

Program and Course Description

Master in

"International Automotive Engineering"

Ingolstadt University of Applied Sciences

Winter term 2011

This program and course description becomes effective on October 1, 2011. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

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1 Introduction

The increasing use of electronics in drive, in chassis, and in equipment of modern automobiles as well as the replacement of whole subsystems by technologies like X-by-wire are important milestones of the automotive industry. Tomorrow's vehicles will be different. Take the higher voltage electrical and electronics systems for example. A 42 volt battery in place of today's 12V system is one change that is coming. Digital wiring harnesses are another.

Therefore, there is a demand for new competences in design and development. Engineers that have solid knowledge in the area of overlap of mechanics, electronics, and computer engineering will be asked for. The Master's program "International Automotive Engineering" provides an opportunity for students to gain a deep understanding in those engineering disciplines the life cycle of the product automobile is based on.

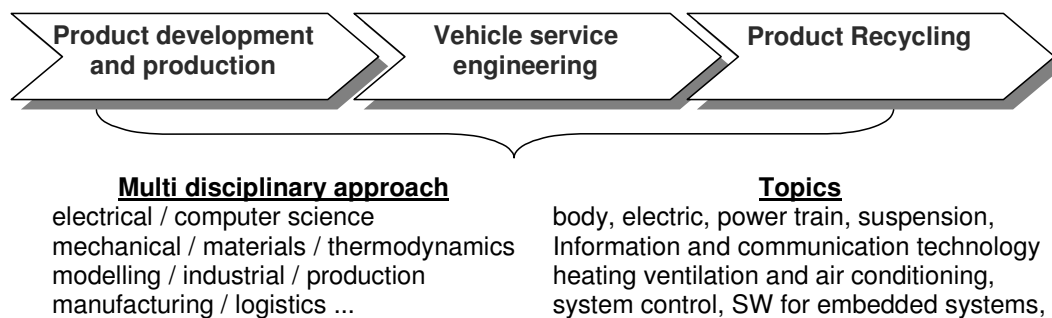


Figure 1: Automotive Engineering is orientated towards the life cycle process with the main focus on the technological product development and production phases

The program is conceived to offer a focused graduate study covering manifold aspects of automotive engineering. These aspects range from the inner workings of the automobile engine to external aspects such as vehicle aerodynamics, and from the potentials of control units used in automobiles to software engineering concepts and telematics. The theoretical foundations of industrial practice and practical applications of the theory of mechanics, dynamics, combustion, aerodynamics, control theory, software development etc. will be presented in a well-balanced fashion.

Furthermore, the rapid increase in the amount of economic activity taking place across national boundaries has changed the job requirements of engineers. Especially in the automotive industry, employees are wanted who are familiar with methods of communication and cooperation in international teams and who learnt to gain access to foreign cultures. Therefore, due to the multi-cultural composite of the trainees, the language of instruction is English.

The Master's program addresses qualified and dedicated students from all countries with an undergraduate degree in an engineering discipline or in computer science. Especially, those students are addressed who want to take on responsible tasks in development, organisation and management in the automotive industry.

The course is organized according to international arrangements. It is divided into modules, and the European Credit Transfer System (ECTS) is used to assign credit to each module. Cooperation with partner universities will allow students to complete selected modules during short stays abroad. International comparability of the program and foreign acceptance of the Master degree is guaranteed.

2 Program Structure

The program takes three semesters. The first two semesters are dedicated to lectures, seminars and projects. The third semester is reserved for the Master's thesis. The curriculum of the Master's program has been tailored towards the intermediation of interdisciplinary expertise that is required to work on problems in development, organization and production of modern automobiles efficiently. It mediates the special of the engineer-scientific approach within the range of automobile development. It explains the means of language and symbols to be used in automobile projects. However, scientific oriented work in a master program means that students learn independently and solely responsible.

Multi-disciplinary modules structure the program. The subjects of the modules emanate from mechanical engineering, electrical engineering, mathematics and computer science, and industrial engineering.

3. Semester	Master-Thesis 30 ECTS			
2. Semester	Project 10 ECTS	Compulsory Product Engineering	Elective III 5 ECTS	Elective II 10 ECTS
1. Semester	Compulsory Foundations of Automotive Engineering 20 ECTS		Elective I 10 ECTS	

Figure 2: Program structure

Compulsory modules aim at transfer of knowledge a multi-disciplinary educated automotive engineer must have. In the compulsory module "Foundations of Automotive Engineering" theoretical foundations used in the development of automotive components are imparted:

- Automotive Mechanic
Procurement of knowledge related to the driving operations, e.g., forces at a vehicle, power transmission, driving conditions
- Automotive Mechatronics
Foundations of power control systems, automotive sensors/actuators and their interfaces to electronic control units
- Automotive Control Engineering
Foundations of control engineering, characteristics of analogue and digital controllers and advanced controls topics such as non-linear and multivariable controllers.
- Mathematical Modeling and Simulation
Introduction to mathematical models of engineering systems

The compulsory module "Automotive Product Engineering" covers principles and techniques of quality engineering for the management, design engineering economics, production, and assurance of quality.

The compulsory module Project enables students to incorporate into a new to complex task and - based on a division of labor - to work on this task interdisciplinary in a team using suitable scientific methods.

Elective modules allows for an individual specialization. From each of the following two catalogs a module has to be selected:

Catalogue "Automotive Technology & Manufacturing"

- **Automotive Design**
provides the technical and design skills necessary a technologist requires to work on the design, manufacture, and operation of motor vehicles
- **Value Optimized Production Processes**
provides fundamental principles, procedures and practices for the understanding, selection and application of planning processes of production lines
- **Materials and Surface Engineering**
provides methods of the development, characterization and application of material and surface techniques
- **Power Train**
provides the principles and theory underlying the design, construction and operation of internal combustion engines
- **Simulation of Structures**
provides the methods to describe and simulate the kinematics and dynamics of mechanical systems

Catalogue "Automotive Electronics & Information Technology"

- **Automotive Electronic Systems Engineering**
provides methods for specification and design of mechatronic control systems
- **Automotive Electronics**
provides the principles of electricity to the design and operation of power supply systems
- **Automotive Communication Systems**
provides the concepts of communications of information processing components in a vehicle as well as with a vehicle
- **Automotive Software Engineering**
provides basic principles and practical examples of processes, methods and tools contributing to the secure management of electronic systems and software in a vehicle
- **Active Safety**
provides methods for the development of complex control- and safety systems of modern vehicles

The master's thesis is a practice-oriented research project on an elective topic subject to approval by the student's supervisor. The thesis is written under the guidance of one professor from University of Applied Sciences Ingolstadt (first supervisor).

In general, teaching is conducted in English. According to the availability of lecturers some lectures may be given in German.

3 Description of Courses

3.1 Modules offered in Winter Semester 2011/12

3.1.1 Compulsory Courses

Mathematical Modelling and Simulation			
Module abbreviation:	IAE_MMS	Num. in Ex.Reg.:	1
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Compulsory	1
Person responsible:	Prof. Dr. Peter Singer		
Lecturer(s):	Prof. Dr. Andreas Hagerer		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time	62 h	
	Self-study	88 h	
	Total:	150 h	
Credits:	5		
Recomm. prerequisite:			
Objectives:	Introduction to modelling methods: setting up models using appropriate mathematical frameworks and using various techniques for analysing them. At the completion of this course, students should be able to construct dynamical models of mechanical/electrical systems, apply these models in a manner suitable for computer solution and use those models to analyze and simulate system behaviour.		
Content:	The following topics are covered: <ul style="list-style-type: none"> • modelling of mechanical, electrical, thermo-fluidic and interconnected systems • linearity: scaling, superposition, linearization of nonlinear processes • Laplace transforms, transfer functions, and frequency response analysis, behaviour (forced/unforced time and frequency domain responses) of linear time-invariant (LTI) ordinary differential equations. • numerical integration and computer simulation. • tools: solution of dynamic problems using a digital simulation packages for continuous time/sampled data systems such as MATLAB/Simulink 		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer		
Literature:	<ul style="list-style-type: none"> • Erwin Kreyszig: Advanced Engineering Mathematics, Wiley, 2006. • Th. Harman et al.: Advanced engineering mathematics with MATLAB, Brooks/Cole, 2000. 		

Automotive Mechatronics			
Module abbreviation:	IAE_MCT	Num. in Ex.Reg.:	3
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Compulsory	1
Person responsible:	Prof. Dr.-Ing Harald Göllinger		
Lecturer(s):	Prof. Dr.-Ing Harald Göllinger		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:		62 h
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):		88 h
	Total:		150 h
Credits:	5		
Recomm. prerequisite:			
Objectives:	To provide students with foundational concepts in mechatronics and familiarity with common elements of mechatronics systems. A structured design approach is to be obtained: analysis of the technical problem, determination of the structure of the overall system, and selection and dimensioning of organizational components.		
Content:	<p>Mechatronic Systems</p> <ul style="list-style-type: none"> • definition, characteristics and principles • control of mechatronic systems <p>Sensors</p> <ul style="list-style-type: none"> • classification and principles, signals and signal processing • measurement chain, integrated and intelligent sensors • measurement of physical quantities <p>Motors and actuators</p> <ul style="list-style-type: none"> • classification and principles, application areas • DC motors analysis and modelling, stepper motors and synchronous/asynchronous motors • pneumatic/hydraulic actuator systems: principles, components and modelling <p>Microcontrollers</p> <ul style="list-style-type: none"> • structure, characteristics and applications • analogue/digital conversion, interfaces • bus structures 		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer		
Literature:			

Automotive Mechanics			
Module abbreviation:	IAE_MEC	Num. in Ex.Reg.:	2
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Compulsory	1 or 2
Person responsible:	Prof. Dr. Armin Arnold		
Lecturer(s):	Prof. Dr. Armin Arnold		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:		62 h
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):		88 h
	Total:		150 h
Credits:	5		
Recomm. prerequisite:			
Objectives:	<ul style="list-style-type: none"> • The students shall be able to understand the tire behaviour and the consequences for the vehicle's steering behaviour • Know about a simple analytical description of the driving behaviour for low lateral accelerations • Understanding of the vehicle's driving behaviour at higher lateral accelerations, reasons for the deviations from the simple analytical description • Understanding of the vehicle's driving behaviour regarding especially power train and chassis components. • The students shall be able to predict the changes of driving behaviour in case of changes to chassis/power train components 		
Content:	<ul style="list-style-type: none"> • tire behaviour, brush model of the tire • general vehicle dynamics (single-track-model) • chassis/suspension influences on vehicle dynamics (kinematics, elasto-kinematics, roll and instant centers, positioning center of gravity etc.) • influence of front/rear/four-wheel-drive • influences on driving behaviour due to (locked) differential gears • further influences on driving behaviour of drivetrain (shafts, torque vectoring etc.) 		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer, hands-on experiments		
Literature:			

Automotive Control Engineering			
Module abbreviation:	IAE_ACE	Num. in Ex.Reg.:	4
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Compulsory	1 or 2
Person responsible:	Prof. Dr.-Ing. Wolfgang Krämer		
Lecturer(s):	Prof. Dr.-Ing. Wolfgang Krämer		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions / lab work	30	4
Workload:	Lecture time		50 h
	Lab work:		10 h
	Self-study (Preparation/Follow ups of lectures, exercises, lab, examination preparation):		90 h
	Total:		150 h
Credits:	5		
Recomm. prerequisite:	Good knowledge of basics of control engineering		
Objectives:	Design of controllers and observers for multiple input / multiple output systems using the state space approach. Representation and design of discrete time systems. Knowledge of the representation of non-linear systems and the design of non-linear controllers. Knowledge of the control design and analysis functions of Matlab and Simulink.		
Content:	Survey of classical control engineering methods State space representation of linear time invariant single input / single output systems Design of state feedback and feedforward control State observers Transformation continuous time systems to discrete time systems Design of digital controllers Representation and analysis of non-linear control systems Lab work: Design and test of different types of control systems by use of Matlab-Simulink		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer, PC		
Literature:	<ul style="list-style-type: none"> • W. Bolton: Control Engineering. Prentice Hall, Harlow, 1998. • S. Burns: Advanced Control Engineering. Butterworth-Heinemann, Oxford, 2001. • G.F. Franklin, J.D. Powell, A. Emami-Naeini: Feedback Control of Dynamic Systems. 4th int. ed., Pearson 2002. • R.C. Dorf: Modern Control Systems. 12th int. ed., Pearson 2011 		

Project			
Module abbreviation:	IAE_PRJ	Num. in Ex.Reg.:	6
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Compulsory	2
Person responsible:			
Lecturer(s):	Prof. Dr. Jörn Schlingensiepen Prof. Dr. Thomas Brandmeier Prof. Dr. Johannes Pforr		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Project	12	4
Workload:	Lecture time:	62 h	
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):	138 h	
	Total:	300 h	
Credits:	10		
Recomm. prerequisite:			
Objectives:	The project conduces to the development of interdisciplinary interrelations and the development of methods and social competence. This compromises the development of alternatives from literature and/or lectures, which solve a given problem, the development of a solution approach, and the representation in a project report. At the same time the project serves gaining experiences in the organization of team processes and techniques of moderation and presentation.		
Content:			
Type of examination(s):	practical assignment		
Media:			
Literature:			

Thesis			
Module abbreviation:	IAE_THS	Num. in Ex.Reg.:	11
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Compulsory	3
Person responsible:			
Language:	English or German		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	-	1	-
Workload:	Self-study	900 h	
Credits:	30		
Prerequisite acc. ex. reg.:			
Objectives:	<p>A written thesis presented by the student to an examination board. Furthermore, an oral presentation giving a compressed and popular presentation of the thesis concludes the course. The thesis will demonstrate the student's ability to clearly define a significant problem; investigate a problem; then organize and logically present data; draw defensible conclusions and make recommendations.</p>		
Content:	<p>The Master thesis is a self study aimed at deepening a students understanding of a selected key subject area in automotive engineering. The work should have elements of research (new knowledge or methods). Normally a pre-study is performed. The pre-study may be literature search, introductory investigations or state of the art surveys.</p> <p>The report must comprise a description of the problem, the results and the work. Prototypes or products developed as part of the work may be included as part of the thesis. The student must give an oral presentation of the work.</p>		
Type of examination(s):	Report		

3.1.2 Elective Courses

3.1.2.1 Catalogue "Automotive Technology & Manufacturing"

Module "Automotive Design"

Car Body Construction			
Module abbreviation:	IAE_CBC	Num. in Ex.Reg.:	7.1.1
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	1 or 2
Person responsible:	Prof. Dr.-Ing. Jörg Wellnitz		
Lecturer(s):			
Language:	Deutsch		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:		62 h
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):		88 h
	Total:		150 h
Credits:	5		
Recomm. prerequisite:			
Objectives:	Der Studierende kann: Grundkenntnisse im modernen Karosseriebau, auch hinsichtlich von Leichtbaukonzepten, Auslegung und Bewertung von Karosseriestrukturen		
Content:	Tragkonzept der Karosserie, Belastungen, Statik und Dynamik Vergleich verschiedener Karosseriekonzepte bei Serienfahrzeugen, bei Rennfahrzeugen; Steifigkeit – und Fertigungsparameter, Biege-, Torsionssteifigkeit, Eigenformen. Profile, Halbzeuge und Gusskonstruktionen, Berechnung, Anwendung und Auslegung. Standard und moderne Füge-technik im Automobilbau, Verbindungstechnik und Karosserieeigenschaften. Einfluss von Türen, Klappen und Anbauteilen, Schubfeldtheorie und Stützwirkung		
Type of examination(s):	written examination in English (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer		
Literature:	will be announced in the lecture		

Aerodynamics, Design and Branding Strategies			
Module abbreviation:	IAE_ADBS	Num. in Ex.Reg.:	7.1.2
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	1 or 2
Person responsible:	Prof. Dr.-Ing. Jörg Wellnitz		
Lecturer(s):	Prof. Dr.-Ing. Jörg Wellnitz Prof. Dr.-Ing. Sabine Bschorer		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:	62 h	
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):	88 h	
	Total:	150 h	
Credits:	5		
Recomm. prerequisite:			
Objectives:	TBD		
Content:	TBD		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer		
Literature:			

3.1.2.2 Catalogue "Automotive Electronics & Information Technology"

Module "Automotive Electronics"

Automotive Electronics			
Module abbreviation:	IAE_AET	Num. in Ex.Reg.:	8.1.1
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	1 or 2
Person responsible:	Prof. Dr.-Ing. Lorenz Gaul		
Lecturer(s):	Prof. Dr.-Ing. Lorenz Gaul		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:		62 h
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):		88 h
	Total:		150 h
Credits:	5		
Prerequisite acc. ex. reg.:	none		
Recomm. prerequisite:	<ul style="list-style-type: none"> • basic knowledge of embedded control electronics 		
Objectives:	<ul style="list-style-type: none"> • knowledge of the architecture of automotive control units and applied integrated circuits • comprehension of the functional dependencies • ability to apply the knowledge to specify and design control units • ability to analyse control units on the level of electric signals, ability for basic analysis on electromagnetic field level 		
Content:	<ul style="list-style-type: none"> • short recapitulation of microcontroller technology • introduction to automotive electric standards • integrated circuits and circuit technology for sensor signal conditioning, controlling actuators, power supply • physical layer of automotive communication networks and onboard communication • board design concerning thermal dissipation, electromagnetic emission and immunity of control units • discussion of contributions to current automotive topics 		
Type of examination(s):	written examination, 90 min		
Media:	script, beamer, blackboard, circuit simulation, exercise material		
Literature:	<ul style="list-style-type: none"> • Manfred Krüger: Grundlagen der Kraftfahrzeugelektronik; Hanser Verlag • Horst Bauer: Automotive electrics, automotive electronics; Robert Bosch GmbH • Richard Valentine: Motor Control Electronics Handbook; McGraw-Hill Handbooks 		

Power Supply and Energy Distribution			
Module abbreviation:	IAE_PSED	Num. in Ex.Reg.:	8.1.2
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	1 or 2
Person responsible:	Prof. Dr.-Ing. Johannes Pforr		
Lecturer(s):	Prof. Dr.-Ing. Johannes Pforr		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:	62 h	
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):	88 h	
	Total:	150 h	
Credits:	5		
Recomm. prerequisite:	Basic knowledge of electronics and electrical engineering		
Objectives:	Good knowledge of power electronics and electric motor drives for automotive applications		
Content:	<p>Introduction, background and design of vehicular electrical energy distribution networks and power electronic systems and devices:</p> <ul style="list-style-type: none"> • Power devices and converter topologies • 14V/42V supply and energy distribution • Generation of electric power in vehicles • Energy management systems • High-voltage electric energy distribution systems for hybrid vehicles • Electric motor drives and motion control • Starter/generator • simulation 		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer		
Literature:	R. Erickson, "Fundamental of Power Electronics", ISBN 0-7923-7270-0 A. Emadi, "Vehicular Electric Power Systems", ISBN 0-8247-4751-8		

Module "Active Safety"

Driver Assistance Systems			
Module abbreviation:	IAE_DAS	Num. in Ex.Reg.:	8.5.1
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	1 or 2
Person responsible:	Prof. Dr.-Ing. Johann Schweiger		
Lecturer(s):	Prof. Dr.-Ing. Johann Schweiger		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:	62 h	
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):	88 h	
	Total:	150 h	
Credits:	5		
Recomm. prerequisite:	Object-oriented programming		
Objectives:	<ol style="list-style-type: none"> 1. Functionality of Driver Assistance Systems; Sensors and actuators for Driver Assistance Systems; Programming concepts for Driver Assistance Systems 2. Handling complexity and quantity of data 3. Configuration of multi-sensor systems for Driver Assistance Systems 4. Implementation of algorithms for Driver Assistance Systems 5. Commercial Driver Assistance Systems 6. Reuse of modules in Driver Assistance Systems 7. Robustness and availability. 		
Content:	Multi-sensor systems for Driver Assistance Systems Algorithms for Driver Assistance Systems Interpretation of sensor data Programming of Applications with mobile robots		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer, hands-on experiments		
Literature:	Conference proceedings		

Sensor Technology and Sensor Data Processing			
Module abbreviation:	IAE_STSP	Num. in Ex.Reg.:	8.5.2
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	1 or 2
Person responsible:	Prof. Dr. Johann Schweiger		
Lecturer(s):	Dr. Stephan Matzka		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	20	4
Workload:	Lecture time:		62 h
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):		88 h
	Total:		150 h
Credits:	5		
Recomm. prerequisite:	Experience in Matlab programming, probability theory, and statistics.		
Objectives:	The objective of this lecture is to give the student a broad understanding about current methods in sensor data processing and fusion.		
Content:	<ul style="list-style-type: none"> • Sensor types and characteristics • Multi-modal sensor systems • Signal types and characteristics • Fourier series and transform • Sampling and signal reconstruction • Laplace- and Z-transform • Digital filters • Pattern recognition • Kalman filter • Track-to-track fusion • Data association 		
Type of examination(s):	Written examination (90 – 120 min.)		
Media:	Presentation during lectures available as handout, exercise sheets, Matlab exercises in computer pool		
Literature:	B.P. Lathi: "Signal Processing and Linear Systems", Oxford Univ. Press Recent Proceedings (provided)		

3.1.3 Additional Electives

System Analysis and Requirement Definitions			
Module abbreviation:	IAE_SARD	Num. in Ex.Reg.:	8.2.1
Assignment to curricula:	Program of study	Compulsory/Elect.	Term
	Master International Automotive Engineering	Elective	2
Person responsible:	Prof. Dr.-Ing. Thomas Brandmeier		
Lecturer(s):	Prof. Dr.-Ing. Thomas Brandmeier		
Language:	English		
Teaching Methods/SWS:	Lecture form	Group size	Hours per week
	Seminaristic instructions	30	4
Workload:	Lecture time:	62 h	
	Self-study (Preparation/Follow ups of lectures, exercises, examination preparation):	88 h	
	Total:	150 h	
Credits:	5		
Recomm. prerequisite:	Lectures "Automotive Mechanics"		
Objectives:	<p>The objectives are to present the main contents of a system development in the automotive business. By using some examples it is shown how to come from common system requirements to a concrete system specification for mechatronic systems with the requirements for each electronic and mechanic component. Furthermore, the methods for evaluation and test on system level are presented.</p>		
Content:	<p>Specifying a new system is developed step by step by some examples. First step is to understand the physical behaviour by system analysis und modelling e.g. with simulation tools like Matlab/Simulink. Then, methods and tools to define requirements are shown (e.g. Doors, Use-Case Analysis). Legislation and safety requirements have to be recognized. Then, a system concept defines the components and leads to their requirements. For the test of the system performance measures in the system are necessary and platforms for simulation, Hardware-in-the-loop and vehicle test have to be developed. An example for an automotive test platform is presented.</p>		
Type of examination(s):	written examination (90 – 120 min.)		
Media:	Blackboard, over head projector, beamer		
Literature:			

3.2 Modules offered in Summer Semester 2012

Probable, in summer semester 2012 the following lectures will be offered:

- Mathematical Modelling and Simulation
- Automotive Mechatronics
- Automotive Product Management
- Project
- Electives
 1. Catalogue "Automotive Technology & Manufacturing"
 - Value Optimized Production Processes
 - Management & Optimization of Production and Logistic Processes
 - Virtual Plant Layout
 2. Catalogue "Automotive Electronics & Information Technology"
 - Automotive Communication Systems
 - Automotive Networks
 - Automotive Telematics