STUDIENDEKANAT
MASCHINENBAU

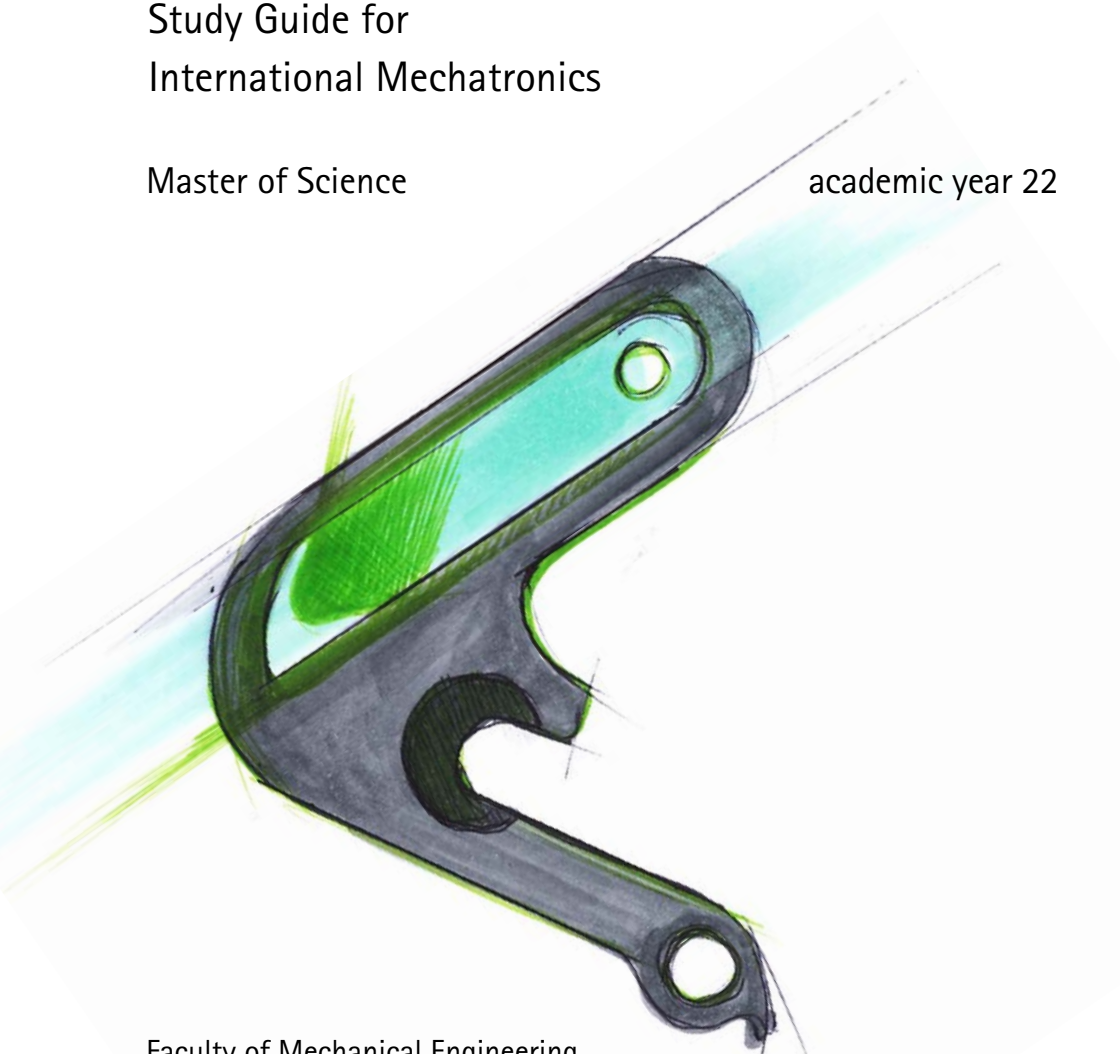
Leibniz
Universität
Hannover

Module Catalogue for PO 2017

Study Guide for
International Mechatronics

Master of Science

academic year 22



Faculty of Mechanical Engineering
Faculty of Electrical Engineering and Computer Science

Fakultät für Maschinenbau
Fakultät für Elektrotechnik und Informatik

Leibniz Universität Hannover

Study Guide

for

International Mechatronics

With the degree

- Master of Science

Summer Term 2022

This Study Guide is also available at:
http://www.mechatronik.uni-hannover.de/

Impressum

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Jördis Samland

Dear Student,

You are holding the course and module catalogue for the M.Sc. International Mechatronics pro-gramme. This degree programme crosses borders. Mechatronics itself is an interdisciplinary field which unites knowledge and skills from the disciplines of mechanical, electrical and information engineering. It allows these technologies to be combined and integrated, providing benefit in daily life.

Each student writes a project report, building upon their scientific and research work. This provides them with the skills necessary for the completion of their final master's degree thesis.The defence of the thesis, like the rest of the course, takes place in English.

The Teaching Office *(Studiendekanat)* is pleased to offer advice regarding the planning and organisation of your studies. Leibniz Universität Hannover also provides help with a wide range of student issues. Do not hesitate to take advantage of this assistance. Additionally, support can be found with experienced student representatives (at the *Fachschaftsrat*) and with the research associates of the various University Institutes.

We wish you every success.

Prof. Dr.-Ing. B. Ponick,
Faculty for Electrical and Information Engineering, Leibniz Universität Hannover

Prof. Dr. M. Becker,
Faculty for Mechanical Engineering, Leibniz Universität Hannover

General information

This course and module catalogue details all courses and modules within the International Mechatronics programme. It has been carefully prepared by the teaching offices of the participating establishments, assisted by the University Institutes and module leaders. Each module consists of several courses, and it is the responsibility of each student to ensure that their course selection meets the requirements of their chosen modules.

The Leibniz Universität Hannover Mechatronics programme website http://www.mechatronik.uni-hannover.de/ provides detailed information regarding mechatronics programmes and the 2012 Examination Regulations. It also offers a variety of insights into the activities of the Faculties. Important information and news can be found on the website of the Mechatronics Student Council (http://www.fmec.uni-hannover.de/).

The Master of Science (M.Sc.) degree provides students with a higher professional qualification. Entry to a master's degree programme requires either a Bachelor of Science degree in an engineering subject, a Bachelor of Engineering degree, or a comparable degree. Further information can be found in the Admission Regulations. A master's degree programme normally lasts for 4 semesters.

Examinations

The examinations associated with the individual courses are held during the lecture-free period of each semester. Students should normally take a course and sit the corresponding examination in the same semester. Most examinations can be repeated, if necessary, in each semester. ECTS credit points are awarded for the successful completion of all courses, laboratory exercises, internships and design projects. The overall grade awarded for a module depends on the credit points and grades achieved for the component courses. On completion of the degree, both the overall grade awarded and the grades for specialist fields are derived from the module grades.

Credit points

When a student passes an examination, ECTS credit points will be awarded in addition to a grade. It is intended that 1 credit point corresponds to 30 hours of study. To successfully complete the master's degree programme, 120 credit points are required.

Structure and content of the programme

The two key aspects of the programme's content are a theoretical education, which is provided by lectures and exercises, and practical training offered by experimental work, independent projects and internships.

If a student has already covered the content of individual obligatory courses as part of their bachelor's degree, it may be possible to substitute optional courses for these obligatory courses. Decisions regarding such substitutions will be taken on a case-by-case basis by the Examination Board in consultation with the relevant lecturers. Before a student is allowed to begin work on their six-month master's degree project and thesis, all remaining academic work must be completed and the student must have passed the preliminary examination *(Vorprüfung)*.

Grading

Credit points are available for all successfully completed courses, laboratory exercises, design projects and internships. If a module consists of several graded components, the overall grade awarded will be a weighted average of the individual grades, with the weighting proportional to the number of credit points available for each component. The overall grade for the degree programme will be a weighted

average of the module grades, with the weighting representing the available credit points in the same way.

Registration for course examinations

Registration for all examinations within the bachelor's and master's degree programmes takes place online. Registration periods will be announced in good time by the Examination Office, both online and on a notice board. The Examination Office publishes a list of candidates and passes this list on to the Institutes. Students must check the list to ensure that their examination registrations have been successful. Each student is free to decide which and how many examinations they wish to take in a given semester.

Withdrawal from an examination

Withdrawal from an examination for which a student has registered is possible until directly before the start of the examination. A student wishing to withdraw should speak to the relevant examiner directly.

If a student does not begin to take a particular examination, they will be automatically withdrawn by the Examination Office. Such students are not necessarily required to take the examination at a later date. However, once a student has taken an examination, they must pass this examination before completing their studies.

Examination failure

Within the programme, module examinations are assigned to various specialist fields. A module is considered to have been passed when all required credit points have been gained.

On average, a student must achieve 30 credit points per semester. At a minimum, 15 credit points much be achieved. If a student achieves fewer than 15 credit points in a semester, they are deemed to have failed the general examination. This can lead to expulsion from the University. On application, an academic hearing with representatives of the Examination Board may be granted. Further details can be obtained from the leaflet concerning the academic hearing process *(Anhörungsverfahren)*, or from the Teaching Office.

Continuous assessment

During the semester, certain assignments *(Teilprüfungen)* may be completed for credit. These can include homework, written tests and oral examinations. Participation is optional and the number of credit points available will be announced by the examiner at the start of the semester. In this case, the examination will consist of these assignments together with a final examination.

Student advice

A representative offering specialist student advice in mechatronics can be reached using the e-mail address mailbox@mec.uni-hannover.de.

Master of Science

International Mechatronics

	1. Semester / St. Petersburg (WiSe)	2. Semester / St. Petersburg (SuSe)	3. Semester / Hannover (WiSe)	4. Semester / Hannover (SuSe)
1	**Software Development Technology** (5 CP) Pass-fail test	**Scientific Discourse** (3 CP) Grading Test	**Compulsory elective courses, in total 15 CP** - Production of opto-electronic Systems (5CP) - Data- and Learning-Based Control (5CP) - Optical Measurement Technology (5 CP) - Engineering Dynamics and Vibrations (5CP) - Image sequence analysis (5CP) - Micro- and Nano Systems (5CP) - Fundamentals and Configuration of Laser Beam Sources (5CP) - Pow er Electronics (5CP) - Physics of ultrasound and its applications (5 CP) Written or Oral Examination	**Master`s Thesis** (30 CP)
2				
3				
4		**Knowledge Engineering and Knowledge Management** (4 CP) Written Examination		
5				
6	**History and Methodology of Science** (3 CP) Pass-fail Test			
7				
8		**Cognitive Multiagent Systems** (4 CP) Written Examination Course work		
9	**Foreign Language in Professional Activity** (4CP) Written Examination			
10				
11				
12		**High-level Synthesis and Modeling of Digital Devices** (4 CP) Pass-fail test Course project		
13	**Neuroinformatics and Neurotechnologies** (4CP) Written Examination Course work			
14				
15				
16		**Software Development Technology** (5 CP) Written Examination Course work	**Aspects of Process Design in Forming Technology** (5 CP) Written/Oral Examination	
17	**Methods of Optimisation and Decision Making Theory** (5 CP) Pass-fail Test			
18				
19				
20				
21		**Introduction Practice** (6 CP) Report	**Electrical Machines and Drives** (5 CP) Written/Oral Examination	
22	**Intelligent Systems** (5 CP) Written Examination			
23				
24				
25				
26			**Project Thesis based on scientific and research work** (5 CP)	
27	**Research Methods** (4 CP) Report	**Project Management** (4 CP) Report		
28				
29				
30				
31		**Corporate Information Systems** (4 CP) * Pass-fail test		
32				
33				
34				
LP	30	34	30	30
			Master complete	**124**

4 CP Scientific and research work will still be assigned to the 5 courses of the 3rd semester.

*** Additional, elective course (not obligatory)**

Modules and Courses

N.N. in the course lists indicates that the course will take place but that the lecturer is not yet known; the abbreviation means „nomen nominandum“ („the name is to be announced“). Courses with an asterisk (*) will always take place.

Modulname	**Aspects of Process Design in Forming Technology**
Modulname EN	Aspects of Process Design in Forming Technology

Verantw. Dozent/-	Behrens, Krimm			**Semester**	WiSe
Institut	Institut für Umformtechnik und Umformmaschinen			**ECTS**	5
Art	☑ **Pflicht** ☐ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	schriftlich
Präsenzstudienzeit	40	**Selbststudienzeit**	110	**Kursumfang**	V2/Ü1

Modulbeschreibung

This module provides an insight into the process of metal forming. Objectives: - Understanding of the basic principles for material characterisation and numerical simulation used for the analysis of forming processes

• Ability to apply digital design tools to solve problems related to forming technology.
Content: After an introduction into the fundamentals of forming technology, the development of forming processes, the computer aided design process and the finite element analysis will be addressed. Experimentally determined parameters build the input for these analyses. The forming process takes place by use of various forming machines and peripheral devices. Subsequently, process-integrated quality assurance methods will be presented.

Vorkenntnisse

keine

Literatur

Handbook of Metal Forming, Lange, K.; McGraw-Hill, New York, 1985. R.H. Wagoner, J.L. Chenot: Fundamentals of Metal Forming, John Wiley and Sons, Inc. 1997 T. Altan, G. Ngaile, and G. Shen: Cold and Hot Forging, Fundamentals and Applications, ASM International, 2005 Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter www.springer.com eine Gratis Online-Version.

Besonderheit

Vorlesungssprache: Englisch / Language of lectures: English

Modulname	**Bildsequenzanalyse**
Modulname EN	Image sequence analysis

Verantw. Dozent/-	Mehltretter			**Semester**	WiSe
Institut	Institut für Photogrammetrie und Geoinformation			**ECTS**	5
Art	☐ Pflicht ☑ Wahlpflich ☐ Wahl ☐ Studium generale / Tutor				
Vertiefungsrichtung				**Prüfungsform**	mündlich
Präsenzstudienzeit	56	**Selbststudienzeit**	94	**Kursumfang**	V2/Ü2

Modulbeschreibung

Aim of the course
The module teaches the extraction of information from image sequences with a focus on semantic aspects. A major topic is object detection and tracking, incl. motion models. As a basis for further Master's studies, the students should develop their analytical and transfer skills through exercises, also from current research projects.

Qualification goals
At the end of the course, students have a good insight into the goals, tasks and methods of image sequence analysis. They are able to evaluate monoscopic and stereoscopic image sequences with regard to 3D geometry and content and know the limits of the automatic methods used for this purpose. At the end of the course, students have exemplary detailed knowledge in individual areas, e.g. in the area of tracking-by-detection and data association.

Content
foreground/background separation,
optical flow and scene flow
object detection and tracking
motion models

Vorkenntnisse

Photogrammetric Computer Vision (from Institute of Photogrammetry and GeoInformation, IPI) or Computer Vision (from TNT)must have been successfully finished before this course can be taken.

Literatur

David A. Forsyth and Jean Ponce (2003). Computer Vision, A Modern Approach. Prentice Hall. Richard Hartley and Andrew Zisserman (2003). Multiple View Geometry in Computer Vision. Cambridge University Press. http://homepages.inf.ed.ac.uk/rbf/CVonline/motion.htm

Besonderheit

The course is taught in English

Modulname	**Electrical Machines and Drives**
Modulname EN	Electrical Maschines and Drives

Verantw. Dozent/-	Ebrahimi			**Semester**	WiSe
Institut	Institut für Antriebssysteme und Leistungselektroni k			**ECTS**	5
Art	☑ **Pflicht** ☐ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	schriftlich
Präsenzstudienzeit	60	**Selbststudienzeit**	90	**Kursumfang**	V2/Ü1/L1

Modulbeschreibung

Fundamental of electromagnetics, Maxwell equations, Biot-Savart Formulation, Faraday law of induction, Lorentz Force. Fundamental of electromechanical energy conversion.
Magnetic equivalent circuit for flux calculation in magnetic structures, magnetomotive force law, permanent magnet Materials, Ferromagnetic materials, non-linear BH-curves, Hysteresis and eddy current losses.
Permanent magnet DC motor, separately excited DC motor, series DC motors, Universal motors, equivalent circuits and load calculation, lap and wave winding, armature reaction.
Fundamentals of rotating field theory, three phase synchronous motor, permanent magnet synchronous motor, BLDC motors.
Basics of control of electrical machines, basics of power electronic devices, pulse width modulation, basics of gearing and mechanical components in mechatronic systems, basic of sensory systems.
Design of a mechatronic device, Biomechanical calculation, electromechanical drive calculation, selection of motor, gearing, battery, power electronics and sensory systems.

Vorkenntnisse

Basic knowledge of electrical engineering and electrical machines would be helpful.

Literatur

Stölting, Kallenbach, Amrhein: Handbook of Fractional-Horsepower Drives, Springer Verlag.
Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter www.springer.com eine Gratis Online-Version.

Besonderheit

Lecture will be teached in english. A course credit must be completed in the form of a lab.

Modulname	**Introduction to Mechanical Vibrations**
Modulname EN	Introduction to Mechanical Vibrations

Verantw. Dozent/-	Wangenheim			**Semester**	WiSe
Institut	Institut für Dynamik und Schwingungen			**ECTS**	5
Art	☐ **Pflicht** ☑ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	schriftlich
Präsenzstudienzeit	56	**Selbststudienzeit**	94	**Kursumfang**	V2/Ü2

Modulbeschreibung

Learning Objectives
In this module, we give an introduction into the linear vibrations of mechqanical systems. After successful participation, our students will be able to

- set up linearized equations of motion for single-degree-of-freedom (SDOF) systems
- characterize the properties of free vibrations by means of eigenvalues
- determine system responses for harmonic, periodic and transient excitation
- propose appropriate measures to improve the system's dynamical performance
- understand the properties of solutions of partial differential equations describing continuum vibrations

Content:

- Free and forced vibrations of single-degree-of-freedom (SDOF) systems
- SDOF systems with damping
- System response functions in frequency and time domain
- Periodic and transient excitation of SDOF systems
- Systems with two degrees of freedom
- Vibration absorbers and tuned mass dampers
- Introduction to systems with multiple degrees of freedom (MDOF)
- Vibrations of strings, rods, shafts and beams

Vorkenntnisse

Statics, Elastostatics, Kinematics, Kinetics (Technische Mechanik 1 - 3)

Literatur

Gross et al.: Engineering Mechanics 3. Dynamics. Springer Inman: Engineering Vibration. Prentice Hall Meirovitch: Fundamentals of Vibrations. McGraw-Hill Tong: Theory of Mechanical Vibration, Literary Licensing, LL

Besonderheit

Integrated course containing lecture (2h) and tutorials (2h). Contents equal to German course „Technische Mechanik 4 / Technische Schwingungslehre“ taught in summer term.

Modulname	**Masterarbeit**
Modulname EN	Master Thesis

Verantw. Dozent/-	Professorinnen und Professoren der Fakultät für M	**Semester**	Wi-/SoS
Institut	Diverse	**ECTS**	30
Art	☑ **Pflicht** ☐ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**		
Vertiefungsrichtung		**Prüfungsform**	schrift./münd.
Präsenzstudienzeit	**Selbststudienzeit**	**Kursumfang**	900h

Modulbeschreibung

Nach dem erfolgreichen Absolvieren des Moduls sind Studierende in der Lage an einer wissenschaftlichen Problemstellung aus den Themenfeldern des Master-Studiums mitzuarbeiten, Teilprobleme in bestehende Theorien einzuordnen und im Studium erlernte Methoden geeignete Methoden zu identifizieren. Sie können erreichte Ergebnisse wissenschaftlich formulieren und dabei übliche Zitierregeln und Recherchemethoden anwenden.

Durch die Teilnahme am Modul Masterarbeit üben Studierende gänginge Tätigkeiten von Ingenieurinnen und Ingenieuren aus, die in der Forschung, der Industrie oder dem Entrepreneurwesen tätig sind.

Vorkenntnisse

keine

Literatur

Diverse

Besonderheit

Zum Modul gehört das erfolgreiche Präsentieren der Abschlussarbeit (1 LP)

Modulname	**Micro- and Nanosystems**
Modulname EN	Micro- and Nanosystems

Verantw. Dozent/-	Wurz			**Semester**	WiSe
Institut	Institut für Mikroproduktionstechnik			**ECTS**	5
Art	☑ **Pflicht** ☐ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	schriftlich
Präsenzstudienzeit	32	**Selbststudienzeit**	118	**Kursumfang**	V2/Ü1

Modulbeschreibung

Students gain knowledge about the most important application areas of micro- and nano technology. A microtechnical system has the following components: micro sensor technology, micro actuating elements, microelectronics. Furthermore, the active principle and construction of micro components as well as requirements of system integration will be explained.

Nanosystems usually use quantum mechanical effects. An example will be the display of the employment of nanotechnology in various areas

Vorkenntnisse

Mikro- und Nanotechnolgie

Literatur

Vorlesungsskript; Hauptmann: Sensoren, Prinzipien und Anwendungen, Carl Hanser Verlag, München 1990; Tuller: Microactuators, Kluwer Academic Publishers, Norwell 1998.

Besonderheit

This lecture is given in English. In addition to a separate exam (4 credits), an online test will be conducted (1 credits). Both must be performed to pass the module. The grade is composed proportionate.

Modulname	**Optische Messtechnik**
Modulname EN	Optical Measurement Technology

Verantw. Dozent/-	Reithmeier			**Semester**	WiSe
Institut	Hannoversches Zentrum für Optische Technologie			**ECTS**	5
Art	☐ **Pflicht** ☑ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	schrift./münd.
Präsenzstudienzeit	58	**Selbststudienzeit**	92	**Kursumfang**	V2/Ü2

Modulbeschreibung

The lecture gives an overview on theory, methods and devices in optical metrology. At the beginning, fundamentals of optics and photonics such as ray and wave optics are revised, which are essential for the understanding of concepts in optical metrology. Focusing on metrology in research and industrial applications, the lecture covers optical methods for measurement of topography, distance, and deformation as well as fiber optical sensors, which include concepts such as interferometry, holography and confocal microscopy. In addition, semi-optical methods such as atomic force microscopy and near field microscopy are addressed and compared to non-optical methods, e.g., scanning electron microscopy. To gain an in-depth understanding of the concepts involved in optical metrology, all devices and optical setups are explained in detail including light sources, cameras, and optical elements.

Vorkenntnisse

Messtechnik I / Measurement Technology I

Literatur

Born, Wolf. Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light; Demtröder: Experimentalphysik; Saleh, Teich: Grundlagen der Photonik; Lauterborn, Kurz: Coherent Optics; Goodman: Introduction to Fourier Optics; Hugenschmidt: Lasermesstechnik; Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter www.springer.com eine Gratis Online-Version.

Besonderheit

Prüfung je nach Teilnehmerzahl: Einzelprüfung mündlich 20 Min. oder schriftlich 90 Min.

Modulname	**Physics of ultrasound and its applications**
Modulname EN	Physics of ultrasound and its applications

Verantw. Dozent/-	Twiefel, Long			**Semester**	WiSe
Institut	Institut für Dynamik und Schwingungen			**ECTS**	5
Art	☐ **Pflicht** ☑ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	mündlich
Präsenzstudienzeit	32	**Selbststudienzeit**	118	**Kursumfang**	V2/Ü1

Modulbeschreibung

This lecture is complementary to the lecture "Ultraschalltechnik für industrielle Produktion, Medizin- und Automobiltechnik" in the summer semester, both lectures can be attended independently of each other and therefore in any order. This lecture focuses on the effects that can be achieved by ultrasound and their various applications, while the summer lecture deals with the basics and methods of the generation of ultrasound.
Learning Objectives: Students will be capable of

- Naming and describing the different effects of ultrasound
- Judging where the application of ultrasound is helpful
- Estimating the impact of ultrasound utilizing the methods used in class
- Describing the necessary system design for the different applications and the ability to identify the operation principle of an unknown ultrasonic system

Contents
The lecture is structured in three main parts

- Effects of ultrasound on: contact mechanics (vibro-impacts); friction reduction; acoustoplastic effect; dynamic recrystallization and atomic diffusion; cavitation in fluids; levitation
- Applications of power ultrasonics: Ultrasonic cleaning (atomization, defoaming); Sonochemistry (mixing, agglomeration, etc.); Metal joining and welding (incl. additive manufacturing); Plastic joining and forming; Ultrasonic metal forming and machining; Ultrasonic motors and transformers (incl. filters); Sensing with ultrasound
- Hands-on-Experience in Ultasound and i

Vorkenntnisse

none

Literatur

Gallego-Juárez, J.A. and Graff, K.F.: Power ultrasonics: applications of high-intensity ultrasound. Elsevier. Heywang, W., Lubitz, K. and Wersing, W.: Piezoelectricity: evolution and future of a technology. Springer Science & Business Media.

Besonderheit

Weekly lecture: 90min and bi-weekly hands-on-lecture: 90min, Lecture will be given in English. Students should prepare protocols for the experiments, which will be included in the grading.

Modulname	**Power Electronics**
Modulname EN	Power Electronics

Verantw. Dozent/-	Friebe	**Semester**	WiSe
Institut	Institut für Antriebssysteme und Leistungselektroni k, EC, El, Mecah, u. Antr.	**ECTS**	5
Art	☐ Pflicht ☑ Wahlpflich ☐ Wahl ☐ Studium generale / Tutor		
Vertiefungsrichtung		**Prüfungsform**	mündlich
Präsenzstudienzeit	72 **Selbststudienzeit** 78	**Kursumfang**	V2/Ü2/L1

Modulbeschreibung

The lecture gives an introduction into the general topics of modern power electronics with a strong focus on the operation principle of power electronic circuits and their components. After participation the students will be able to explain the basic characteristics of power semiconductors, design passive components for typical applications and calculate and simulate converter stages. They will also be able to understand and characterize the interaction between one or multiple converters and the grid.

Vorkenntnisse

Power Electronics for high efficient energy conversion, Applications, Components, Line-commutated converter, dc/dc-Converter, dc/ac-Converter

Literatur

-Mohan, Undeland, Robbins: Power Electronics: Converters, Applications, and Design -Lutz, Schlangenotto, Scheuermann, De Donker: Semicondutor Power Devices -Van den Bossche, Valchev: Inductors and Transformers for Power Electronics

Besonderheit

Covered within “Energy Technologies” and “International Mechatronics.

Modulname	**Production of Optoelectronic Systems**
Modulname EN	Production of Optoelectronic Systems

Verantw. Dozent/-	Overmeyer			**Semester**	WiSe
Institut	Institut für Transport- und Automatisierungstechnik			**ECTS**	5
Art	☐ Pflicht ☑ Wahlpflich ☐ Wahl ☐ Studium generale / Tutor				
Vertiefungsrichtung				**Prüfungsform**	schriftlich
Präsenzstudienzeit	40	**Selbststudienzeit**	110	**Kursumfang**	L2/E2

Modulbeschreibung

Outcomes: This module gives basic knowledge about processes and devices that are used in production of semiconductor packages and microsystems. The main focus is on the back-end-process that means the process thins wafer dicing. After successful examination in this module the students are able to

- correctly use the terms optoelectronic system, wafer production, front end and back end and to give an overview of production processes of semiconductor packages
- explain the production processes beginning from crude material sand and to have an idea about process relevant parameters
- visualize different packaging techniques and explain the corresponding basics of physics
- choose and classify different package types for an application

Contents:

- Wafer production
- Mechanical Wafer treatment
- Mechanical connection methods (micro bonding, soldering, eutectic bonding)
- Electrical connection methods (wire bonding, flip chip bonding, TAB)
- Package types for semiconductors
- Testing and marking of packages
- Design and production of printed circuit boards
- Printed circuit board assembly and soldering techniques

Vorkenntnisse

Literatur

Lau, John H.: Low cost flip chip technologies : for DCA, WLCSP, and PBGA assemblies. McGraw-Hill, New York 2000. Pecht, Michael: Integrated circuit, hybrid, and multichip module package design guidelines : a focus on reliability. Wiley, New York 1994. Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter www.springer.com eine Gratis Online-Version.

Besonderheit

Modulname	**Scientific Research Work: Mechatronics Lessons**
Modulname EN	Scientific Research Work: Mechatronics Lessons

Verantw. Dozent/-	N.N.			**Semester**	Wi-/SoS
Institut	Institut für Mechatronische Systeme			**ECTS**	5
Art	☑ **Pflicht** ☐ **Wahlpflich** ☐ **Wahl** ☐ **Studium generale / Tutor**				
Vertiefungsrichtung				**Prüfungsform**	schrift./münd.
Präsenzstudienzeit	16	**Selbststudienzeit**	104	**Kursumfang**	Ü

Modulbeschreibung

The scientific and research work enables each student to practise research techniques, literature review, academic discussion, scientific writing and the practical application of specialist knowledge. After completion of the course, each student becomes familiar with a current research theme and assumes responsibility for a small project. The project is completed under guidance, with the student documenting the results in written form, giving a presentation and finally leading an academic discussion on the subject.

Vorkenntnisse

keine

Literatur

"Holman, J. P.: Experimental Methods for Engineers, Mcgraw-Hill Publ.Comp. Ackerson, L.G.: Literature Search Strategies for Interdisciplinary Research: A Sourcebook For Scientists and Engineers. Scarecrow Press."

Besonderheit

Keine