

Course unit title:	Vehicle Dynamics & Control I with Programming		
Course unit code:	AU303		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	3		
Semester when the unit is delivered:	6 (Spring)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Marios Lestas		
Learning outcomes of the course unit:	<ol style="list-style-type: none"> <li>1. Define what ride quality is. Explain what a quarter-car and half-car model is. Name common sources of vibrations for a vehicle. Know the most common types of suspension systems.</li> <li>2. Compute the frequency and time domain response of a vehicle with a (passive or active) suspension system. Numerically simulate the vehicle's vertical response using Matlab or Carsim.</li> <li>3. Analyse and compare open and closed loop control systems.</li> <li>4. Measure the vertical response of a vehicle using the data acquisition system, accelerometers and other dedicated equipment.</li> <li>5. Design, as a group, a non-linear suspension system for a small formula car.</li> </ol>		
Mode of delivery:	Face-to-face		
Prerequisites:	AU211	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	<ul style="list-style-type: none"> <li>• <b>Suspension system:</b> know the most common types of suspension systems, sketch the characteristic of a coil or torsion spring, sketch the characteristic of a shock absorber, derive the differential equations of motion for <math>\frac{1}{4}</math>, <math>\frac{1}{2}</math> vehicle model, know excitation sources, compute the eigenfrequencies and eigenmodes, compute the frequency and time domain response of a vehicle, know about vibration suppression, know what is linearisation and why we use it, measure ride quality using data acquisition system, accelerometers and other dedicated equipment.</li> <li>• <b>Automotive control:</b> know what a control system is, know what open and closed loop control, list sensors and actuators used in automotive engineering, know how to model a controlled system.</li> <li>• <b>Active suspension systems:</b> modelling and analysis of an active suspension system, know how to model and analyse a semi-active suspension system, know what sky hook damping is.</li> <li>• <b>Modelling of vehicle suspension using applicable software:</b> Individual or small group modeling performed with the use of common industrial packages such as Carsim, Matlab. Experiments will include measurement of vehicle's vertical response.</li> </ul>		
Recommended and/or required reading:			
Textbooks:	J. Y. Wong, <i>Theory of Ground Vehicles</i> , Wiley-Interscience, 4th edition, 2008 R. Rajamani, <i>Vehicle Dynamics &amp; Control</i> , Springer, 2 <sup>nd</sup> Edition, 2012		
References:	T. D. Gillespie, <i>Fundamentals of Vehicle Dynamics</i> , SAE International, 1992 W. F. Milliken, et al, <i>Chassis Design: Principles and Analysis</i> , Society of Automotive Engineers, 2002. R. Bosch, <i>Automotive Handbook</i> , Robert Bosch GmbH, ISBN: 0837612438 M. Blundell, <i>The Multibody Systems Approach to Vehicle Dynamics</i> ,		

	Butterworth-Heinemann, 2004 H. Pacejka, <b><i>Tire and Vehicle Dynamics</i></b> , SAE International, 3 <sup>rd</sup> Edition, 2012
Planned learning activities and teaching methods:	The taught part of course is delivered to the students by means of lectures, conducted with the help of computer presentations. Lecture notes and presentations are available through the web for students to use in combination with the textbooks. Furthermore, theoretical principles are explained by means of specific examples and solution of specific problems. Lectures are supplemented with computer laboratory work carried out with the supervision of a lecturer. Here a demonstration of actual problems and computational methods takes place. Additionally, during laboratory sessions, students apply their gained knowledge and identify the principles taught in the lecture sessions by means of working on different modelling tasks and evaluating simulation results.
Assessment methods and criteria:	<ul style="list-style-type: none"> <li>• Assignments: 5%</li> <li>• Tests: 25%</li> <li>• Laboratory Work: 10%</li> <li>• Final Exam: 60%</li> </ul>
Language of instruction:	English
Work placement(s):	No