Module Catalogue for PO 2012

Study Guide for
International Mechatronics

Master of Science

academic year 15/16

Faculty of Mechanical Engineering
Faculty of Electrical Engineering and Computer Science
Study Guide

for

International Mechatronics

With the degree

• Master of Science

Winter Terms 2015/16
Dear Student,

You are holding the course and module catalogue for the M.Sc. International Mechatronics programme. This degree programme crosses two borders. Firstly, mechatronics is itself 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.

Secondly, the programme is offered as a co-operative venture between Leibniz Universität Hannover and Saint Petersburg State Polytechnical University. The first year is taught in Russia and the second year in Germany, allowing each student to experience two universities, two cultures and two countries. On successful completion of the programme, both German and Russian M.Sc. degrees are awarded. Graduates are therefore ideally qualified to work in global engineering and commerce.

After the first two semesters in Saint Petersburg, students progress to the second half of the programme in Hannover. 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. Please remember that the master's degree thesis must be presented and defended in both Saint Petersburg and Hanover. 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. D. Sc. V. Shkodyrev,
Control Systems and Technologies Department, St. Petersburg State Polytechnical University

Prof. Dr.-Ing. J. Wallaschek,
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 must 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.

Grade improvement

If a student passes the regular examination during the normal duration of study (Regelstudienzeit), they may take a supplementary examination (Ergänzungsprüfung) on request, with the intention of improving their grade. If they have failed the examination, they may also take the supplementary examination, but normally only if they have achieved at least 75% of the credit points required to pass the examination.

In this case, the grade awarded depends on both the grades achieved in the original examination and supplementary examination. The grade awarded in the supplementary examination counts for 33% of the eventual grade. The duration of the supplementary examination is determined by the number of candidates and number of credit points available: 5 minutes are allowed per candidate, per credit point. Students must submit their application for a supplementary examination to the relevant examiner. It is possible that a student’s overall grade may be worsened by the result of the supplementary examination.

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.
<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Credits</th>
<th>Instructor</th>
<th>Project Thesis</th>
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<tbody>
<tr>
<td>Winter 1</td>
<td>Software Development Technology</td>
<td>4</td>
<td>Malykhina</td>
<td></td>
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<tr>
<td>Winter 2</td>
<td>History and Methodology of Informatics and Computer Science</td>
<td>8.5</td>
<td>Kapralov</td>
<td></td>
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<tr>
<td>Summer</td>
<td>Machine Dynamics</td>
<td>4</td>
<td>Wallaschek</td>
<td></td>
</tr>
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<td>Winter 1</td>
<td>Neuroinformatics and Neurotechnologies</td>
<td>4</td>
<td>Shkodyrev</td>
<td></td>
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<td>Summer</td>
<td>Modern Problems of Computers and Information Science</td>
<td>3</td>
<td>Rodionova</td>
<td></td>
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<td>Winter 1</td>
<td>Methods of Optimization</td>
<td>4</td>
<td>Rodionova</td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>Intelligent Systems</td>
<td>5</td>
<td>Yarotskiy</td>
<td></td>
</tr>
<tr>
<td>Winter 1</td>
<td>Scientific and research work</td>
<td>6.5</td>
<td>Kudryavtsev</td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>Distributed Databases</td>
<td>4</td>
<td>Malykhina</td>
<td></td>
</tr>
<tr>
<td>Winter 1</td>
<td>Intelligent Computing</td>
<td>4</td>
<td>Potekhin</td>
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</tr>
<tr>
<td>Summer</td>
<td>Electrical Drives: Small Electric Motors and Servo Drives</td>
<td>4</td>
<td>Ponick</td>
<td></td>
</tr>
<tr>
<td>Winter 1</td>
<td>Scientific and research work</td>
<td>7</td>
<td>Kuchmin</td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>Project Thesis based on scientific and research work</td>
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**Credits:**
- 1 LP
- 2 LP
- 3 LP
- 4 LP
- 5 LP
- 6 LP
- 8.5 LP
- 6.5 LP
- 30 LP

**Instructors:**
- Malykhina
- Overmeyer
- Kapralov
- Wallaschek
- Shkodyrev
- Rodionova
- Yarotskiy
- Potekhin
- Kuchmin
- Ponick
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.
### Pflicht

<table>
<thead>
<tr>
<th>German name</th>
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<tbody>
<tr>
<td>Semester</td>
<td>SS</td>
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<tr>
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<tr>
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<td>1350</td>
</tr>
<tr>
<td>Responsible Professor</td>
<td>Shkodyrev</td>
</tr>
<tr>
<td>Contact</td>
<td>Viacheslav P. Shkodyrev</td>
</tr>
<tr>
<td>E-mail</td>
<td><a href="mailto:cst@icc.spbstu.ru">cst@icc.spbstu.ru</a></td>
</tr>
<tr>
<td>Telephone</td>
<td>+7 (812) 329-4790</td>
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</tbody>
</table>

**Description**
The first two terms in St. Petersburg teach advanced engineering techniques, methods of research and scientific writing skills.

### Lectures

#### Pflichtkurse

<table>
<thead>
<tr>
<th>No.</th>
<th>Lecture</th>
<th>Lecturer</th>
<th>WS/SS</th>
<th>Test</th>
<th>ECTS</th>
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<tr>
<td>Computing Systems</td>
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<td>Knowledge Management and Knowledge Engineering</td>
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<td>Mathematical Modelling and Simulation</td>
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<td>SS</td>
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<tr>
<td>Modern Problems of Computers and Information Science</td>
<td>Rodionova</td>
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<tr>
<td>Neuroinformatics and Neurotechnologies</td>
<td>Shkodyrev</td>
<td>WS</td>
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<tr>
<td>Scientific and Research Work</td>
<td>Shkodyrev</td>
<td>WS/SS</td>
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<td>8.5</td>
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<tr>
<td>Software Development Technology</td>
<td>Chernosvitov</td>
<td>WS</td>
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#### Wahlkurse

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<th>ECTS</th>
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<tr>
<td>Cognitive and Multiagent Systems</td>
<td>Kapralov</td>
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<td>Kapralov</td>
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</table>
After the first two semesters in Saint Petersburg, students progress to the second half of the programme in Hannover. 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.

### Obligatory Courses Hanover

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</tr>
<tr>
<td>Contact</td>
<td>Björn Niemann</td>
</tr>
<tr>
<td>E-mail</td>
<td><a href="mailto:mailbox@mec.uni-hannover.de">mailbox@mec.uni-hannover.de</a></td>
</tr>
<tr>
<td>Telephone</td>
<td>+49 (0) 511 762-2423</td>
</tr>
</tbody>
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### Description

After the first two semesters in Saint Petersburg, students progress to the second half of the programme in Hannover. 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.

### Lectures

<table>
<thead>
<tr>
<th>No.</th>
<th>Lecture</th>
<th>Lecturer</th>
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<th>Test</th>
<th>ECTS</th>
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<td>Pflichtkurse</td>
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<td></td>
<td>Electrical Drives: Small Electric Motors and Servo Drives</td>
<td>Stübig</td>
<td>WS</td>
<td>schriftl./mündl</td>
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<td>Engineering Dynamics and Vibration</td>
<td>Wallaschek</td>
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<td>Micro- and Nanosystems</td>
<td>Rissing</td>
<td>WS</td>
<td>mündlich</td>
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<td>Production of Optoelectronic Systems</td>
<td>Overmeyer</td>
<td>WS</td>
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<td>Scientific and Research Work: Student Research Thesis</td>
<td>Diverse Institute</td>
<td>WS</td>
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<td>6</td>
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<td></td>
<td>Scientific Research Work: Mechatronics Lessons</td>
<td>Ortmaier</td>
<td>WS</td>
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<td>Softwaretools: Aspects of Process Design in Forming Technology</td>
<td>Behrens</td>
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### Pflicht

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</table>

**Responsible Professor**

Overmeyer

**Contact**

Björn Niemann

**E-mail**

mailbox@mec.uni-hannover.de

**Telephone**

+49 (0)511 762-2423

**Description**

Students completing a master’s degree thesis work to address a current scientific problem in an international research environment. Each student writes their own project plan and conducts research independently. The scope of the project includes calculations, experiments, analysis and documentation. The project is concluded by writing the master’s degree thesis according to established standards and by leading a discussion of the results.

### Lectures

<table>
<thead>
<tr>
<th>No.</th>
<th>Lecture</th>
<th>Lecturer</th>
<th>WS/SS</th>
<th>Test</th>
<th>ECTS</th>
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<td></td>
<td>Master's Degree Thesis</td>
<td>Diverse Institute</td>
<td>SS</td>
<td>schriftl./mündl</td>
<td>30</td>
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### Pflichtkurse
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.

Qualification Profile legend:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Knowledge</td>
<td>Research and Problem-Solving</td>
<td>Methods of Planning</td>
<td>Methods of Evaluation</td>
<td>Personal and Social Skills</td>
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</table>
Cognitive and Multiagent Systems

Cognitive and Multiagent Systems

Lecturer: Kapralov
E-mail: kapralov@phtf.stu.neva.ru

Institute: St.Petersburg State Polytechnical University

Short summary:

Cognitive principles of the human nervous system: cognitive and effective systems; intelligence and knowledge structure, perception, decision-making, and execution; learning, self-learning, and self-organization; cognitive approach in intelligent systems.

Cognitive components: logical, neural, and neurological modules; cognitive information processing; learning and self-learning; building of various modules; pruning and growing structures; models and algorithms of processing and learning.

Applications of cognitive multi-agency systems: virtual teamwork games – soccer, basketball and so on; distributed industrial control systems; military strategic and tactic planning systems; humanoid robot and group robots control systems.

Skills:

<table>
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<tr>
<th>A</th>
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<th>C</th>
<th>D</th>
<th>E</th>
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<td>30 %</td>
</tr>
<tr>
<td>A1: 20 %</td>
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<td>C1: 20 %</td>
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<td>E1: 50 %</td>
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<td>C2: 10 %</td>
<td>D2: 10 %</td>
<td>E2: 10 %</td>
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<td>C3: 30 %</td>
<td>D3: 20 %</td>
<td>E3: 10 %</td>
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<tr>
<td>A4: 10 %</td>
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<td>C4: 20 %</td>
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<td>E4: 30 %</td>
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<td>B5: 10 %</td>
<td>C5: 20 %</td>
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</table>

Mandatory prior knowledge:

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Recommended background reading:

Barto A.G and Sutton R.S., Reinforcement Learning: An Introduction., The MIT Press, 1998;
I. Cloette and J.M. Zura

Distinctive features:

Lectures are interspersed with short seminars on fresh developments in the field cognitive science.
During semester students develop project of a multiagent system as a distributed artificial intelligence system. The course ends with a defense of a techno

| timetabled hours: 72h | Examination: schriftlich | length of time: 270 h |
| self-study hours: 198h | ECTS: 8.5 | Semester: SS |
Computing Systems

Lecturer: Potekhin
E-mail: cst@icc.spbstu.ru

Institute: St.Petersburg State Polytechnical University

ECTS: 5

Lecturer: Potekhin
E-mail: cst@icc.spbstu.ru

Institute: St.Petersburg State Polytechnical University

Short summary:
1. History and stages of evolution of computer engineering; classification of computer complexes and systems.
2. Designing of hardware and software for computing systems.
3. Planning of processes; levels, the purposes, criteria, parameters and algorithms of planning; cooperation of processes and the basic aspects of ist logic organization.
4. Hypermedia and system multimedia; the distributed databases and integration of resources with the distributed databases.
5. Software life cycle; technologies of working out of program complexes; technologies of an estimation of quality ON.
7. Technologies and means of e-learning; videoconferences; basic telecommunication systems; standards and communication protocols.

Skills:

A: 20 %  B: 30 %  C: 20 %  D: 20 %  E: 10 %
A1: 30 %  B1: 20 %  C1: 20 %  D1: 30 %  E1: 30 %
A2: 30 %  B2: 20 %  C2: 30 %  D2: 20 %  E2: 20 %
A3: 20 %  B3: 20 %  C3: 20 %  D3: 20 %  E3: 20 %
A4: 20 %  B4: 20 %  C4: 10 %  D4: 30 %  E4: 30 %
A5: 20 %  B5: 20 %  C5: 20 %

Mandatory prior knowledge:
---

Recommended background reading:

Distinctive features:
The assessment will be done by a course project and an examination.

Timetabled hours: 54h  Examination: schriftlich  Length of time: 150
Self-study hours: 96h  ECTS: 5  Semester: SS
Distributed Databases

Mandatory prior knowledge:

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Distinctive features:
The assessment will be done by a course project and an examination

<table>
<thead>
<tr>
<th>timetabled hours:</th>
<th>54h</th>
<th>Examination:</th>
<th>schriftlich</th>
<th>length of time:</th>
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Recommended background reading:

Skills:

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Mandatory prior knowledge:

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Institute:
St.Petersburg State Polytechnical University

E-mail: g_f_malychina@mail.ru

ECTS: 7

Lecturer: Malykhina

Stand: 09.09.2015

Short summary:
Electrical Drives: Small Electric Motors and Servo Drives

Small Electric Motors and Servo Drives

Lecturer: Stübig
E-mail: cornelia.stuebig@iwes.fraunhofer.de


Short summary:
This lecture gives a basic overview of electrical machine types with special emphasis on small motors and servo drives with an output power smaller than 1 kW. This includes knowledge on construction, in-service behaviour and control as well as application range and economic importance of these motors. The lecture is designed for developers of drive systems and for users of small electrical machines in order to support them in the choice of a motor in a specific case of operation.

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Mandatory prior knowledge:
Basic knowledge of electrical engineering and electrical machines would be helpful.

Recommended background reading:
Engineering Dynamics and Vibration

Students will learn the basics necessary for constructing and operating machines. Mathematical methods on the basis of mechanical models will be used.

**Skills:**

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**Mandatory prior knowledge:**

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**Recommended background reading:**


**Distinctive features:**

- timetabled hours: 32h
- self-study hours: 88h
- examination: schriftlich
- ECTS: 4
- length of time: V2/Ü1
- semester: WS
History and Methodology of Informatics and Computer Science

Mandatory prior knowledge:

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Recommended background reading:


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Mandatory prior knowledge:

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Short summary:

The course deals with modern directions of computer science history and development, such as history and evaluation of operating systems; events processing and threads control ability; history and the present state of relational and object-oriented databases; computer networking and client-server interaction.

• mathematical logic and the theory of algorithms;
• cybernetics and computer science;
• computer mathematics; numerical methods and analytical calculations;
• programming languages and technology development;
• computer graphics and multimedia systems.

Distinctive features:

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timetabled hours: 36h
self-study hours: 54h
Examination: schriftlich
ECTS: 2.5
length of time: 90 h
Semester:
Intelligent Computing

Lecturer: Kuchmin
E-mail: radiotelescope@yandex.ru

Institute: St.Petersburg State Polytechnical University

Short summary:
The objective of this course is to study the base aspects in the fields of modern computer science, computational intelligence, software and hardware of intellectual systems. During this course students will: learn main technologies, approaches and methods of computational intelligence; learn modern aspects in software and hardware of intellectual systems; implement modern aspects of intellectual computing, and implement neuro-processors and fuzzyprocessors for solving variable applied tasks.

Main topics: Robotics systems; Fuzzy Logic; Preprocessing; Adaptive Resonance Theory; Expert System; Artificial Immune Systems; DNA-computing; Swarm Intelligence; Hybrid Systems; Evolutionary Computation; Intellectual Hardware; Intellectual Software.

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Mandatory prior knowledge:

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Recommended background reading:

Konar, Computational Intelligence, Springer Berlin Heidelberg 2004;

Distinctive features:
The Assessment is done by a course project and an examination

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timetabled hours: 54h
self-study hours: 156h
Intelligent Control Systems


Skills:

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Mandatory prior knowledge: ---

Recommended background reading:

Distinctive features: ---
timetabled hours: 72h  Examination: schriftlich
self-study hours: 198h  ECTS: 8,5
length of time:  Semester: SS
Intelligent Systems

The purpose of the course is to prepare the student for practical activities in the field of creation, introduction and operation of intellectual systems. The goals of this course are to acquaint the student with brief history of becoming and development of artificial intellect (AI); to consider technical statements of the primary goals solved by systems of artificial intellect; to acquaint with modern areas of research on an artificial intellect; to acquaint with the basic models of representation of knowledge in intellectual systems; to consider theoretical and some practical questions of creation and operation of expert systems.

1. The theoretical problems solved by AI.
2. Practical application areas of AI methods.
3. Logic.
4. Production rules.
5. Languages of the description production models Prolog and Lisp.

Skills:

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Mandatory prior knowledge:
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Recommended background reading:
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Distinctive features:
The assessment will be done by an examination.

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<td>Semester:</td>
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Knowledge Management and Knowledge Engineering

Knowledge Management and Knowledge Engineering

Lecturer: Kudryavtsev
E-mail: dmitry.ku@gmail.com

Institute: St. Petersburg State Polytechnical University

Short summary:
The course will introduce the underlying theme of the new degree, methodological data and knowledge processing. Knowledge engineering will be defined as an information structuring methodology for different domains. Characteristics of knowledge engineering include the principles, practices, issues, methods, techniques and programs involved with the knowledge elicitation, structuring and formalizing.  
1. Elicit, structure and formalize knowledge acquired from different sources
2. Think creatively about and understand the strategic role of knowledge acquisition techniques in information processing and the role of information analysts in this area
3. Contribute to increasing the creativity and productivity of information processing and working with different information.

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Mandatory prior knowledge:
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Recommended background reading:
M., Vincent: The Kno

Distinctive features:
Use popular scientific and business software (Mind Manager, Cmap Tool, K-vision, etc.) for knowledge structuring and knowledge base development.

| timetabled hours: | 54h | Examination: | schriftlich | length of time: | 210 h |
| self-study hours: | 156h | ECTS: | 6.5 | Semester: | WS |
Master's Degree Thesis

Mandatory prior knowledge:
The Master's Thesis can only be started once all other exams have been passed and 90 ECTS-CP have been achieved.

Distinctive features:
Can be started any time, requires a written thesis and an oral defence to pass.

Recommended background reading:

Skills:

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Mandatory prior knowledge:
The Master's Thesis can only be started once all other exams have been passed and 90 ECTS-CP have been achieved.

Exam:
schriftl./mündl.

ECTS:
30

Length of time:
900 h

Semester:
SS
Mathematical Modelling and Simulation

Short summary:
1. Mathematical modelling is the basis of investigation and designing of complex and dynamic real-world systems.
3. Changes in traditional designing technologies due to computers application for modelling and
4. Simulation of complex systems.
5. Fundamental importance of changes.
7. Computer modeling as the basis for computer designing technologies

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Mandatory prior knowledge:
Software Development Technology, Modern Problems of Informatics and Computer Science

Recommended background reading:

Distinctive features:
The assessment will be done by coursework and examination.

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Stand: 09.09.2015
Methods of Optimization

The main objective of the course is to display basic concepts of the optimization theory and numerical methods of solving extremal problems. The course provides profound knowledge of numerical optimization techniques and demonstrates examples of technical and economic applications.

1. Mathematical programming: theory and applications;
2. Data analysis and decision making problems;
3. Decision making under uncertainty;
4. Optimal control theory and numerical methods;
5. Applications of ANN and GA in the problems of optimization

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A4: 20 %  B4: 30 %  C4: 30 %  D4: 20 %  E4: 30 %
B5: 20 %  C5: 20 %
Micro- and Nanosystems

Short summary:
Students gain knowledge about the most important application areas of micro- and nanotechnology. 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.

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Mandatory prior knowledge:
Micro- and Nanotechnology

Recommended background reading:
Modern Problems of Computers and Information Science

Modern Problems of Informatics and Computer Science

Lecturer: Rodionova
E-mail: e_a_rodion@mail.ru

Institute: St.Petersburg State Polytechnical University

Short summary:
The main objective of the course is to display fundamental concepts and new achievements of informational technologies and resources and their applications in different fields of human activity. The course provides the profound knowledge of modern optimization techniques playing an increasingly important role in controlling and planning, system analysis, designing, industrial automation, communications and management science.
2. Choose and investigate corresponding optimization algorithm.
3. Construct optimization analysis program to select the best decision.
4. Construct technical report and provide data analysis of optimal project.
5. Use popular scientific software (Matlab, MathCAD, GeneHunter, etc.) for optimization analysis and modeling.

Skills:

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Mandatory prior knowledge:

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Recommended background reading:
Jang J.S.: ANF

Distinctive features:

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timetabled hours: 54h
self-study hours: 66h
ECTS: 4
Examination: schriftlich
length of time: V2/Ü2
Semester: WS
Neuroinformatics and Neurotechnologies

The objectives of the course are to provide an evaluation of new computation paradigms of artificial intelligence and brain-like computing intelligence for a large class of intellectual ill-formalising tasks solution; to develop an understanding of a new mathematical theory of self-organizing & adaptive machine learning algorithms via artificial neural networks paradigms; to gain experience of the main requirements:

2. Perceptron and threshold logic classification.
4. Laboratory training with the fulfillment of a set of exercises. The use of LabView graphical programming system for real experiments and modelling problems solution.

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Mandatory prior knowledge:

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Recommended background reading:


Distinctive features:

The assessment will be done by an examination course project.
Production of Optoelectronic Systems

Produktion elektronischer Systeme

Lecturer: Overmeyer
E-mail: ita@ita.uni-hannover.de

Institute: Institut für Transport- und Automatisierungstechnik

Short summary:

Students have gained knowledge about product manufacturing techniques of semiconductor components and Microsystems. The focus is on the back-end-process, the production and cutting of wafers. Techniques like the machining of wafers, bonding (die-, wire-, flip-chip-), Burn-In and encasing of components with special consideration of optoelectronical components will be taught. Furthermore, application-specific assembly techniques as well as methods for integrating electronical and microtechnological systems will be dealt with.

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B5: 0 %  C5: 10 %

Mandatory prior knowledge:

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Recommended background reading:


Distinctive features:

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timetabled hours: 32h  Examination: mündlich  length of time: V2/Ü2
self-study hours: 88h  ECTS: 4  Semester: WS
Scientific and Research Work

Wissenschaftliches Arbeiten und Recherche

Lecturer: Shkodyrev
E-mail: cst@icc.spbstu.ru
Institute: St. Petersburg State Polytechnical University

Short summary:
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.

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Mandatory prior knowledge:

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Recommended background reading:


Distinctive features:

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timetabled hours: 0h  Examination: ---  length of time: 300 h
self-study hours: 300h  ECTS: 8.5  Semester: WS/SS
Scientific and Research Work: Student Research Thesis

Short summary:
The student research thesis serves as preparation for the master's degree thesis. It enables each student to practise research techniques, literature review, academic discussion, scientific writing and the practical application of specialist knowledge. To this end, 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.

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Mandatory prior knowledge:

Recommended background reading:

Distinctive features:
The Study Thesis shall be written during third term.

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Scientific Research Work: Mechatronics Lessons

Lecturer: Ortmaier
E-mail: lehre@imes.uni-hannover.de
Institute: Institut für Mechatronische Systeme

Short summary:
Students will apply the knowledge they gained in preceding lectures and practical courses. The mechatronics lessons consist of experiments in the fields of electrical and mechanical engineering. Students have to carry out the experiments autonomously. Those experiments are supervised by various institutes.

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Mandatory prior knowledge:
Basic knowledge of electrical, mechanical and control engineering

Recommended background reading:
Lecture notes

Distinctive features:
All participants have to prepare the basics and instructions necessary for the practical execution of the experiments with the help of the lecture notes in advance of each lesson. For each experiment a written lab report has to be provided by the students.

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Software Development Technology

Software Development Technology

Lecturer: Chernosvitov
E-mail: ris@imop.spbstu.ru

Institute: St. Petersburg State Polytechnical University

Short summary:
The course develops skills of using the object-oriented approach in applications programming on the basis of classes library usage:.NET Framework Classes on a platform.NET CLR; shared languages C#, C++ and Visual Basic 7.0.
1. New ways of building Windows-based applications and Web applications.
2. New approaches based on the principle of the Windows operating system fundamentals.
3. Message handling mechanisms.
4. The structure of a standard Windows application based on API elements: functions, macro extensions, messages, interfaces.

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Mandatory prior knowledge:
Methods of Optimization, Neuroinformatics and Neurotechnologies

Recommended background reading:
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Distinctive features:
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timetabled hours: 36h  Examination: schriftlich  length of time: V2/Ü1
self-study hours: 84h  ECTS: 4  Semester: WS
Software tools: Aspects of Process Design in Forming Technology

Aspects of Process Design in Forming Technology

Lecturer: Behrens
E-mail: peshekhodov@ifum.uni-hannover.de
Institute: Institut für Umformtechnik und Umformmaschinen

Short summary: After an introduction into the fundamentals of metal forming technology, the development and production process of non-cutting formed products will be addressed on selected milestones. The path leads initially to the computer aided design process, before design is tested by finite element analysis. Experimentally determined parameters build the input for these analyses. The forming process takes place by use of various forming machines and peripheral devices. Examples will be given how mechatronic systems are integrated in such technical environment and which questions arise from this connection. Closing, process-integrated quality assurance methods will be presented.

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Mandatory prior knowledge:
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Recommended background reading:
T. Altan, G. Ngaile, and G. Shen: Cold and Hot Forging, Fundamentals and Applications, ASM Intern

Distinctive features:
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stand: 09.09.2015
Contacts
Specific Offices
International Mechatronics Master

Course Guidance
Björn Niemann
Institut für Transport- und Automatisierungstechnik
An der Universität 2
30823 Garbsen
Phone: +49 (0)511 762-2423
E-mail: mailbox@mec.uni-hannover.de

Office Hours
Tuesday: 14:30 – 16:15 Uhr

Student Representatives Mechatronics
Fachschaftsrat Mechatronik
Office
Callinstraße 34
Postal Address
Appelstraße 9 A
30167 Hannover
Electronic Contact
http://www.fmec.uni-hannover.de/kontakt.html

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Prof. Dr.-Ing. P. Nyhuis
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Jens Lübkemann, M. Sc.
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Phone: +49 (0)511 762-4279
Fax.: +49 (0)511 762-3814
E-mail: pa@maschinenbau.uni-hannover.de

Office Hours
Tuesday – Thursday: 9:00 – 10:00 Uhr
Consultation by phone:
Tuesday + Thursday: 9:00 – 16:00 Uhr

Dean of Teaching
Prof. Dr.-Ing. J. Wallaschek

Secretariat
Ms G. Schnaidt
Im Moore 11 B
30167 Hannover
Phone: +49 (0)511 762-4165
Fax: +49 (0)511 762-2763
E-mail: studiendekan@maschinenbau.uni-hannover.de

Office Hours
Monday – Thursday: 9:00 – 11:30 Uhr
and by appointment

Central Offices
Leibniz Universität Hannover

ServiceCenter
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30167 Hannover
Phone: +49 (0)511 762-2020 (hotline)
Fax: +49 (0)511 762-19385
E-mail: studium@uni-hannover.de
http://www.uni-hannover.de/servicecenter/

Office hours
Monday – Thursday: 10:00 – 17:00 Uhr
Friday: 10:00 – 15:00 Uhr

Admissions (I-Amt)
Welfengarten 1
30167 Hannover
Phone: +49 (0)511 762-2020 (hotline)
E-mail: studium@uni-hannover.de
http://www.uni-hannover.de/i-amt

Sprechstunde (in ServiceCenter)
Monday – Thursday: 10:00 – 17:00 Uhr
Friday: 10:00 – 15:00 Uhr
International Office
Wilhelm-Grunwald-Haus
Welfengarten 1 A
30167 Hannover
Phone: +49 (0)511 762-2548
Phone: +49 (0)511 762-2020 (hotline)
Fax: +49 (0)511 762-4090
E-mail: internationaloffice@uni-hannover.de
http://www.international.uni-hannover.de/

General office hours
Monday – Thursday: 10:00 – 12:00 Uhr
Tuesday + Thursday: 14:00 – 16:00 Uhr

Advisory and support for foreign students (taking place in ServiceCenter)
Support for international Students, ISEP
Monday + Wednesday: 10:00 – 13:00 Uhr

Accommodation Advice
Wednesday + Thursday: 16:00 – 17:00 Uhr

ERASMUS Incomings, Exchange Students
Thursday: 11:00 – 13:00 Uhr

Events and field trips
Tuesday: 14:00 – 16:00 Uhr
Thursday: 13:00 – 14:00 Uhr

Student Advisory Service (ZSB)
Welfengarten 1 (central campus)
30167 Hannover
Phone: +49 (0)511 762-2020 (hotline)
Fax +49 (0)511 762-5504
E-mail: studienberatung@uni-hannover.de
http://www.zsb.uni-hannover.de/

One-to-one consulting
only by appointment from +49 (0)511 762-2020

Brief consultation
(Infothek, max. 10 minutes)
Monday – Friday: 10:00 – 14:00 Uhr

Open consultation
(Sign up at ServiceCenter)
Thursday: 14:00 – 17:00 Uhr

During summer terms (01.06.-15.07.), there is an additional open consultation at
Tuesday: 10:00 – 12:00 Uhr

Infothek (handouts and literature)
Monday – Thursday: 9:00 – 17:00 Uhr
Fr: 9:00 – 15:00 Uhr

Advisory by phone
Monday – Thursday: 9:00 – 17:00 Uhr
Fr: 9:00 – 15:00 Uhr

Examination Office
Welfengarten 1
30167 Hannover
Phone: +49 (0)511 762-2020 (hotline)
Fax: +49 (0)511 762-2137
E-mail: studium@uni-hannover.de
www.uni-hannover.de/pruefungsamt

Contact: Ms Kerstin Gries
E-mail: kerstin.gries@zuv.uni-hannover.de

Office hours
Monday – Thursday: 10:00 – 12:00 Uhr
Thursday: 14:00 – 16:00 Uhr

Telephone Enquiries
Monday – Thursday: 9:00 – 17:00 Uhr
Fr: 9:00 – 15:00 Uhr
Institutes and Professors for Faculty of Mechanical Engineering

<table>
<thead>
<tr>
<th>Institute</th>
<th>Professor</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Email</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institut für Dynamik und Schwingungen</td>
<td>Prof. Dr.-Ing. J. Wallaschek</td>
<td>Appelstraße 11, 30167 Hannover</td>
<td>+49 (0)511 762-4161</td>
<td>+49(0)511 762-4164</td>
<td><a href="mailto:office@ids.uni-hannover.de">office@ids.uni-hannover.de</a></td>
<td><a href="http://www.ids.uni-hannover.de">www.ids.uni-hannover.de</a></td>
</tr>
<tr>
<td>Institut für Fabrikanlagen und Logistik</td>
<td>Prof. Dr.-Ing. habil. P. Nyhuis</td>
<td>Produktionstechnisches Zentrum Hannover, An der Universität 2, 30823 Garbsen</td>
<td>+49 (0)511 762-2440</td>
<td>+49 (0)511 762-3814</td>
<td><a href="mailto:office@ifa.uni-hannover.de">office@ifa.uni-hannover.de</a></td>
<td><a href="http://www.ifa.uni-hannover.de">www.ifa.uni-hannover.de</a></td>
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<tr>
<td>Institut für Fertigungstechnik und Werkzeugmaschinen</td>
<td>Prof. Dr.-Ing. habil. L. Schulze</td>
<td>Fachgebiet Planung und Steuerung von Lager- und Transportsystemen, Callinstraße 36, 30167 Hannover</td>
<td>+49 (0)511 762-4885</td>
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<td><a href="mailto:schulze@pslt.uni-hannover.de">schulze@pslt.uni-hannover.de</a></td>
<td><a href="http://www.pslt.uni-hannover.de">www.pslt.uni-hannover.de</a></td>
</tr>
<tr>
<td>Institut für Produktentwicklung und Gerätebau</td>
<td>Prof. Dr.-Ing. R. Lachmayer</td>
<td>Welfengarten 1 A, 30167 Hannover</td>
<td>+49 (0)511 762-3472</td>
<td>+49 (0)511 762-4506</td>
<td><a href="mailto:ipeg@ipeg.uni-hannover.de">ipeg@ipeg.uni-hannover.de</a></td>
<td><a href="http://www.ipeg.uni-hannover.de">www.ipeg.uni-hannover.de</a></td>
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<tr>
<td>Institut für Kontinuumsmechanik</td>
<td>Prof. Dr.-Ing. P. Wriggers</td>
<td>Appelstraße 11, 30167 Hannover</td>
<td>Phone: +49 (0)511 762-3220</td>
<td>Fax: +49 (0)511 762-5496</td>
<td>E-mail: <a href="mailto:Sekretariat@ikm.uni-hannover.de">Sekretariat@ikm.uni-hannover.de</a></td>
<td><a href="http://www.ikm.uni-hannover.de">www.ikm.uni-hannover.de</a></td>
</tr>
<tr>
<td>Institut für Kraftwerkstechnik und Wärmeübertragung</td>
<td>Prof. Dr.-Ing. R. Scharf</td>
<td>Callinstraße 36, 30167 Hannover</td>
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<td><a href="mailto:sekretariat@ikw.uni-hannover.de">sekretariat@ikw.uni-hannover.de</a></td>
<td><a href="http://www.ikw.uni-hannover.de">www.ikw.uni-hannover.de</a></td>
</tr>
<tr>
<td>Institut für Maschinenkonstruktion und Tribologie</td>
<td>Prof. Dr.-Ing. G. Poll</td>
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<td>Phone: +49 (0)511 762-2496</td>
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<td><a href="http://www.imkt.uni-hannover.de">www.imkt.uni-hannover.de</a></td>
</tr>
<tr>
<td>Institut für Mechatronische Systeme</td>
<td>Prof. Dr.-Ing. T. Ortmaier</td>
<td>Appelstraße 11 A, 30167 Hannover</td>
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Institut für Mehrphasenprozesse

Prof. Dr.-Ing. B. Glasmacher
Callinstraße 36
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Phone: +49 (0)511 762-3828
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Institut für Thermodynamik

Prof. Dr.-Ing. S. Kabelac
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Institut für Transport- und Automatisierungstechnik

Prof. Dr.-Ing. L. Overmeyer
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Institut für Turbomaschinen und Fluidodynamik

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Institut für Umformtechnik und Umformmaschinen

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### Institutes und Professors Faculty of Electrical Engineering and Computer Sciences

#### Bereich Elektrotechnik

**Institut für Antriebsysteme und Leistungselektronik**
- Fachgebiet Leistungselektronik u. Antriebsregelung
  - Prof. A. Mertens
- Fachgebiet El. Maschinen u. Antriebssysteme
  - Prof. B. Ponick

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**Institut für Elektroprozesstechnik**
- Prof. E. Baake
- Prof. B. Nacke

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Fax: +49 (0)511 762-3275
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http://www.etp.uni-hannover.de/

**Institut für Grundlagen der Elektrotechnik und Messtechnik**
- Fachgebiet Sensorik
  - Prof. S. Zimmermann
- Fachgebiet Elektromagnetische Verträglichkeit
  - Prof. H. Garbe

**Institut für Energieversorgung und Hochspannungstechnik**
- Fachgebiet Elektrische Energieversorgung
  - Prof. L. Hofmann

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(Schering Institut)
- Prof. E. Gockenbach

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E-mail: schering@si.uni-hannover.de
http://www.si.uni-hannover.de/

**Institut für Materialien und Bauelemente der Elektronik**
- Fachgebiet Bauelemente der Mikro- u. Nanoelektronik
  - Prof. K. R. Hofmann
Fachgebiet Materialien der Mikro- und Nano-
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Bereich Informatik

Institut für Mensch-Maschine-Kommunikation
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Institut für Praktische Informatik
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Fachgebiet Programmiersprachen und Übersetzer
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Fachgebiet Software Engineering
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http://www.se.uni-hannover.de/

Institut für System Engineering
Fachgebiet Echtzeitsysteme
Prof. B. Wagner
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Fachgebiet Simulation
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Profp. Ch. Müller-Schloer
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http://www.thi.uni-hannover.de/

Institut für Verteilte Systeme
Fachgebiet Distributed Virtual Reality
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Phone: +49 (0)511 762-3978
Fax: +49 (0)511 762-3170
E-mail: vonvoigt@rrzn.uni-hannover.de
http://www.rrzn.uni-hannover.de/ful.html
Fachgebiet Wissensbasierte Systeme
Profp. W. Nejdl

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30167 Hannover
Phone: +49 (0)511 762-19711
Fax: +49 (0)511 762-19712
E-mail: vanagen@kbs.uni-hannover.de
http://www.kbs.uni-hannover.de/

Bereich Informationstechnik

Institut für Hochfrequenztechnik und Funksysteme
Profp. H. Blume
Appelstraße 9 A
30167 Hannover
Phone: +49 (0)511 762-5269
Fax: +49 (0)511 762-4010
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Institut für Informationsverarbeitung
Fachgebiet Multimedia Signalverarbeitung
Profp. J. Ostermann
Fachgebiet Automatische Bildinterpretation
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Fachgebiet Übertragungssysteme
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Jun.-Profp. P. Papadimitriou, PhD
Fachgebiet Nachrichtenübertragungssysteme
Profp. J. Peissig
Institut für Mikroelektronische Systeme
Fachgebiet Architekturen und Systeme
Prof. H. Blume

Fachgebiet Entwurfsautomatisierung
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E-mail: blume@ims.uni-hannover.de
http://www.ims.uni-hannover.de/
<table>
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<tr>
<th>Affiliated Institutes</th>
<th>Laser Zentrum Hannover e.V. (LZH)</th>
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<tr>
<td>Hannoversches Zentrum für Optische Technologien (HOT)</td>
<td>Leibniz Universität Hannover</td>
</tr>
<tr>
<td>Nienburger Straße 17, 30167 Hannover</td>
<td>Sprecher des Vorstands</td>
</tr>
<tr>
<td>Phone: +49 (0)511 762-17908</td>
<td>Prof. Dr. Wolfgang Ertmer</td>
</tr>
<tr>
<td>Fax: +49 (0)511 762-17909</td>
<td>Hollerithallee 8, 30419 Hannover</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:info@hot.uni-hannover.de">info@hot.uni-hannover.de</a></td>
<td>Telefon: +49 (0)511 27 88-0</td>
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<tr>
<td><a href="http://www.hot.uni-hannover.de">www.hot.uni-hannover.de</a></td>
<td>Fax: +49 (0)511 27 88-100</td>
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<tr>
<td></td>
<td>E-mail: <a href="mailto:info@lzh.de">info@lzh.de</a></td>
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<td><strong>Institut für Integrierte Produktion Hannover</strong></td>
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<td>gGmbH (IPH)</td>
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<td><strong>Geschäftsführung</strong></td>
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<td></td>
<td>Prof. Dr.-Ing. B.-A. Behrens</td>
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<td></td>
<td>Dr.-Ing. Georg Ullmann</td>
</tr>
<tr>
<td>Hollerithallee 6, 30419 Hannover</td>
<td>Phone: +49 (0)511 762-4464</td>
</tr>
<tr>
<td>Phone: +49 (0)511 27976-0</td>
<td>Fax: +49 (0)511 762-4536</td>
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<tr>
<td>Fax: +49 (0)511 27976-888</td>
<td>E-mail: <a href="mailto:mailbox@mzh.uni-hannover.de">mailbox@mzh.uni-hannover.de</a></td>
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<td><strong>Sprecher des Vorstands</strong></td>
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<td>Prof. Dr.-Ing. B. Ponick</td>
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<td></td>
<td>Phone: +49 (0)511 762-2571</td>
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<td></td>
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<td><a href="http://www.mzh.uni-hannover.de">www.mzh.uni-hannover.de</a></td>
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<td><strong>Zentrum für Biomedizintechnik (zbm) der Leibniz</strong></td>
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<td>Universität Hannover</td>
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<td><strong>Sprecherin des Vorstandes</strong></td>
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<td></td>
<td>Prof. Dr.-Ing. B. Glasmacher</td>
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<tr>
<td></td>
<td><strong>Geschäftsführer:</strong></td>
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<tr>
<td></td>
<td>Dipl.-Ing. G. Hohenhoff, M.Sc.</td>
</tr>
<tr>
<td></td>
<td>Callinstraße 36, 30167 Hannover</td>
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<tr>
<td></td>
<td>Phone: +49 (0)511 762-2786</td>
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<td></td>
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<td><a href="http://www.zbm.uni-hannover.de">www.zbm.uni-hannover.de</a></td>
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