

1	Course Number	Study Program KEEP/INTAP	Semester 2-4	Offered in ☑WS, ☑SS	Duration 1 Semester	Course Type optional	Workload (h)	ECTS Points 4
2	Course Computer Simulation		Teaching and Learning Forms Lectures, practices and exam preparation		Contact Time (SWS) (h) 4 40 (1h=45 min.)		Self-Study Time (h) 20	Language English
3	Learning Outcomes and Competences After successfully completing the module, students will be able to ... Know and understand - ... the fundamentals of time domain simulation models, its weaknesses and strength Use, application and generation of knowledge <i>Use and transfer</i> - ... of how to model, mathematically describe, implement, apply and analyze time domain simulation models using Matlab/Simulink - ... based o - ... estimate typical magnitudes of fluid mechanical parameters and material properties. <i>Scientific innovation</i> - ... independently carry out optimizations and further developments of dynamic systems. Overarching competencies <i>Communication and Cooperation</i> - ... argue their point of view in technical discussions using simulation results <i>Methodological competence</i> - ... have learned to apply the concept of block-oriented modelling to describe the dynamics of an automotive system. - ... define test maneuvers and check the plausibility/validity of such a simulation model systematically. Scientific self-image/professionalism - ... the students can work independently on scientific and automotive projects featuring system dynamics challenges.							
4	Participation Requirements Desirable but not mandatory: Basic math (calculus, linear algebra) and computer programming and software usage skills.							
5	Course Contents (1 h = 45 min) <ul style="list-style-type: none"> • Simulation and simulation tools in automotive engineering (2 h) • Notation: processes, systems, models, state systems (2 h) • Mathematical modeling of a car suspension (1 h) • Introduction to MATLAB/SIMULINK (1 h) • Numerical aspects: integration methods, stability, accuracy, robustness (1 h) • treatment of nonlinearities (play, dry friction, stops etc.) (1 h) 							

6	<p>Laboratory Projects (1h = 45 min)</p> <p>One session per week with 4 hours per session (1h=45 min.).</p> <ul style="list-style-type: none"> • Modeling, programming and simulation of a car suspension (4 h) • SIMULINK model of a car suspension (4 h) • SIMULINK S-Function for embedding of user defined models (4 h) • State Space form of car suspension LTI model (4 h) • Automatic linearization of nonlinear systems (4 h) • Modeling approaches for a nonlinear shockabsorber (4 h) • "Skyhook" damping concept for active suspension systems (4 h) • Active suspension system with road preview (mechanics, hydraulics, control). Simulation of system performance: (4 h)
7	<p>Examination Forms and Prerequisites for Awarding ECTS Points</p> <p>Midterm and final exam written examination 90 min., graded</p> <p>The exam is an open book exam and the students may use all documents in paper form (scripts and notes) and calculators.</p>
8	<p>Estimated Student Workload</p> <p>40 hours</p>
9	<p>Further Use of Course</p> <p>Electrical Engineering, Mechatronics, Mechanical Engineering</p>
10	<p>Grading Scheme</p> <p>Total grade: 50% midterm exam and 50% final exam</p> <p><i>Local grading scale Esslingen University:</i> 1,0/1,3 very good; 1,7/ 2,0/ 2,3 good; 2,7/3,0/3,3 satisfactory; 3,7/4,0 adequate; 4,3/4,7/5,0 insufficient/failed.</p>
11	<p>Course Manager and Full-Time Lecturer</p> <p>Prof. Dr.-Ing. Thomas Schirle</p>
12	<p>Literature</p> <p>Lecture scripts with notes, exam samples with solution, instructor provides exercises with solutions.</p> <p>Further reading:</p> <p>Matlab/Simulink simulation software: User manual and introduction/demos to to manual and demo</p>
13	<p>Course registration per email</p> <p>Due to the limited number of participants, we ask that you register in advance by emailing kremena.daneva@hs-esslingen.de</p>
14	<p>Last Updated</p> <p>01.09.2025</p>