Ruhr Master School
of Applied Sciences

Dieses Wahlpflichtmodul ist ein Angebot der:

Fachhochschule Dortmund
University of Applied Sciences and Arts

Master Embedded Systems for Mechatronics

Signals and Systems for Automated Driving

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STIFTUNG MERCATOR

Signals and Systems for Automated Driving (MOD-E04)

Code Number	Workload	Credits	Semester	Frequency	Duration
10404	180 h	6		annually	1 Semester

1	Course Title	Contact hours	Self-Study	Planned Group Size
	Signals and Systems for Automated Driving	4 SWS / 60 h	120 h	25 students

2 Course Description

Automated driving requires the use of a multitude of sensors, controllers and actuators installed on the vehicle. Additionally, vehicle to vehicle and vehicle to infrastructure communication will be necessary. This course gives an overview about technologies used for automated driving. It starts with an overview about current R&D trends and then covers several sensor technologies with a special focus upon radar. Students will learn basic principles of stochastic signal processing and its application to tracking and mapping. Motion models and vehicle control technologies will be discussed to gain further insight into requirements for sensors and algorithms. Additional focus of this course is on architectures and infrastructures for automated driving. This includes bus interfaces and SW architectures as well as the basic principles of systems engineering. ISO 26262 as well as legal frameworks and their application to automated driving will be discussed. In addition to the lecture, exercises and small projects give additional insight into the technologies and concepts introduced in this course.

3 Course Structure

1. Technology overview
2. Sensors
3. Signal processing
4. Actuators & Vehicle Control
5. System Architectures
6. System Engineering
7. ISO 26262
8. Legal frameworks

4 Parameters

- Course characteristics: elective
- Course frequency: every year - summer semester
- Capacity: 25 students
- Course admittance prerequisites: higher mathematics, programming, signal processing
- Skills trained in this course: theoretical, practical and methodological skills
- Assessment of the course: Oral Exam (30 min) at the end of the course (50%) and group work as homework (50%)
- Teaching staff: Prof. Dr. Andreas Becker

5 Learning outcomes

5.1 Knowledge

- Knows common driver assistance components and architectures
- Knows basic signal processing algorithms for radars
- Knows state estimation algorithms
- Knows basics of related system engineering and norms

5.2 Skills

- Can develop tracking algorithms
- Can develop radar signal processing algorithms
- Can analyze requirements for subsystems of automated driving

	5.3 Competence – attitude • Understands the challenges in the development of automated driving and can discuss with experts from different domains • Can lead development of subsystems for automated driving • Can lead system level tests for automated driving
6	**Teaching and training methods** • Lectures, Labs (with Matlab/Simulink) • Access to tools and tool tutorials • Access to recent research papers • Company visit
6	**Course mapping** Requires: • MOD1-01 - Mathematics for Signals & Controls Connects to: • MOD1-04 – Requirements Engineering • MOD2-01 – Mechatronic Systems Engineering • MOD-E10 – Automotive Systems • MOD-E06 – Computer Vision
7	**References** Winner et al., Handbook of Driver Assistance Systems, Springer reference, 2016 Pebbles, Radar Principles, John Wiley & Sons, 1998 Bar-Shalom et al., Estimation with Applications to Tracking and Navigation, John Wiley & Sons, 2001 Maurer et al., Autmotive Systems Engineering, Springer 2013