Name of module:	**Ride and Handling**
Keywords:	Ride, Handling, Suspension Control Systems, Multibody Dynamics, Suspension SDi
Modulenumber:	**ASM 223**
Target group(s):	2. Semester ASM
ECTS-Credits:	8
Language of instruction:	english
Module owner:	Prof. Erich Schindler

Extent of work (hours)

Workload	Contact hours	Self study	Exam preparation
240	120	90	30

Prerequisites:	• undergraduate course in mechanics (especially planar kinematics and kinetics of rigid bodies) • fundamentals of automotive engineering including principles of chassis design • linear algebra including fundamental matrix calculus and eigenvalues
Total target:	• Ability to develop an understanding of theory and methods in vehicle dynamics, with the focus on ride and handling properties • Ability to apply scientific tools to the development of computer simulation models • Ability to estimate the effect of changing model parameters on ride and handling criteria • Ability to analyze the performance characteristics for ride and handling
Module content:	• terminology of vehicle handling, control loop ”driver-vehicle-environment”, demands on vehicle handling, planar kinematics of vehicle motion, linear (bicycle) model, under- and oversteer, steady state and transient test procedures, handling characteristics under normal driving conditions, analysis and discussion of vehicle dynamics and vehicle handling including a description of the tire, nonlinear model, yaw velocity damping characteristics, effects of design parameters and the road/tire friction coefficient on handling performance • terminology in multibody dynamics, kinematics of free bodies, force and torque elements, play and friction, Newton-Euler equations, constraint functions, joints and linkages, flexible bodies, structure and functionality of multibody codes, types of analysis, introduction into MSC.ADAMS, application in suspension modeling and simulation for ride, handling on uneven roads, and load case generation for durability • Lab projects: development of a simple multibody simulation blockset in Simulink, modeling and analysis of double wishbone and McPhersion suspensions in MSC.ADAMS, full vehicle simulations in MSC.ADSAMS/Car

Reference material:	• Schindler, E.: Lecture Notes Vehicle Dynamics • Schindler, E.: Fahrdynamik – Grundlagen des Lenkverhaltens und ihre Anwendung für Fahrzeugregelsysteme. expert verlag, 2007 • Gillespie, T.D.: Fundamentals of Vehicle Dynamics. SAE • Zomotor: Fahrwerktechnik: Fahrverhalten Vogel Verlag, 1987 • Wong: Theory of Ground Vehicles. SAE • Gipser, M.: Lecture Notes Multibody Systems • Nikravesh, P. E.: Computer-Aided Analysis of Mechanical Systems. Prentice Hall 1988 • MSC:ADAMS Documentaion and Tutorials
Offered:	Summer term only

Submodules and assessment

Title of submodule	**Handling**
Type of instruction / form of learning:	Lecture
ECTS-Credits:	4
Hours per week:	4
Aims, learning outcomes:	• to understand the linear vehicle model describing the dynamics in lateral direction • to become familiar with the steady state and transient test procedures • to become familiar with the directional control response characteristic • to develop an understanding of vehicle dynamics and vehicle handling • to understand the nonlinear behavior of vehicle dynamics • to understand the relationship between vehicle design parameters and the handling characteristics
Type of assessment:	final written examination 90 min

Title of submodule	**Suspension Modeling**
Type of instruction / form of learning:	Lecture
ECTS-Credits:	4
Hours per week:	4
Aims, learning outcomes:	• to learn the fundamentals of multi-body dynamics • to understand the principles of related software • to learn to assess and efficiently apply MBS software for vehicle dynamics simulations • to become familiar with ADAMS and ADAMS/Car (including practical working with ADAMS) • to understand the concepts of detailed suspension modeling • to use ADAMS/Car and COSIN/mbs for full vehicle simulations
Type of assessment:	final written examination 90 min