics at the Baden-Wuerttemberg Cooperative State University Stuttgart at Campus Horb. As founder of Simulation Systems Consulting he currently works as an engineering consultant providing services for specification and analysis of simulator systems, with special focus on technical and experimental aspects of human-in-the-loop simulation.

D4 - TEST VS. SIMULATION

Automotive Solution Center for Simulation

CONTENT

- Simulation validity issues
- Methodological approach to simulation validation
- Example instantiation of simulation validation
- Deriuving assertions from combined test and simulation (contributed evidence)

LECTURERS

DR. HARDI HUNGAR
DLR - Institute of Transportation Systems

Hardi Hungar received a PhD in computer science from the Christian Alberechts University in Kiel, and has the venia legendi (habilitation) at the Carl-von-Ossietzky University Oldenburg. For many years, he has worked on methods and tools for the development of dependable and safety-critical systems. These concerned mainly applications in the transportation domain. He has held various positions in academia, research and industry. In his current position, he leads the team on "Processes and Methods for Verification and Validation" at the Institute of Transportation System, which is one of the institutes of the German Aerospace Center (DLR). He is currently working mainly on methods for the verification and validation of highly automated vehicles. His focus areas include concepts and languages for defining test scenarios, algorithms and tools to perform exhaustive virtual tests, standard-conformant development, and safety argumentations

D5 - FUNCTIONAL SAFETY

Automotive Solution Center for Simulation

CONTENT

Defintion of "Safety Case"

- Purpose
- Relation to relevant standards
- Important terms and concepts

Structure of a safety case Constituents

- arguments and factual evidence

Safety Case example sketch

Relation to develoment activities

LECTURERS

DR. HARDI HUNGAR
DLR - Institute of Transportation Systems

Hardi Hungar received a PhD in computer science from the Christian Alberechts University in Kiel, and has the venia legendi (habilitation) at the Carl-von-Ossietzky University Oldenburg. For many years, he has worked on methods and tools for the development of dependable and safety-critical systems. These concerned mainly applications in the transportation domain. He has held various positions in academia, research and industry. In his current position, he leads the team on "Processes and Methods for Verification and Validation" at the Institute of Transportation System, which is one of the institutes of the German Aerospace Center (DLR). He is currently working mainly on methods for the verification and validation of highly automated vehicles. His focus areas include concepts and languages for defining test scenarios, algorithms and tools to perform exhaustive virtual tests, standard-conformant development, and safety argumentations

D6 - CREDIBLE SIMULATION

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CONTENT

Virtual-enriched Development Process

- Motivation for virtual testing
- How is simulation used?

Credibility Definition

- History and recent developments
- Relation to Quality

Process and Artefact quality

- History and related standards (ISO, ASPICE, etc.)
- Credible Simulation Process
- Credible Assessment Framework

Credibility Argumentation

- MBS representation for analysis
- Application Example (ALKS)

LECTURERS

DR. MARTIN BENEDIKT
Virtual Vehicle Research GmbH

Description to follow

D7 - DISTRIBUTED LEDGER TECHNOLOGIES I

Automotive Solution Center for Simulation

CONTENT

DLT AS PROCESS FACILITATOR

- DLT for data-driven, simulation-based development (identity management, logging)
- automation of testframeworks
- state of the art
- remaining/inherent challenges

LECTURERS

CARLO VAN DRIESTEN
BMW AG

Carlo van Driesten graduated from TU München with an M.Sc. in Electrical Engineering and Information Technology. He researched in the field of Radar Clutter Simulation at Rohde & Schwarz for hardware in the loop testing of ship radars before he joined BMW in the field of automated driving in 2016. As Systems Architect for Virtual Test & Validation he is focused on international standardization of simulation interfaces, data structures and open architectures for the purpose of virtually enhanced homologation processes. He initiated the OpenX Simulation Standards at ASAM e.V., authored the initial version of the ASAM Open Simulation Interface (OSI) and is mentor of the ENVITED Research Cluster at asc(s e.V. pursuing the goal of creating decentralized data markets for simulations. In 2018 he co-founded vDL Digital Ventures with StakeNow as the largest German staking service for Tezos which brought his greatest passions together: Automated driving and distributed ledger technologies.

PROF. FLORIAN MATTHES
Technical University Munich

Since 2002 Florian Matthes holds the chair for Software Engineering for Business Information Systems at Technische Universität München. The current focus of his work is on blockchain-based system engineering, the semantic analysis of legal texts, and privacy-preserving data and service management. He is co-founder of CoreMedia, infoAsset and Tr8cy, co-founder and chair of Blockchain Bayern e.V. scientifc advisor of Noumena Digital, member of the advisory board of the Ernst Denert-Stiftung für Software Engineering, and initiator and organizer of international conferences and workshops in software and enterprise engineering.

D8 - DISTRIBUTED LEDGER TECHNOLOGIES II

Automotive Solution Center for Simulation

CONTENT

DLT ON MORE TECHNICAL LEVEL

- blockchain basics: consensus, safety assumptions, attack vectors, p2p networks, core concepts
- public vs permissioned ledgers
- smart contracts: language design, safety concepts and token standards
- change management process: governing and upgrading decentralized and distributed systems
- utilizing economies of scale and network effects of shared and open source resources
- example projects: knowledge and application transfer to the automotive domain

LECTURERS

CARLO VAN DRIESTEN
BMW AG

Carlo van Driesten graduated from TU München with an M.Sc. in Electrical Engineering and Information Technology. He researched in the field of Radar Clutter Simulation at Rohde & Schwarz for hardware in the loop testing of ship radars before he joined BMW in the field of automated driving in 2016. As Systems Architect for Virtual Test & Validation he is focused on international standardization of simulation interfaces, data structures and open architectures for the purpose of virtually enhanced homologation processes. He initiated the OpenX Simulation Standards at ASAM e.V., authored the initial version of the ASAM Open Simulation Interface (OSI) and is mentor of the ENVITED Research Cluster at asc(s e.V. pursuing the goal of creating decentralized data markets for simulations. In 2018 he co-founded vDL Digital Ventures with StakeNow as the largest German staking service for Tezos which brought his greatest passions together: Automated driving and distributed ledger technologies.

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Technical University Munich

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FAQ

Automotive Solution Center for Simulation

WHAT IS A CASE ?

A case is a small application-oriented task (homework), which the participants have to work out to a presentation (max. 20min) within at least two weeks. The case topics are provided by the module lecturers. Several cases are offered in each module. The case can be worked on alone or in a group of two persons. The presentation takes place in the last block of each module. The supervising module lecturer evaluates the case presentation and gives feedback. Cases are only obligatory to obtain a certificate on module level or for the entire certificate course.

WHAT IS A TRANSFER PAPER ?

A transfer paper should link what has been learned with a familiar issue from the participant's everyday professional life. Here, for example, a case can be deepened in writing, or a new topic can be chosen. Different module lecturers are available as supervisors. The choice of topic is made in coordination with the related module lecturer. The transfer work should have a scientific claim and comprise approx. 10 DIN-A4 pages. The processing period is minimum four weeks. The supervising module lecturer evaluates the Transfer Paper and gives feedback. A Transfer Paper is only obligatory to obtain a course certificate.

FURTHER QUESTIONS ?

YOUR CONTACT

Egon Wiedekind
Senior Project Lead Game Changer Simulation
wiedekind.extern@asc-s.de
Phone: +49 160 97592843

on behalf of
Automotive Solution Center for Simulation e.V.
Curiestrasse 2
70563 Stuttgart, GER
events@asc-s.de

REGISTRATION FORM

ONLINE CERTIFICATE COURSE SIMULATION OF AUTOMATED VEHICLES

Automotive Solution Center for Simulation

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