Hochschule Konstanz
University of Applied Sciences

**Course number: ASE 40520**
**Powertrain and Connected Control Units – Simulation and Function Development**
**Study level: Master / Graduate**

**Prof. Dr. Alexander Basler**

**Language of instruction: English**
**ECTS Credits: 6**

**Objectives:**

The students

- know the background of CO2 legislation, which influences significantly the future mobility
- can apply the state of the art methodologies in context of automobile software development process
- know the benefits and drawbacks of different powertrain architectures
- chose the most suited powertrain structure within a development project under consideration of specific requirements
- supply plausible own assumptions when confronted with incomplete specifications
- find convincing arguments in discussions about the different modern driving technologies and their impact on environment and society
- work together as a development team to find an appropriate solution as well as documentation, implementation and testing of simulation models
- moderate the decision processes within engineering teams with respect to other people and other opinions
- find the appropriate depth of modelling for different components of the automotive powertrain
- use simulation carefully keeping the modelling errors and the numerical errors in mind
- interpret simulation results due to given input assumptions and can explain the results to colleagues from other disciplines
- have the knowledge and experience to develop the automotive control unit software from a Simulink model via the rapid-prototyping toolchain to a processor code,
- have the ability to test drivetrain models and new implemented functionalities within a model-in-the-loop (MIL) approach in relevant use cases
- apply style guidelines to implement simulation models und model-driven software functionalities

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**Contents:**

Powertrain and Connected Control Units (Prof. Dr. Alexander Basler)

- overview of current and future CO2-legislation
- future trends and needs in automobile and drivetrain development
- control unit architectures
- automotive communication systems (CAN, FlexRay, Automotive Ethernet)
- components and functionalities of a powertrain with combustion engine
- components, layouts and functionalities of electrified powertrains with electrical engine and high voltage battery systems
- interaction of sensor systems within specific drivetrain layouts
- required functionalities for automated driving depending on certain levels of autonomy

Simulation of Powertrain Functions (Prof. Dr. Alexander Basler)

- overview of drivetrain functionalities
- functional principles of driving and braking functionalities
- development methods for automotive software implementation especially regarding functional safety
- tool chain for model-driven software development
- requirements and documentation
- implementation, test and validation of drivetrain models and functionalities
- test strategies in MIL/SIL/HIL approach
- presentation of results und discussion of experiences