Name of module:	Simulation and Control 2
Keywords:	Modeling, Simulation, Control, Drive-Train, Electric Drive, Ride Comfort, Longitudinal and Vertical Dynamics, Fuel Consumption, Components
Modulenumber:	**ASM201**
Target group(s):	2. Semester ASM, 2. Semester ASM, 2. Semester ASM
ECTS-Credits:	7
Language of instruction:	english
Module owner:	Prof. Dr. rer. nat. Michael Gipser

Extent of work (hours)

Workload	Contact hours	Self study	Exam preparation
210	105	80	25

Prerequisites:	• undergraduate course in mechanics • undergraduate course in electrical engineering • undergraduate course in computer science, programming in C or C++ • fundamentals of automotive engineering • module ASM101 (Mathematical Methods in Engineering) • module ASM103 (Simulation and Control 1)
Total target:	To acquire deeper skills in system-level modeling and simulation of automotive components and subsystems, with the focus on drive-train, suspension, and electric drives

Module content:	• simulation models for powertrains in Simulink • transient behavior of flexible drive-trains • fuel- and energy consumption of hybrid and electrical cars • advanced systems simulation techniques: operating point, linearization, frequency domain methods, nonlinearities, S-functions etc. • simulation models for vertical dynamics and ride comfort • suspension component models: tire, damper, air spring, leaf spring, hydraulic actuator, etc. • road surface and terrain models • ride comfort assessment • active suspension: concepts, potentials, simulation • electrical drives in vehicles • power electronic devices • control of electrical drives for hybrid and electric vehicles • simulation of electrical drives with Matlab/Simulink
Reference material:	• Wong: Theory of Ground Vehicles. SAE • Oberhauser, M.: Lecture Notes Drive-Train Modeling and Simulation • Gipser, M.: Lecture Notes Ride Comfort Modeling and Simulation • Haag, J.: Lecture Notes Electric Drives Modeling and Simulation • Matlab/Simulink Student Edition and on-line Documentation
Offered:	Winter term only

Submodules and assessment

Title of submodule	Longitudinal Dynamics
Type of instruction / form of learning:	Lecture
ECTS-Credits:	1
Hours per week:	1
Aims, learning outcomes:	• to become familiar with transient behavior of flexible drive-trains • to understand fuel- and energy consumption of hybrid and electrical cars
Type of assessment	Final written examination part I: 30 min

Title of submodule	Ride Comfort Modeling and Simulation
Type of instruction / form of learning:	Lecture
ECTS-Credits:	2
Hours per week:	2
Aims, learning outcomes:	• to become familiar with advanced systems simulation techniques • to develop suspension component models: tire, damper, air spring, leaf spring, hydraulic actuator, etc. • to develop road surface and terrain models • ride comfort assessment
Type of assessment	Final written examination part II: 60 min

Title of submodule	Automotive Controller systems
Type of instruction / form of learning:	Lecture
ECTS-Credits:	1
Hours per week:	1
Aims, learning outcomes:	• to become familiar with electrical drives in vehicles • to become familiar with power electronic devices • to understand the control of electrical drives for hybrid and electric vehicles •
Type of assessment	Final written examination part III: 30 min

Title of submodule	Lab Long. Dynamics, Ride Comfort and Automotive Controller Systems
Type of instruction / form of learning:	Lab
ECTS-Credits:	3
Hours per week:	3
Aims, learning outcomes:	• to develop simulation models for powertrains in Simulink • to develop simulation models for vertical dynamics and ride comfort • to develop simulation models of electrical drives with Matlab/Simulink
Type of assessment	Lab report