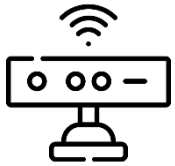
Institute of Automotive Technology
Faculty for Mechanical Engineering
Technical University of Munich

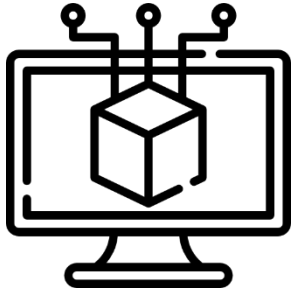
Autonomous Driving Software Engineering

Prof. Dr.-Ing. Markus Lienkamp

Dipl.-Ing. Nico Uhlemann

Simon Sagmeister, M.Sc.





Institute of Automotive Technology – FTM

- Where is the Institute of Automotive Technology?
  - Building 5 / 3rd floor → "Guide" to the employees
  - www.mos.ed.tum.de/ftm

- Course guidance module “Automotive Engineering”
  Dr.-Ing. Frank Diermeyer, MW 3528, by arrangement

- Lecturers responsible for this semester:
  - Nico Uhlemann
  - Simon Sagmeister

- For general information and questions please write an email to: vl.adse.ftm@ed.tum.de

General Course Information

In-person Lecture

- This summer term 2023 this will be an in-person session (English)
- Lecture room: 004, Hörsaal 1 "Interims II" (5416.01.004)
- Time: Tuesday, Lecture: 10:15 – 11:45, Practice: 12:00 – 12:45
- Additionally, lecture and practice videos will be available online afterwards
- Homework via Code Freak → See Video to Practice 1

Exam

- 5 ECTS
- Date: 04.08.2023, 11:00 Uhr – 12:30 Uhr
- Duration: 90 minutes
- Further detailing on the contents of the exam will be done in the last lecture
- No oral / no foreign examinations

Lecture Overview

Lecture and Practice Online Available	
1 Introduction: Autonomous Driving	18.04.2023 – Uhlemann
2 Perception I: Mapping	25.04.2023 – Sauerbeck
3 Perception II: Localization	02.05.2023 – Sauerbeck
4 Perception III: Detection	09.05.2023 – Huch
5 Prediction	29.05.2023 – Uhlemann
6 Planning I: Global Planning	06.06.2023 – Trauth
7 Planning II: Local Planning	13.06.2023 – Trauth
8 Control	20.06.2023 – Sagmeister
9 Safety Assessment	27.06.2023 – Dr. Diermeyer
10 Teleoperated Driving	04.07.2023 – Dr. Diermeyer
11 End-to-End	11.07.2023 – Betz
12 From Driver to Passenger	18.07.2023 – Dr. Diermeyer

General Course Information

Registration:

- Website https://www.moodle.tum.de/course/view.php?id=86740
  Registration in Moodle is automatic when you register for a course in TUM-Online
- Moodle cannot be used without a TUM online account (LRZ code)
- Exam registration is done separately via TUM-Online

What you will find on Moodle: Video recordings, Lecture materials, Practice materials

Homework will be done via Code Freak, see adse.ftm.ed.tum.de → Further information will be provided in Practice 01

Prerequisites and Recommended Lectures

The following topics are recommended to successfully attend the lecture “Autonomous Driving Software Engineering”. The mentioned lectures are recommendation to catch up on, if there is a knowledge gap in a specific topic:

Basics of Artificial Intelligence

- Artificial Intelligence in Automotive Technology (MW2378)
- Introduction to Deep Learning (IN2346)

Basics of Automotive Sensors and Actuators

- Advanced Driver Assistant Systems in Vehicles, Chapter 2 – 4 (MW2352)

Methods for State Estimation / Control Theory

- Systems theory in mechatronics (MW1929),
- Modern methods of control engineering I (MW0538)

Basics of Control Theory and Vehicle Dynamics

- Vehicle Dynamics of Passenger Cars (MW0028)

Recommended Books and Papers

J. Betz et al., “A Software Architecture for an Autonomous Racecar,” in 2019 IEEE 89th Vehicular Technology Conference (VTC2019-Spring), 2019, pp. 1–6.

J. Betz et al., “A Software Architecture for the Dynamic Path Planning of an Autonomous Racecar at the Limits of Handling,” in 2019 IEEE International Conference on Connected Vehicles and Expo (ICCVE), 2019, pp. 1–8.

S. Pendleton et al., “Perception, Planning, Control, and Coordination for Autonomous Vehicles,” Machines, vol. 5, no. 1, p. 6, 2017, doi: 10.3390/machines5010006.

M. Maurer, B. Lenz, H. Winner, and J. C. Gerdes, Autonomous Driving: Technical, Legal and Social Aspects. s.l.: Springer, 2016.

M. H. Daniel Watzenig, Ed., Automated Driving: Springer International Publishing, 2017.

A. Faisal, T. Yigitcanlar, M. Kamruzzaman, and G. Currie, “Understanding autonomous vehicles: A systematic literature review on capability, impact, planning and policy,” JTLU, vol. 12, no. 1, 2019, doi: 10.5198/jtlu.2019.1405.

→ But feel free to ask the expert of each lecture for specific literature. Autonomous driving combines multiple disciplines, so it‘s hard to cover all of them in one book