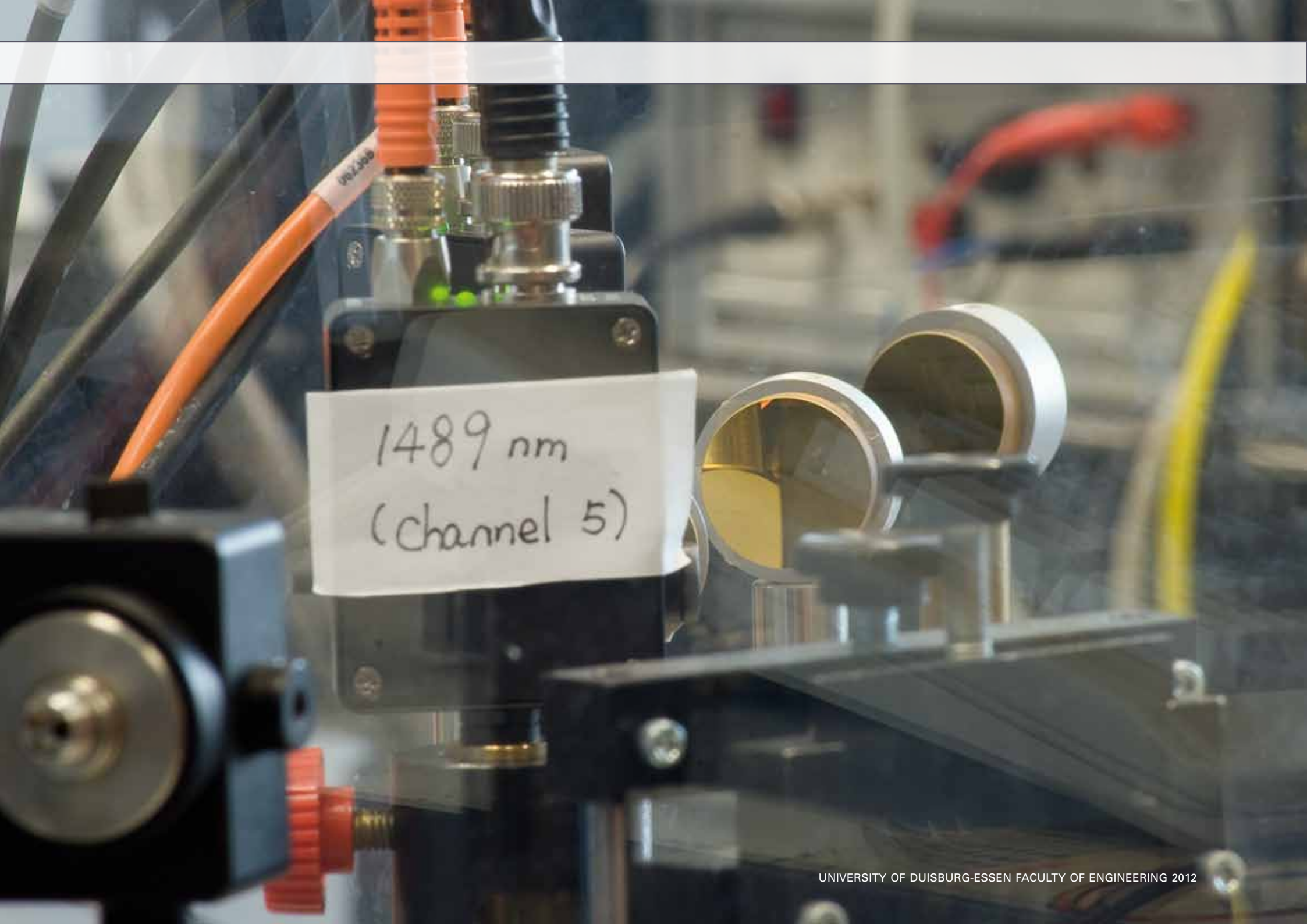
UNIVERSITÄT
DUISBURG
ESSEN

FACULTY OF
ENGINEERING

COURSES
RESEARCH
APPLICATIONS

FACULTY OF ENGINEERING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WELCOME NOTE FROM THE DEAN

Dear Reader,

It is with great pleasure and anticipation that I welcome you to the Faculty of Engineering of the University of Duisburg-Essen. The current University was established in 1972, and in 2003 was merged with the University of Essen so as to combine the strengths of both locations and offer more specialized education with a wider range of research and learning options. In this brochure, we will seek to give you a succinct but thorough overview of the variety of options that you can look forward to at Duisburg-Essen.

The structure of the faculty thus attempts to provide an exemplary platform of study in fundamental, advanced and applied theories and research. The facilities and guidance offered in each of the four departments are renowned for their impeccable conformity with the highest international standards. One of the largest faculties in Germany, we have the distinction of comprising about 80 Institutes and over 7500 students. Both locations of study, in Duisburg and in Essen, provide extremely modern and consistently upgraded facilities and a serene, inviting work atmosphere for both teachers and students.

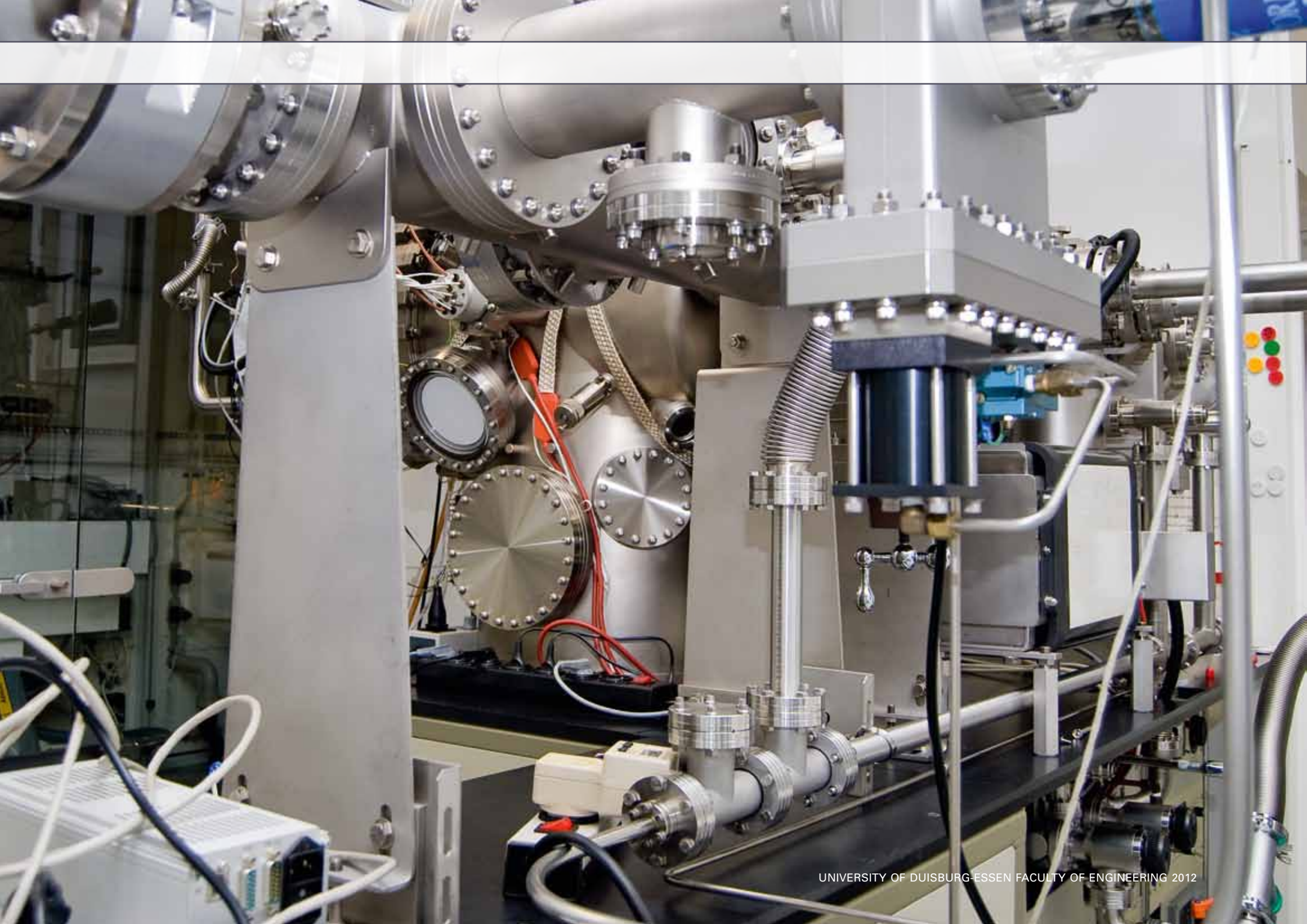
Students have the invaluable opportunity to be flexible and experimental in their studies, as the course structure of the faculty allows students to take up single, multi- and inter-disciplinary degree courses that facilitates attainment of skill sets across a multi-disciplinary framework and of specialized qualifications.

The faculty offers opportunities for research and study in key areas of engineering. It has also always placed great importance on the practical relevance of the theory being imparted. Accordingly, high standards of teaching have been rigorously maintained, and the faculty has a close knit, symbiotic network with the six associated and cooperation institutes and a number of industrial partners. These partnerships are so engineered so as to enable the quick and ready transfer of our highly respected research results into projects and commercial realizations.

Consistent with our objectives of providing not only a very high standard of education but one that can be universally applicable, the composition of the faculty in the University of Duisburg-Essen has been extensively reviewed to offer the best available resources for visiting and international students. The system of study and learning is also in conformity with internationally accepted and recognized standards, the faculty having been among the very first in Germany to convert to a system of conferral of degrees of Bachelors and Masters respectively. The International Studies in Engineering Program (ISE) is tailor-made for international students with extensive lectures in English. And for our German students we have in place an institutionalized mechanism of support for those wishing to study abroad at our foreign partner Universities. Located in the heart of the metropolitan and culturally diverse Ruhr region, the industrial powerhouse of the country, the University is uniquely situated to offer opportunities of interaction with industrial giants doing path-breaking work in engineering. I invite you, through this brochure, to inform yourself adequately of the exciting world of opportunity that the Faculty of Engineering of the University of Duisburg-Essen has to offer, to know more about our Professors, the fields of study and research in our Departments and the facilities that await you here.

D. Schramm

Dieter Schramm (Dean)



WELCOME TO THE UNIVERSITY OF DUISBURG-ESSEN

AND … WELCOME TO ONE OF GERMANY'S LEADING ENGINEERING UNIVERSITIES.

The profile of the University of Duisburg-Essen is unique – at no other university in Germany will you find engineering sciences working so closely together. Five departments teach and research under one roof: Mechanical Engineering, Electrical Engineering & Information Technology, Computational & Cognitive Sciences, Materials Technology, and Civil Engineering. The result is a synergy that cuts across disciplines, with nine major research strongholds and a hotbed of cross-project initiatives.

WE LIKE TO STIR THINGS UP A LITTLE.

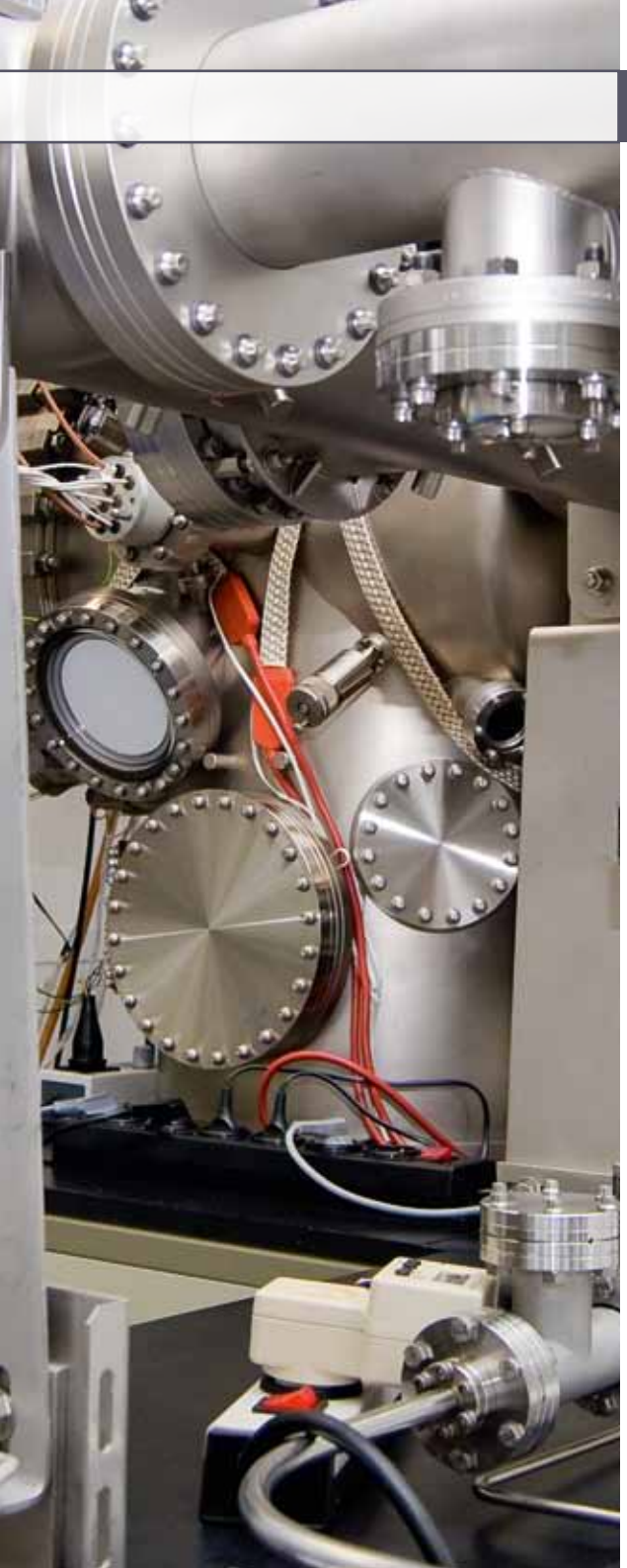
The University of Duisburg-Essen (UDE) has a creative history. We are at the same time one of Germany's oldest universities, founded in 1566, and it's youngest, after a strategic merger of the University of Duisburg and the University of Essen in 2003. This means that we have the resources of not just one campus, but two, in neighbouring towns. Being both young and old, you'll notice that the association of 'Made in Germany' as a sign of 'quality' can find a new home: Our scientists attract world-wide attention in fresh, modern areas like nanotechnology, environmental engineering, the automotive industry (particularly combustion processes), and electronics, and are innovative forerunners in areas like ship propulsion, mobile communication optimisation, building sciences, media technology and optoelectronics. Our engineers bring with them energy and passion into the classroom and community, and are in high demand as advisors and consultants to major corporations.

AT UDE ENGINEERING YOU CAN CONNECT WITH PEOPLE LIKE YOU.

Our team is made up of over 200 faculty and 4,700 engineering students, in what we like to think of as a global village. In fact, the region in which UDE is located has been dubbed 'Germany's Academic Triangle' because it is the largest concentration of academics in one location, surrounded by 4 major universities and several institutes. This community spirit of academic curiosity and cross-fed innovation may be one of the reasons why UDE engineering is making such a speedy climb in Germany's teaching and research rankings. One litmus test of a university's ranking in Germany is the amount of funding a university or faculty receives from the prestigious Deutsche Researchsgemeinschaft (DFG, or in English, The German Research Foundation). Engineers from the University of Duisburg-Essen are among the leaders of this list.

WE'RE ALSO PROUD OF OUR UNIQUE CONNECTION TO INDUSTRY.

Connecting our two campuses is the Ruhr river, which winds its way through central Germany to one of the world's largest inland harbors, next to our Duisburg campus. During the middle ages the Ruhr area was the heart-line of a bustling European trade route, a meeting point for innovative entrepreneurs. And, when rich layers of coal were discovered throughout the area a few centuries later, the Ruhr valley developed further into the capital of European coal and steel manufacturing. Expert engineers and skilled workers from around the world flocked to the area, creating a melting pot of cultures, brainpower, commerce and industry that remains today.



WELCOME TO THE UNIVERSITY OF DUISBURG-ESSEN

Dozens of old factories and steel mills still dot the landscape, but many have now been transformed into innovative cultural sites, with concerts, theatre, and adventure activities in unexpected venues. Our students can go rock climbing on an old bunker, scuba diving in a silo, watch lightshows on chimney stacks or theatre in a meadow. In fact, the European Union recently awarded the Ruhr area, represented by the city of Essen, the title 'Europe's Cultural Capital' due to its active calendar of events. This combination of old and young industry, all in a spirited location, makes UDE not only a fun place to study and do research at, but also a unique career connection – 10 of Germany's most important corporations have chosen Essen as their headquarters location.

ADVANCING ENGINEERING SCIENCES

At UDE engineering our demographics are still changing. Over the last few years, the percentage of female engineering students has risen rapidly from 5 percent to 17 percent. This rise in popularity among women is due largely to our faculty's active promotion of engineering to young female innovators. One example is the annual "Women's Day", when female high school students are invited to take a close look at engineering science and shed inhibitions about working in what used to be a male-dominated profession. Alongside the regular open days, the faculty also offers high school students of both genders 'Taster Courses', inspiring enthusiasm and early insight in the next generation of young engineers.

The teaching concept at Duisburg-Essen University is an additional success story. Our educational strategy is to emphasize a broad theoretical basis with well-structured courses, combined with carefully selected opportunities for hands-on experience and one-to-one advising. The 'Student-Support Programme' is an integral part of this concept. Advanced students are assigned as mentors for incoming students to help manage the transition from school to university life. Working in small groups, they go through lecture notes, help students prepare for exams, and offer skilled tutoring on subjects that are known to be difficult for incoming students.

Our Engineering "Fitness Training" courses are also part of this approach. Towards the end of the semester, once lectures are over, students are given intensive revision courses to make them 'fit' for the upcoming exam. Exams are timetabled so that revision does not clash with other classes, and students are able to concentrate solely on studying for their final exams. Statistics clearly demonstrate that students who take part in the student-support programme, engineering fitness training, and mock exams pass their exams more easily and fail less frequently. And, the time they take to complete their studies is significantly shorter. An added bonus of the support scheme is that it also creates welcome tutorial jobs for talented students, both helping them to finance their studies and improving valuable leadership skills.

Finally, students of the engineering department are assisted via our online tools. Our 'organizer' link informs students of available classes, timetables, events and exams. Students can also download scripts, lecture recordings and sample exam questions. We also ask students to evaluate and provide feedback on each course, the teaching, and the organization of courses as a whole, so we can carefully monitor and maintain our high teaching standards each and every semester.

... AND THE FACULTY OF ENGINEERING

A GLOBAL OUTLOOK AND REAL WORLD APPLICATION

Our emphasis at UDE is on global preparation. One way you can see this is in our "International Studies in Engineering" degree – ISE for short. Courses within this program are initially taught in English, while students receive German language training and increase their proficiency, followed by several courses taught in German. This bilingual approach is popular with German students as well, who have opted for an ISE degree in order to prove and improve their bilingual credentials for the job market. Almost 25 percent of German students at UDE are matriculated in one of the seven ISE courses: Mechanical Engineering, Electrical and Electronic Engineering, Control and Information Systems, Computer Science and Communications Engineering, Computer Engineering and Materials Technology. The program is popular and very competitive world-wide: Every semester we receive over 1,200 applications for this program.

INDUSTRY PARTNERSHIPS

While emphasizing on the job skills like dual language ability, an additional part of our success is also our 'learning by doing' approach. From the very first semester of study and students gain hands-on experience with real world projects in both laboratories and especially in joint projects that we have set up with our industry partners. Through these joint projects students learn to skilfully combine theory and real-world practice.

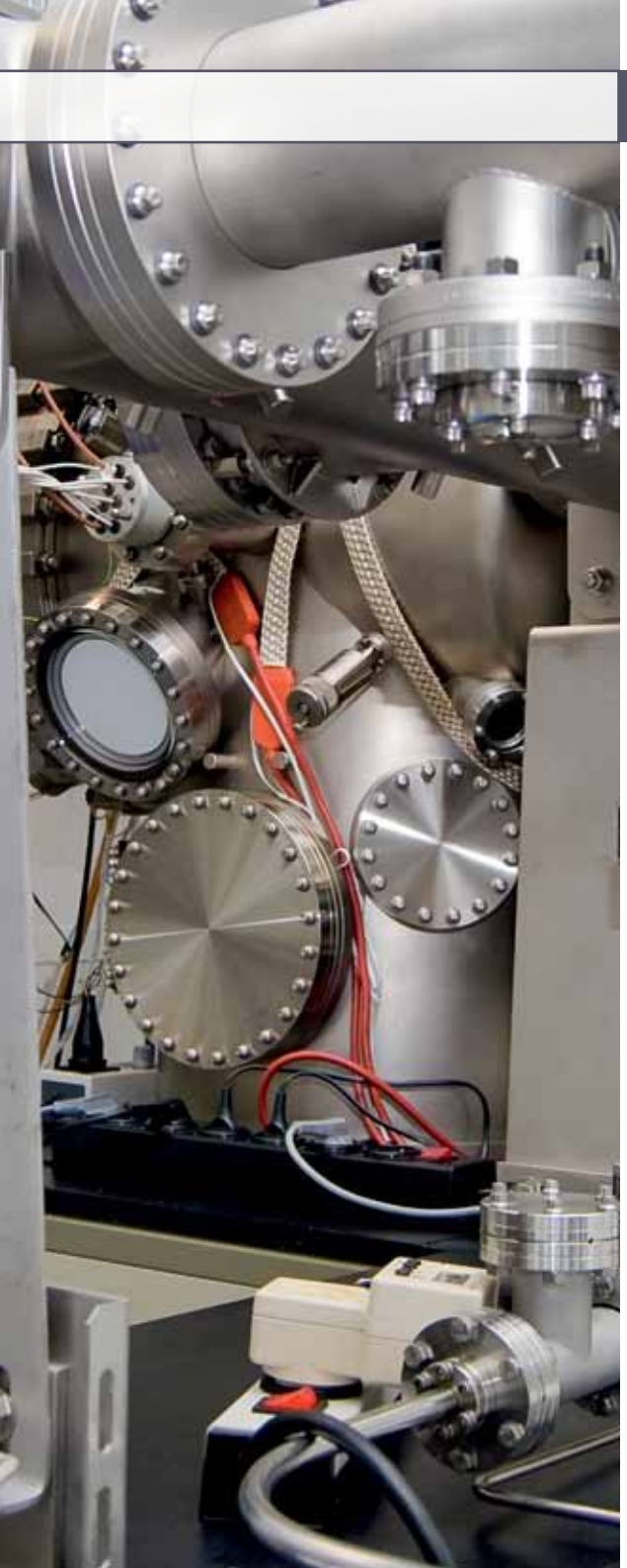
Equipped with a strong degree, CV, and bilingual ability, our students then graduate into a network with an extremely high demand for engineers, Germany-wide. Global players such as Siemens or ThyssenKrupp are strong recruiters of our students, as are small engineering offices and medium-sized companies. This is partially due to the network maintained by our faculty, who have been an important partner to the industry for many years. The various chairs in engineering science and a network of institutes affiliated to the university are releasing impressive results contributing to the successful interaction of research and industry.

EQUIPMENT + KNOW-HOW

UDE engineering has invested more than 60 million Euros in machinery and equipment. It makes these facilities available to many companies who would normally not be able to afford them. But that is only one aspect. What use would equipment be without know-how? Faculty scientists assist industry in the development and optimisation of products and processes, above all in the fields of nanotechnology, mechatronics, energy and environmental engineering, communications engineering, microelectronics and medical technology, information technology, product engineering, mechanical engineering and materials science, building sciences, and computational and cognitive sciences. Here, a listing of our research strongholds:

NANOTECHNOLOGY

The faculty has made a name for itself through a variety of projects in basic and applied nanotechnology, conducted via three Collaborative Research Centres, known as CRCs, and a Research Training Group. In CRC 445, for example, scientists from cross-disciplines are researching the origin and fabrication of nanoparticles. Nanotechnology ranging from engineering to chemistry and experimental/theoretical physics is organized under one roof: the Center for NanoIntegration



WELCOME TO THE UNIVERSITY OF DUISBURG-ESSEN

(CeNIDE) One of its focal areas being the development of nanomaterials in energy-related applications. This department is also offering a new course in nanoengineering, the only one of its kind.

MECHATRONICS

Innovation has been a trademark of engineering science at Duisburg-Essen. UDE was one of the first universities to recognize the power of combining the 3 areas of mechanical engineering, electrical engineering, and information technology & informatics. Our chair for mechatronics was founded already in the 1980's, the first of its kind in Germany.

ENERGY AND ENVIRONMENTAL ENGINEERING

For decades steel and iron shaped the Ruhr area's industrial landscape. That explains why energy and environmental issues have been a major concern to science and industry here perhaps more than anywhere else. It is hardly surprising that energy and environmental technology is a particularly strong field at the University of Duisburg-Essen. Three affiliated institutes – the IUTA Institute for Energy and Environmental Technology, the IWW Water Centre and the ZBT Center for Fuel-Cell Technology play an important role. Each year they alone attract around 10 million Euros of outside funding for research projects.

COMMUNICATION SYSTEMS

Major mobile-phone companies value the research carried out at UDE. Most of them work with the chairs of electrical engineering, communication systems and the affiliated IMST Institute for Mobile and Satellite Radio Technology. Founded in 1992 in Kamp-Lintfort, North Rhine-Westphalia, IMST has accompanied the development of wireless communications ever since the first generation of mobile phones. It evolved from the renowned department of General and Theoretical Electrical Engineering (ATE) at Duisburg.

MICROELECTRONICS AND MEDICAL TECHNOLOGY

Medical technology is one of the largest and most promising growth sectors and for several years now has been one of our research focal points in engineering science. The establishment of 'The Fraunhofer Institute of Microelectronic Circuits and Systems' in the direct vicinity of the university has further consolidated the excellent position of the faculty and made it possible to turn research results into application-oriented projects faster than ever. In the field of biomechanics, a junior professor has recently been sponsored by the Founders' Association for the promotion of Science and Humanities in Germany.

INFORMATION TECHNOLOGY

The ZHO Centre for Semiconductor Technology and Optoelectronics is a research project that has acquired a unique status within Europe. Working together with the Fraunhofer Institute of Microelectronic Circuits and Systems, this department has been pioneering groundbreaking research – for example on information technology markets.

PRODUCT ENGINEERING AND MATERIALS TECHNOLOGY

At UDE several chairs in mechanical engineering work together under the virtual roof of Product Engineering. Plastics experts, materials testers and rapid and virtual prototyping specialists all

... AND THE FACULTY OF ENGINEERING

work together on the development of new materials and innovative products for diverse markets. We have shown that specific interdisciplinary cooperation efficiently speeds up the product engineering process, from the initial concept to series production, and cuts manufacturing costs.

CIVIL ENGINEERING

Civil Engineering has been taught at the University of Duisburg-Essen for the past 30 years. Experts from seven major German companies based in Essen sat on the "Civil Engineering Board" when the discipline underwent extensive restructuring and reorganisation. Such a tight link with the business and the construction sector gives our students career and learning advantages.

COMPUTATIONAL AND COGNITIVE SCIENCES

This department cooperates closely with the departments of Mechanical Engineering, Electrical Engineering and Information Technology. With almost 1,400 students, it is one of the largest and most successful in the state of North Rhine-Westphalia. Companies have noticed this and work closely together with us, including the automotive and mobile phone industry, and firms in ecology sector, logistics, aerospace, safety engineering, automation and robotics, medical technology, nautical engineering, energy, software, hardware and the plastics, steel and foundry industry.

INDUSTRIAL ENGINEERING

In 2008, UDE's wide-spread activities concerning industrial engineering were incorporated into the Faculty of Engineering. Engineering competence in Mechanical Engineering, Power Engineering as well as Information Technology is combined with Management and Business Administration skills in research as well as in bachelor and master programmes. Research emphasizes among others the economic as well as the business aspects of mobility, logistics and the automotive industry.

LOGISTICS

The world's largest inland port is located in Duisburg, making it naturally a European centre for logistics. This finds its counterpart in the Engineering department with an active research group that focuses on research in supply-chain management and the logistics of transport systems The Ruhr area as a multi-central metropolitan area is a template for future development of urban areas. In 2007 and 08 UDE was selected the best school for Logistics out of 190 Universities from seven leading European countries

For centuries engineers have been changing the world, whether Otto Lilienthal as a pioneer of aviation or Karl-Heinz Brandenburg as the inventor of the MP3 format. The challenges faced by engineers have changed radically over the years, and study and research have evolved accordingly. What remains unchanged is the fascination for a subject that is one of the most exciting areas science has to offer and that continues to be a driving force behind industry and people.

Welcome to the University of Duisburg-Essen.
Welcome to the School of Engineering!

CIVIL ENGINEERING

The perception of civil engineers has undergone a radical change in the last few years. The employment market is expecting more from young professionals in the areas of inter-disciplinary technologies, competency planning and management skills.
The Department of Civil Engineering, through consequent reorientation and restructuring, caters to these demands by providing their young engineers with an internationally applicable skill-set through a modular and internationally accredited study course. All 15 professorships of the department present in unification an integrated approach, which enables future civil engineers to realize successfully, complex projects in an interdisciplinary environment.

The different branches of the department cover the whole range of civil engineering areas. Starting with fundamental sciences such as engineering mathematics, mechanics and computational mechanics followed by geotechnical engineering, structural analysis, and material sciences that deal with concrete, steel or light material structures up to the structures made of concrete, steel or light materials as well as operations and management studies. The branches of hydraulic engineering, water and waste management as well as city planning, urban design and road construction research deal with topics related to infrastructure and large-scale structures.

The Department of Civil Engineering carries out both theoretical and practical research together with partners from the industry and civic departments. The department through partnerships with universities in France, Poland and Slovakia enable an active exchange of international students and lecturers.

The department, at an early stage, conceived of a consecutive Bachelor-Master study program as well as the ability to study part-time. The accredited Bachelor's degree for the classical Civil Engineering provides the foundation for in 7 Semesters the Master's. The duration of the Master's is 3 semesters and one can choose between three different specializations: Construction Management and Infrastructure Systems, Design Engineering and lastly Material Science and Applied Mechanics. The part-time Bachelor's degree is organized into thirteen semesters and the Master's degree takes place over six semesters. A new element in these studies is the integration of building operations and economics concerning large projects. The course also includes design and implementation of different kinds of building techniques as well as computer-aided simulation and modeling. Material Sciences provides the basic knowledge regarding the production, behavior and the utilization of building materials. Studies on infrastructures and the environment focus on the needs and issues related to the urban area of the Rhine Ruhr region.

Research and development projects with industrial partners are important elements related to the practice-orientated training. This integrated approach combining theory and practice over many years has been very fruitful for the students, the teachers and the promoters.

CONSTRUCTION OPERATIONS AND CONSTRUCTION INDUSTRY

COURSES

- Construction operations foundation
- Presentations and debating techniques
- Project and property management

RESEARCH

- Simulation of processes in construction
- Risk management
- Sustainability in the construction economy
- Problems encountered in construction

APPLICATIONS

- Construction projects of all sizes
- Construction management
- Construction economics

CONTACT

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Prof. Dr.-Ing. Alexander Malkwitz

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The courses at the IBB deal with all areas related to construction economics and operations as well as the management of projects and construction companies. The courses cover the entire construction cycle starting with the project development and financing, the actual execution of the construction, up to the management of the completed structure, thus providing the students with an extensive competence in construction management. Due to the excellent links Prof. Dr.-Ing. Alexander Malkwitz and his team of ten staff members maintain with the industry, they are able to provide many additional activities and opportunities for the students In addition to the normal curriculum.

The demand for engineers with the special ability to carry out project based work and management has risen over the last few years. The study program provided by the institute meets this demand by providing competence in complex construction projects, presentation and debating skills thus preparing the student for a management career in the industry.

The scientists at the institute deal with, among others, simulation of construction operations. Risk management, studies of sustainability issues within the construction industry and the investigation of problems in the construction phases form part of the research program.

The goal is to optimize project development and the management of all relevant processes in the construction industry. The results have an effect on construction projects of all sizes, the management of the projects and also the complete cycle of property development and investment projects.

STRUCTURAL ANALYSIS AND CONSTRUCTION

Structural Analysis forms the scientific foundation upon which the safety and reliability of all civil structures are evaluated. Construction teaches how individual materials and building components are combined together, in order to realize a complete building or structure. This is the field of research of Professor Dr.-Ing. Jochen Menkenhagen and his 15 staff members.

The Bachelor's degree provides the fundamental knowledge for the planning of support structures, construction informatics, construction techniques and technical design. More intensive courses in "Civil Engineering" and "Computational Mechanics" with greater emphasis on depth are provided during the Master's degree course, especially in the areas of structural analysis and computer-aided design relevant for civil engineers.

The institute focuses above all on software-based automated computations and measurements, and develops practical methods and concepts for measurement and validation. This approach can be used, for example, in the innovative use of glass such as point supported glass plates. This is important for the development of composite materials made of steel and glass with load supporting functionalities.

The application of structural analysis and construction covers the whole range of constructions projects from planning and computation to project realization for the industry, engineering companies and inspection organizations.

COURSES

- Structural support planning
- Construction
- Construction informatics

RESEARCH

- Automated computation and measurements
- Innovative uses of glass in the construction industry

APPLICATIONS

- Planning, computations and project realization in the whole area of construction

CONTACT

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COMPUTATIONAL MECHANICS

COURSES

- Mechanical structural assignments
- Material modeling
- Applied mechanics
- Material science

RESEARCH

- Modeling and simulation of coupled problems
- Multiphase materials
- Porous media

APPLICATIONS

- Civil engineering
- Medicine (Biomechanics)

CONTACT

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Prof. Dr.-Ing. Tim Ricken

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The use of computer-assisted strategies to solve practical problems has rapidly increased in the last decades. The basis of this development is the concept that a reliable problem analysis can be provided by complex continuous mechanical modeling, computational methodology and experimental techniques. Computational Mechanics thus build up a communication network between experimental realities, theoretical modeling and numerical simulation, the area of work in which Prof. Dr.-Ing. Tim Ricken and his team of 3 focus on.

The Master's degree course of Computational Mechanics deals with the calculation and simulation of structural mechanical applications and the modeling of materials. Key areas of applied mechanics such as engineering-orientated material science and their applications in a broad range of fields are part of the study plan. This course is part of the International Studies in Engineering Program (ISE).

The research at the institute is focused on modeling and simulation of coupled problems in structural mechanics, multi-phase materials and porous media.

Practical applications are based on soil mechanics and road construction, as well as in material sciences and waste management technologies. Computational Mechanics plays an important role in the area of Biomechanics: for example in the modeling and simulation of the liver, in the investigation of the growth of organic tissues, and in the development of bone replacement materials.

GEOTECHNICAL ENGINEERING

The Institute of Geotechnical Engineering has been led by Prof. Dr.-Ing. habil. Eugen Perau since January 2010. He is supported by a team of ten staff members. Geotechnical Engineering is a specialized area of structural engineering which deals with constructions both below and above ground as well as those related to earthworks.

The courses in Geotechnical Engineering concentrate on soil mechanics, groundwater flow, shallow foundations, foundation plates and piles, excavation walls and other support structures. Other areas are concerned with the safety and stability of slopes, site investigation and geotechnical reporting, tunnel constructions, soil injection technologies, soil dynamics, material behavior in soil mechanics, behavior of rock materials and rock constructions as well as numerical modeling.

Currently its major areas of work are in the description of multi-phase materials on the basis of rational mechanics, the hydro-dynamics of particle redistribution, stability analysis of geotechnical structures by numerical modeling, soil behavior under cyclic loading and development of probabilistic safety concepts. The practical applications of this research are intrinsic to this endeavor.

Research results have an influence on the determination of the stability of geotechnical constructions such as excavation walls, the foundation of off shore wind farms, as well as provisions to prevent erosion at geotechnical structures.

COURSES

- Soil mechanics
- Ground Engineering

RESEARCH

- Description of multi-phase media
- Hydro-dynamical particle grouping
- Stability of geotechnical structures
- Probabilistic safety concepts

APPLICATIONS

- Geotechnical structures
- Excavated structures
- Off shore wind farms

CONTACT

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ENGINEERING MATHEMATICS

COURSES

- Numerical mathematics
- Mathematics for civil engineers

RESEARCH

- Convection and diffusion equations
- Navier-Stokes equations

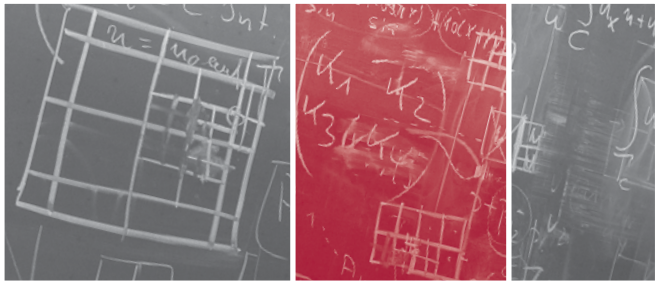
APPLICATIONS

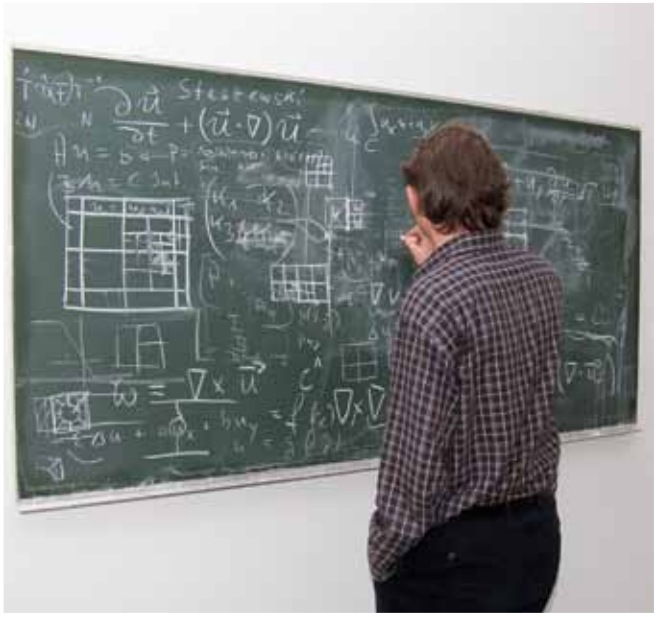
- Applied mathematics
- Fundamental Mathematical research

Mathematics is one of the most fundamental subjects in engineering since it determines reliable methods for finding the right solutions and methodologies for engineers who require a precise calculation of the behavior and prediction of physical processes. This needs a sound foundation of the theoretical principles as well as that of mathematical analyses. The Head of Chair, Prof. Dr. rer. nat. Wilhelm Heinrichs forms the working group of Engineering Mathematics and Applied Analysis together with Prof. Dr. Markus Kunze from the Department of Mathematics and five staff members.

Students will learn in stages about numerical mathematics and mathematics needed for civil engineers.

The increasing capacity of high performance computers have enabled improved methods for numerical calculations in the last few years. That also applies to finite elements, boundary element methods, spectral and pseudo-spectral methods, multilevel and domain decomposition, and parallel algorithms. Key areas of research included in engineering mathematics are mathematical analyses and numerical simulation of flow processes and phase changes in porous media. The institute also has a special focus on spectral finite elements for convection diffusion equations. These equations describe the behavior of physical parameters – such as the mixture of two fluids – in relation to flow and particle movement. Another major area of research is the spectral approximation of the Navier-Stokes equations to define flows in water, oil and many gases.





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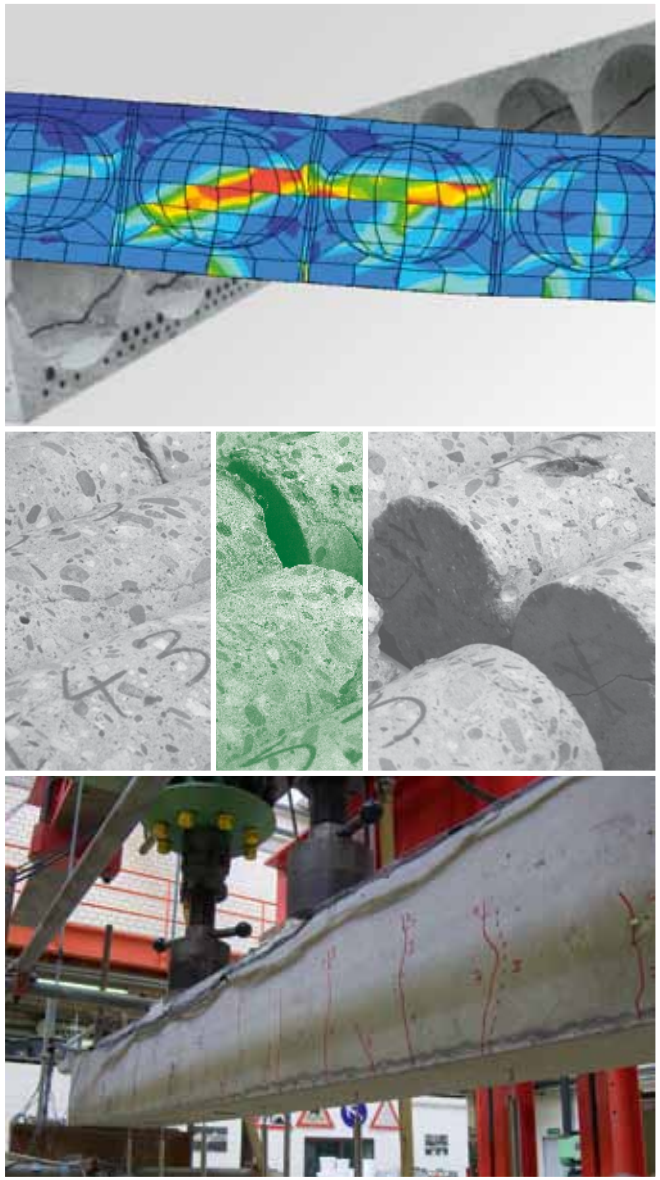
STRUCTURAL CONCRETE AND SOLID STRUCTURES



Professor Dr.-Ing. Martina Schnellenbach-Held with her team of 15 staff members and 14 student assistants at the Institute of Concrete Structures Engineering does extensive research related to new construction materials, construction systems and reinforcement elements as well as their design concepts.

With the Bachelor's degree and the knowledge of the fundamentals of construction, students will be able to design standard concrete structures and put into practice the theory related to concrete and reinforced concrete structures. The Master's Degree concentrates on prestressed concrete, bridge construction, strengthening methods, the utilization of new construction materials as well as finite element analyses of prestressed and reinforced concrete structures. Further themes are the repair and maintenance of concrete structures, design of masonry and precast concrete structures.

The research covers a wide range of reinforced and prestressed concrete including structural and deformation behaviour of reinforced and prestressed concrete, lightweight and innovative structures from modern high-performance concrete and the repair and strengthening of concrete structural elements. Unique facilities with advanced testing equipment such as a load test rig with a 4000 kN capacity and a hydro-pulse unit for experiments with dynamic loading are available. Large-scale experiments investigating the climatic influence on the structural behaviour of concrete and crack fillers can be carried out in a specialized climate chamber.

The Institute also develops methodologies and solutions for structural engineering and related areas assuring graduates a secure future.

COURSES

- Reinforced concrete structures
- Concrete and composite bridges
- Finite elements in concrete structures
- Repair of concrete structures

RESEARCH

- Lightweight concrete structures
- High and ultra-high performance concrete
- Repair and strengthening of concrete structures
- Structural health monitoring

APPLICATIONS

- Over- and underground civil engineering
- New construction and structural materials
- Certification tests
- Expertise for specific structural problems

CONTACT

University of Duisburg-Essen
Institute for Structural Concrete
and Solid Structures

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Prof. Dr.-Ing. Martina Schnellenbach-Held

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MATERIAL SCIENCE

COURSES

- Introductory physics for civil engineers
- Building materials
- Basic materials science
- Building physics
- Physical properties of materials
- Ceramic, organic and inorganic composites

RESEARCH

- Ferroelectric and piezoelectric materials
- Concrete, reliability and frost
- Thermal insulation materials

APPLICATIONS

- Civil engineering
- Transport and aircraft design
- Electronic materials
- Energy materials

CONTACT

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Institute for Material Science

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Prof. Dr. rer. nat. habil. Doru C. Lupascu

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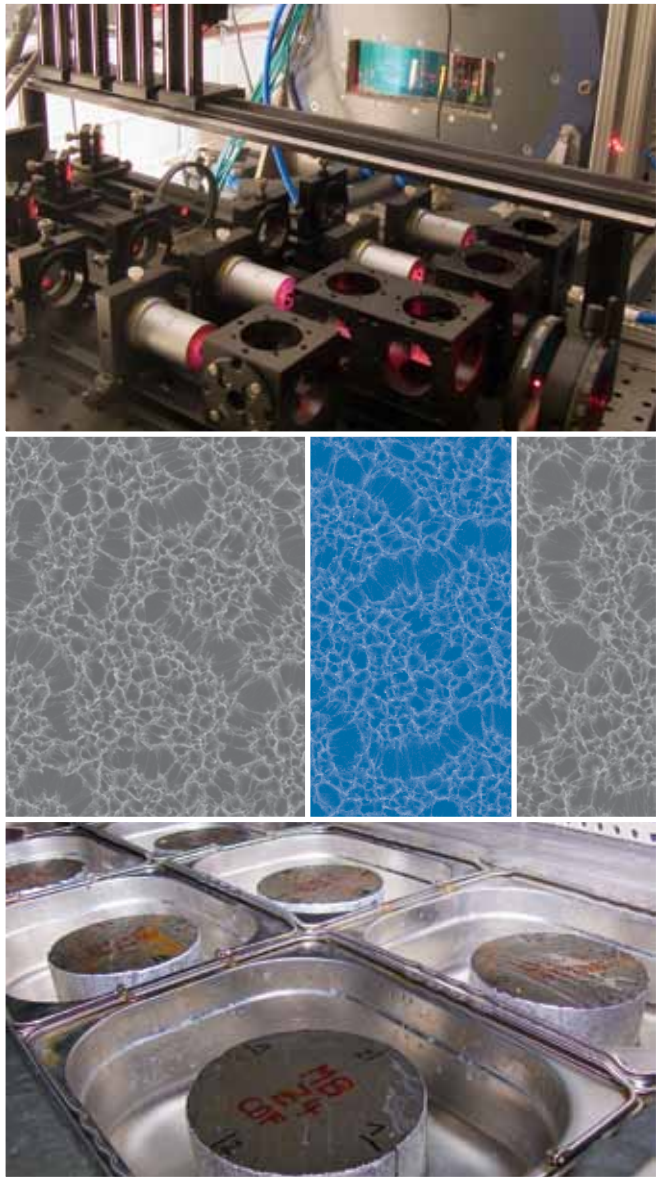
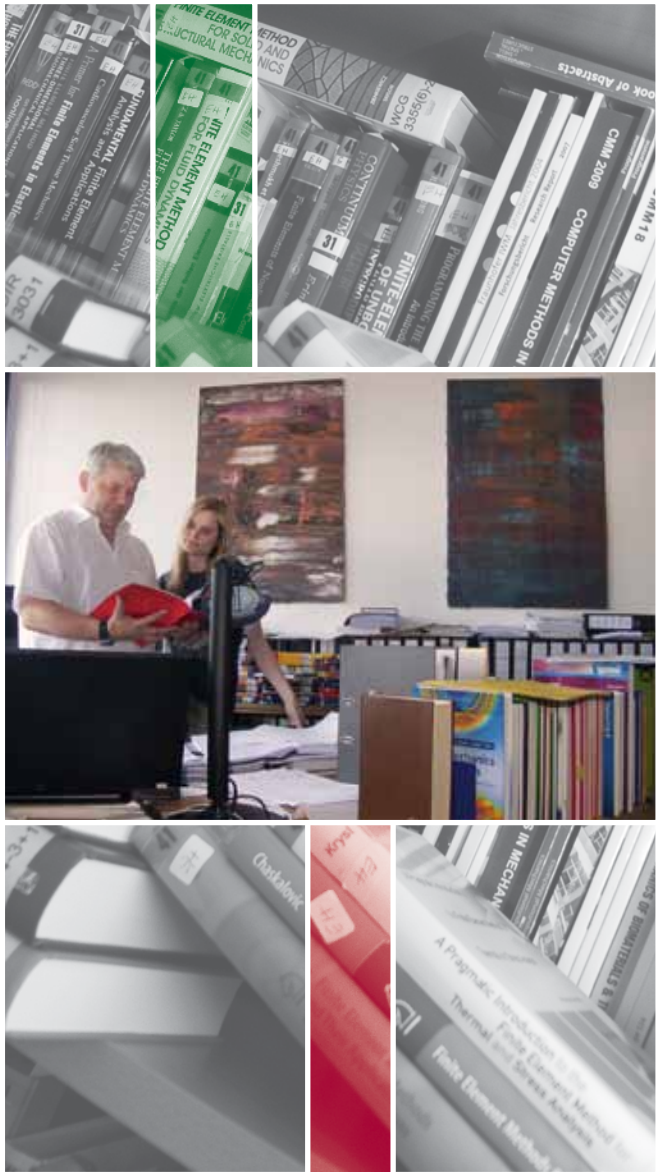
Professor Dr. rer. nat. Doru C. Lupascu and his team investigate classical and modern functional materials for civil, electrical, and mechanical engineering applications. Four fields of expertise form the portfolio: non-metallic inorganic functional materials, classical building materials, thermal insulation and organic solar cell materials. Material development in the Institute is devoted to the integration of the different engineering disciplines via material application.

Teaching includes introductory physics, building materials, building physics, introduction to materials science, functional materials, ceramic materials as well as their physical properties. The Master's degree "Materials Science and Applied Mechanics" offers an in depth approach to materials and their modelling along with an applied mechanics focus provided by the Institute for Mechanics. Concrete technology, durability and repair, building physics, fire protection, technical equipment for buildings, and acoustics round off the Institute's coursework.

Major research expertise lies in piezoelectric and ferroelectric materials for actuator and sensor systems. Classical civil engineering topics such as frost damage in concrete and durability are equally covered. New developments are organic solar cell materials and thermal insulation. The interaction between the environment and active and inactive materials complete the Institute's agenda. Functional nanostructures for organic solar cell electronics as well for organic solar cell electronics as well as thermal insulation nano-materials are new dynamic fields of research.



MECHANICS



The research focus of the Institute of Mechanics (Prof. Dr.-Ing. habil. Jörg Schröder) is in the field of theoretical and computer oriented mechanics, computational materials science and the Finite Element Method (FEM). The lectures include the courses in mechanics, continuum mechanics, and thermodynamics of materials as well as linear and nonlinear FEM.

Based on a number of research projects an extensive network with other universities has been established. This network allows for a multifaceted and interdisciplinary cross linking with other research institutions. The topic "Massive parallel simulations of arterial walls: Continuum-mechanical modelling and numerical analysis with the help of FETI domain decomposition methods" is undertaken with the Medical Faculty and the Institute of Mathematics of the University of Duisburg-Essen. The project "Statistically similar representative micro-structures in elasto-plasticity" is conducted in the DFG Research Group "Analysis and computation of micro-structure in finite plasticity". Furthermore, the institute has successfully demonstrated the application of phenomenological material models for the macroscopic description of high-tech steels for deep-drawing and metal forming simulations. Functional materials such as piezo and ferroelectric components are subjects of current research and development. The DFG research group "Ferroic functional materials – multiscale modelling and experimental characterization" (FOR 1509: speakers are Prof. Schröder, Institute of Mechanics, and Prof. Lupascu, Institute for Materials Science at the University of Duisburg-Essen) will get on their work in April 2012.

The institute develops methodologies and solutions for the whole field of structural engineering and related areas assuring its graduates bright opportunities for the future.

COURSES

- Mechanics
- Thermodynamics of materials
- Finite Element Method (FEM)

RESEARCH

- Continuum mechanical modelling
- Elastoplasticity theory
- Theory of porous media

APPLICATIONS

- Medicine (Biomechanics)
- Smart materials (Electromechanics)
- Steel production

CONTACT

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STEEL CONSTRUCTION

COURSES

- Structures and connections
- Hall structures, multistory buildings and bridges
- Lightweight structures

RESEARCH

- Fatigue behavior of structural steel details
- Quality assurance and control
- Sustainability of steel structures

APPLICATIONS

- Steel structures
- Timber structures
- Membrane structures

CONTACT

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Institute for Steel Construction

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Prof. Dr.-Ing. habil. Natalie Stranghöner

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The Institute for Metal and Lightweight Structures (Steel Construction) deals with the design and construction of steel, composite and timber structures for building and bridge constructions as well as welding and material technologies and fracture mechanics. Professor Dr.-Ing. habil. Natalie Stranghöner and her thirteen staff members are involved in projects within and beyond the Institute such as sustainability of steel structures for renewable energies, identification and tagging systems in the steel construction industry and 3-D façade planning.

Graduates of the Institute know the material behavior of steel and timber and they are able to design and construct complex structural details and connections of halls, multistory buildings and bridges. Further key points are shells, towers and masts made of steel, the utilization of foils, membranes and ropes, as well as the design and construction of lightweight structures.

The Institute carries out research in the areas of fatigue behavior of structural steel details, quality assurance and control during fabrication and erection, sustainability of steel, bolting connections as well as the choice of steel material for steel structures.

These research results are relevant to the fatigue behavior of steel structures under dynamic loading, the durability and quality of steel constructions, the sustainable use of steel for energy savings, the safety of bolting connections as well as the load bearing behavior of steel structures.

URBAN WATER AND WASTE MANAGEMENT

The metropolitan Ruhr area is the ideal laboratory for the development of future water and waste management concepts for urban systems. Professor Dr.-Ing. Renatus Widmann works on this subject together with his seventeen staff members. The Institute takes part in projects of KuLaRuhr, cognE-mobil, BioHyMeth and dynaklim which is working on developing climate change strategies for the Emscher-Lippe region. Graduates of Waste Management will be able to plan, operate and manage waste plants. They will also master fundamental laboratory analytical methodologies and the categorization of results within the context of waste management. Graduates in Urban Water Management will learn about technologies related to the provision and disposal of water, standard waste water parameters and how to measure and determine the parameters. In addition, they will use models to simulate canal networks. Graduates of the Waste Management as well as Urban Water Management will learn about the environment, licenses, planning regulations, management systems, alternative energy sources, eco balances, system optimization and Emission Trading.

Research focus of the institute is the long term behavior of landfills, eco balances, biological methods for energy production and storage systems, optimization of the sewage treatment plants, with active investigation via FisH tests, the biological production of hydrogen and the assessment of co-substrates.

Practical applications lie in the construction, operation and optimization of waste water treatment plants, digestion and composting plants as well as in drinking water treatment, distribution and storage. Further areas of interest are the optimization of landfills and the eco balances of waste water treatment plants.

COURSES

- Planning and operation of waste plants
- Analytical techniques
- Biological and chemical processes
- Provision and disposal technologies

RESEARCH

- Long term behavior of landfill sites
- Bio energy production and storage
- Optimization of waste water treatment plants

APPLICATIONS

- Disposal
- Drinking water provision
- Landfill technologies

CONTACT

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CITY PLANNING AND URBAN DESIGN

COURSES

- Civil Engineering and Cities
- Integrated Approaches towards sustainability
- Urban planning and design

RESEARCH

- Sustainability and Energy Efficiency
- Health and Climate Change
- Urban Green Spaces and City Lighting
- E-Mobility and Urban Infrastructure

APPLICATIONS

- Cooperation with Municipalities and Ministries
- Urban Design

CONTACT

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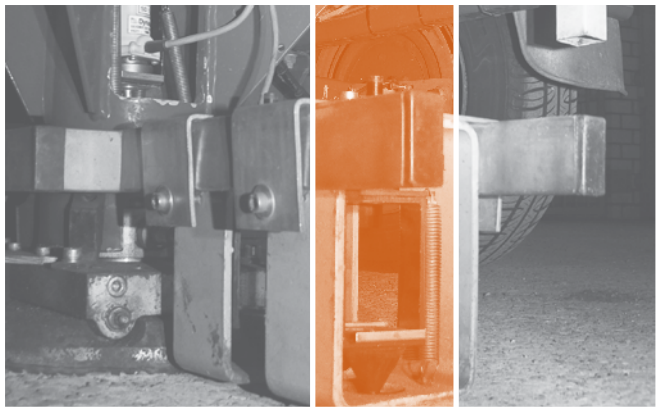
The Institute of City Planning and Urban Design (ISS) has been working at the interface between the areas of urban design and other city-centered scientific research for over 10 years. Important focus is the quality of life in our urban spaces especially in times of conflicting priorities and interests. Professor J. Alexander Schmidt is the head of the team consisting of fifteen academic staff members. The ISS Institute is a participant in many significant projects including Cologne E-Mobility ("colognE-Mobil"), the BMBF project Climate Change Initiative for Essen, Urban Strategies to combat climate change in Essen, as well as in Shanghai: Integrated Approaches towards a Sustainable and Energy Efficient Urban Development. Professor J. Alexander Schmidt is also the spokesman of the main research group "Urban Systems".

The courses at the institute provide a good understanding of the city within the context of civil engineering and encompass an integrated approach. Additionally an understanding of the fundamentals in urban design and development as well as specialized knowledge regarding the aims and challenges found in urban planning and design will be imparted.

The institute carries out inter-disciplinary research under the general heading of "The City" with different themes such as sustainability, health, energy efficiency, climate change, criminality, urban green spaces and city lighting.

The research results are highly valued nationally and internationally by municipalities, civic organizations and governmental ministries.

ROAD CONSTRUCTION AND TRANSPORTATION ENGINEERING



The Institute of Road Construction and Transportation Engineering deals with all areas related to individual and public transport. The team of three academic staff, led by Professor Edeltraud Straube, is investigating the possible issues and consequences of extremely quiet electric cars on road safety within the framework of the Cologne E-Mobility project ("colognE-mobil").

Courses at the institute include topics such as asphalt technologies, water drainage management, road maintenance management and calculations of transport area requirements. In addition, students will gain knowledge in the areas of transport planning and technologies, road designs as well as the planning and financing of transport infrastructures. The Institute also offers additional courses in rail transportation, public transportation systems as well as the environment and transport.

The institute carries out research on theoretical and practical calculations of transport systems as well as on road maintenance and management. The institute also works with a wide variety of clients giving advice to communities and municipalities at the local and national levels especially in the assessment of public roads as a component of effective pavement management systems. The research team also works in the area of road construction, especially within the aspects of load bearing abilities of transport networks, as well as how road surfaces differ in their ability to generate grip.

The application of research results are especially relevant to the areas of public and private transport planning as well as in the areas of construction and maintenance of roads and transport systems.

COURSES

- Asphalt technologies
- Load bearing abilities
- Maintenance management
- Planning, technologies and financing

RESEARCH

- Transport networks measurement
- Road maintenance and management
- Consultancy and certification
- Load-bearing abilities

APPLICATIONS

- Road construction
- Public transport planning
- Assessment and certification office

CONTACT

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HYDRAULIC ENGINEERING AND WATER MANAGEMENT

COURSES

- Hydraulics; Hydrology; Hydraulic Engineering
- Water Management
- Production of Energy

RESEARCH

- Morphodynamics
- Links between Hydromorphology and Biodiversity
- Hydropower
- Underground Pumped Storage Plants
- Flood Management
- Water Quality Management

APPLICATIONS

- Flood Risk Management
- Monitoring of River Rehabilitation
- New Energy Concepts

CONTACT

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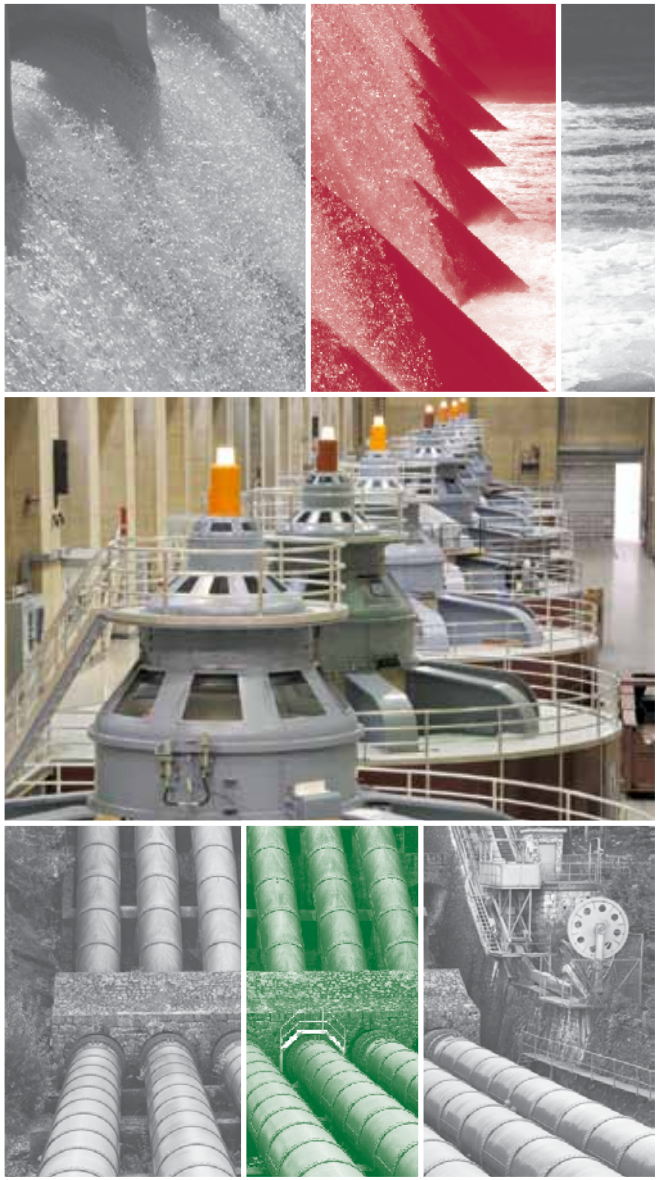
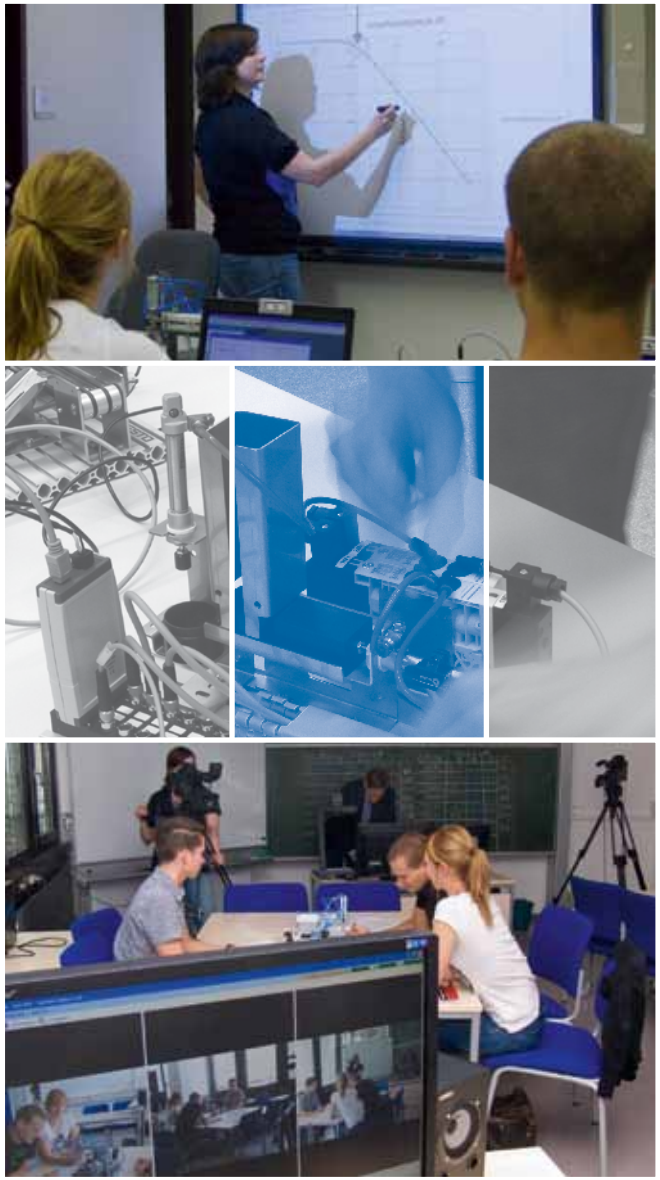
Hydraulic Engineering is a branch of civil engineering dealing with the usage and the control of water bodies. Water resources management focuses on urban water, hydromorphology and morphodynamics, river rehabilitation measures, ecological consistency and fish migration concepts, water quality management and modelling, implementation of the water framework directive, socioeconomics of water management actions, flood control, risk management and climate change. Prof. Dr.-Ing. André Niemann is the director of this institute and leads a team of ten.

Students learn fundamental principles of hydraulics, hydrology, water management and hydraulic engineering, including flood containment systems, the development of channels to divert flows, the application of hydraulics, water movement in pipes and gutters, modelling water movement in hydraulic systems as well as the transportation of solid particles within water bodies. They will also learn the fundamentals of power production in hydropower systems.

The laboratories available, among others an experimental hall (420 m^2), a water cycle of 250 m^2, and a flow structure of 20 m length, 3 meter width and a maximum depth of one meter allow hydraulic model testing. In addition, a tilting runner and a piping test rig are available. These are available for both research and services rendered to industry. In a co-operation within the Civil Engineering Division at the UDE, the institute works with the Department of Geotechnical Engineering and of Urban Water and Waste Management.



TECHNOLOGY AND DIDACTICS OF TECHNICS



Understanding fundamental technologies, the individual and collective responsibility to use and actively contribute to the development of new technologies and shaping future human activities through technology can be considered to be the general responsibility of society. In this aspect, it is essential to inspire young people in technology and to train them to be technically competent in order to sustain the aptitude for innovation needed to secure the technological position of Germany. Technical teachers in educational establishments act as catalysts and ambassadors and provide a fundamental contribution to this process. The team under Professor Dr. Martin Lang and Professor Dr. Stefan Fletcher train technical teachers for every level of schooling within the German educational system.

The main goal of this course is to simplify and explain in detail the complexities of technology as well as its inter-relationship with economics, science and society. This course will provide a comprehensive understanding of different technologies. The contents of the courses range from lab and workshop training, fundamentals of technology, didactic of technology and socio-technologies.

The Institute carries out research in empirical education systems in the areas of planning and provision of learning processes and competence diagnostic. An addition research activity deals with the conception, development and evaluation of computer-based learning media and environments for effective training in the different technologies.

The above mentioned research when applied, results in the development of very effective learning processes and teaching methods to transfer the technical know-how to different educational contexts.

COURSES

- Didactics of technologies
- General technologies
- Socio-technology

RESEARCH

- Empirical research of training
- Analysis of teaching and learning processes
- Diagnostics of technical competence

APPLICATIONS

- Development of teaching and learning media
- Curricula development
- Planning and presentation of training processes

CONTACT

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TEACHING PROFESSION IN TECHNICAL AND VOCATIONAL FIELDS

COURSES

- Didactics
- New media
- Data processing in product development

RESEARCH

- Didactics
- New media
- Data processing product development

APPLICATIONS

- IT systems in product development
- Bench-marking for CAD-PLM systems
- Tailor-made software for specific applications

CONTACT

University of Duisburg-Essen
Teaching Profession in Technical
and Vocational Fields

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PD Dr.-Ing. Frank Lobeck

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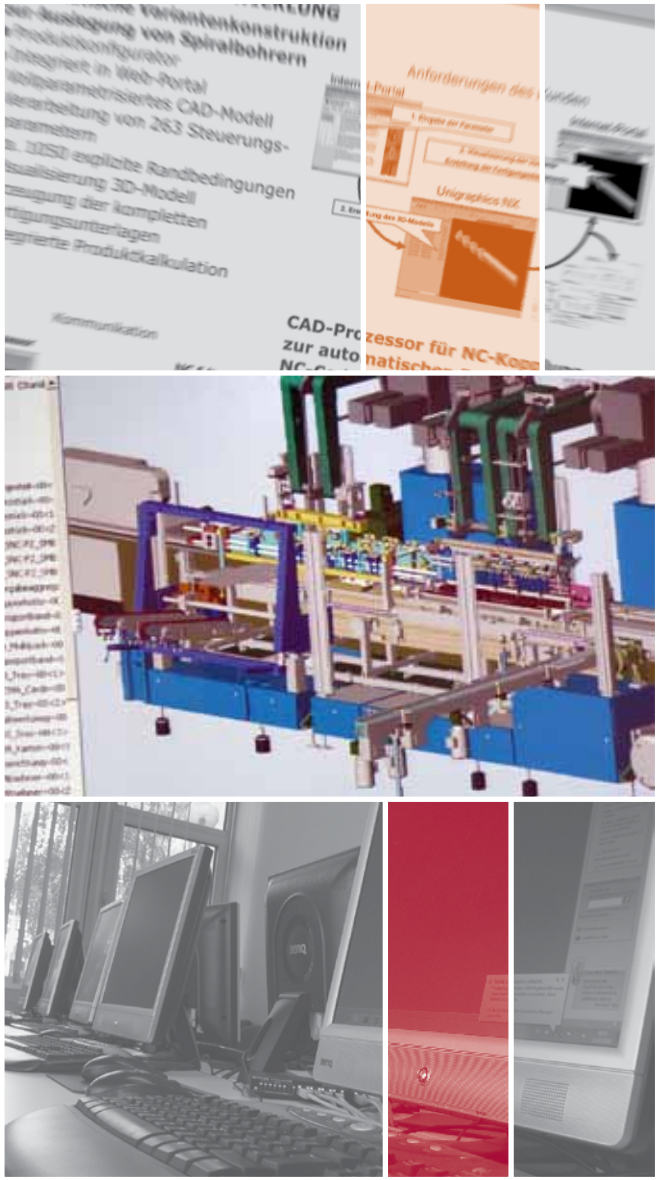
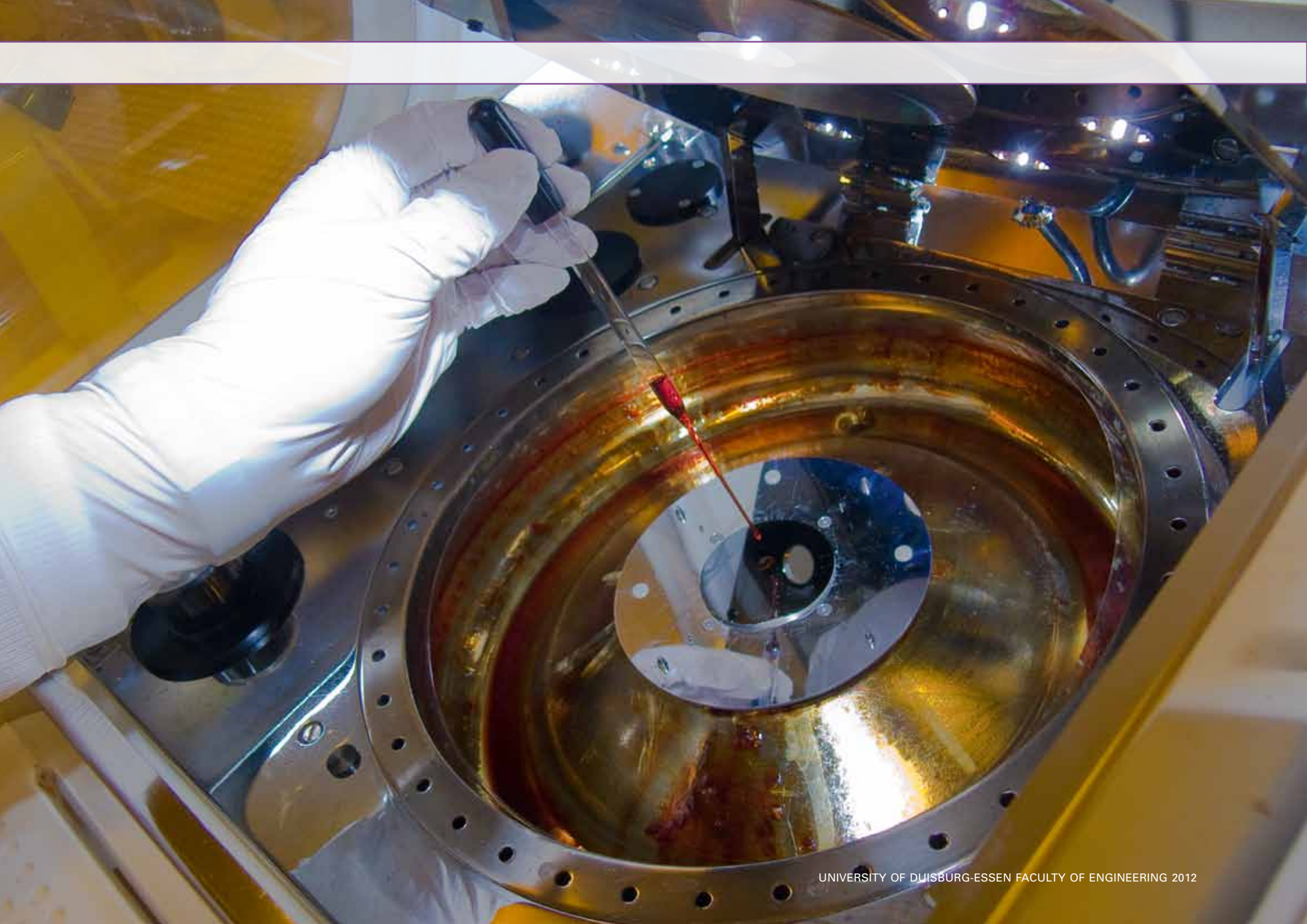
Teachers in vocational schools are providing general training covering both theoretical and practical aspects. They provide their students with the essential knowledge and competence required to act effectively in their chosen professions and careers as well as be able to embrace future training opportunities. These teachers are active in a diverse range of educational institutes in Germany including vocational colleges as well as specialized institutes. PD Dr. Frank Lobeck and his two scientific staff train future teachers in the areas of technical professions.

The courses are designed to provide didactics related to mechanical and electrical -engineering as well as in the use of new media in teaching. Competence in data processing related to product development, computer aided design, product life cycle and management, knowledge management in engineering, knowledge based engineering and programming applications all form essential parts of the courses provided.

Dr. Frank Lobeck and his team carry out research in the areas of development and optimization of computer-aided interactive teaching systems. A second primary area of research is the continuous utilization of parameterized product models over the whole development cycle through the integration of knowledge-based engineering in the product life cycle management.

In practical terms, this work is important for the optimization of IT systems, in product development and bench-marking, as well as for making recommendation for CAD-PLM systems including the conceptualization and implementation of tailor-made software.





ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

More than 1,200 young men and women are studying under the guidance of 18 Professors in the 14 institutes in the Department of Electrical Engineering and Information Technology. Topics cover all aspects of electrical and information technologies ranging from electrical energy technologies, communication technologies, micro-electronics and medical technologies right up to nanotechnologies.

The participation in research under two Collaborative Research Centers, a number of EU projects, targeted research regions, a large number of industrial cooperation projects as well as running a graduate college underline the impressive range of intensive research activities of the department. These research activities are supported by an excellent technical infra-structure. Modern laser technologies, analytic equipment and microscopy, a number of clean rooms and special facilities such as the Centre for Semiconductors Technology and Opto-Electronics, the high voltage laboratory and fire detection laboratory offer the most appropriate facilities for research and training.

Effective cooperation and knowledge transfer takes place through the interaction between this department and external research organizations such as the Fraunhofer Institute for Microelectronics Circuits and Systems, or the Institute for Mobile and Satellite Radio Technology (IMST GmbH). As a result of which, the Director of the Fraunhofer Institute as well as two department heads are professors at the university.

The Department of Electrical Engineering and Information Technology also adopted the new system of Bachelor's and Master's degrees very early on. The courses on offer include Electronics and Information Technologies, Business Management, Nano-Engineering and International Studies in Engineering. Additionally the department offers training for vocational teachers. As is the case in the entire faculty strong emphasis is placed on the practical relevance and application. Practical studies, projects and internships are an essential part of the study.

The department tries to stimulate interest at the school level in engineering in an exemplary manner. A wide range of activities evoke the interest of students and teachers assuring their later uptake of careers in electronics and information technologies. The success of these measures can be particularly seen in the number of young women, currently about 15%, choosing this line of work.

GENERAL AND THEORETICAL ELECTRICAL ENGINEERING

COURSES

- Fundamentals in electrical engineering
- Electromagnetic fields and electrodynamics
- Computational electromagnetics

RESEARCH

- Electromagnetic and optical metamaterials
- Nanophotonics and plasmonics
- Optical interconnects

APPLICATIONS

- Automotive technology
- Medical technology
- Computer engineering
- Photonics

CONTACT

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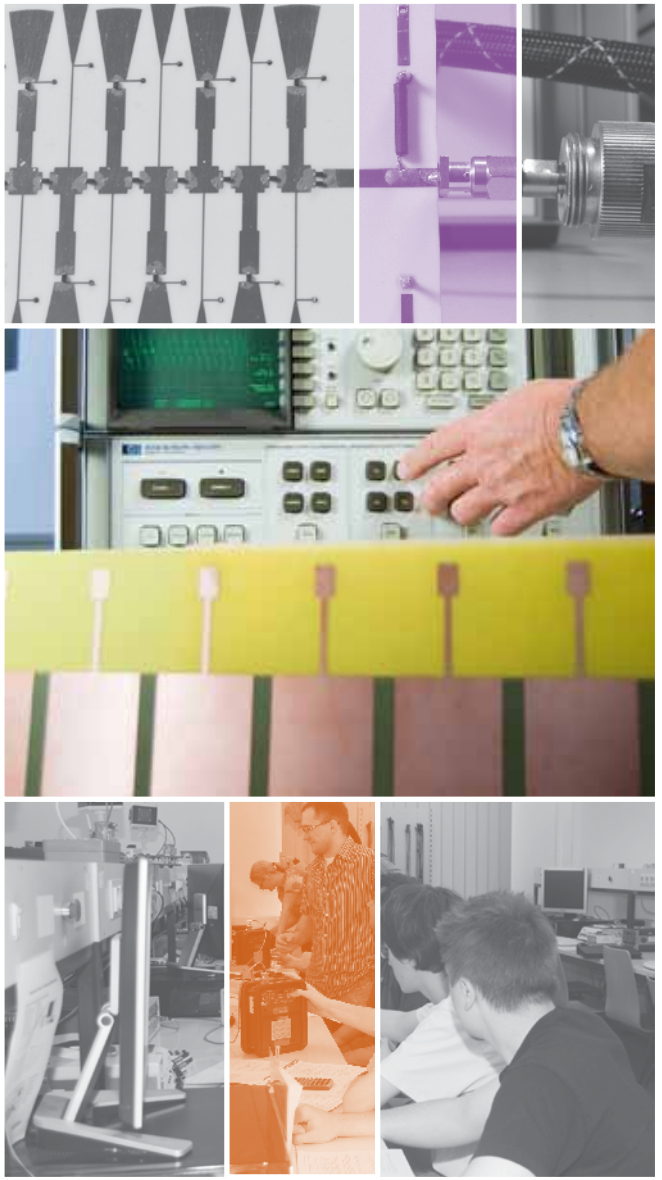
The Laboratory for General and Theoretical Electrical Engineering (ATE) is involved in a broad range of research activities covering topics in both fundamental and applied engineering science. Prof. Dr. Daniel Erni and his team of 9 scientific staff are members of CeNIDE and actively participating in an informal medical engineering research network at UDE.

The courses offered by the laboratory include lectures in theoretical electrical engineering, electrodynamics, and computational electromagnetics, as well lab courses in electronic circuit design (electronic workshop for students) and electromagnetic field simulation (CoFT-Lab).

The current research of the laboratory encompasses activities in the realm of electromagnetic and optical metamaterials with a specific emphasis on innovative antenna designs. Additional research fields include optical interconnects at highest data rates, nanophotonics and metal-based nano-optics (plasmonics), as well as new methods for computer-guided device design based on numerical structural optimization.

In the framework of various collaborative research projects the laboratory is developing low-cost microwave antennas for advanced automotive applications and multi-functional RF coils for high-field magnetic resonance imaging (MRI) including advanced schemes such as travelling-wave MRI. Further investigations comprise a study for the German Navy dealing with the electric current flow around marine vessels stemming from the cathodic corrosion protection system. Additional studies are carried out in biomedical engineering addressing e. g. microfluidic chip-based ultra-fast cell sorters and the electromagnetic/optical analysis of biological tissues and nanocomposites.



AUTOMATIC CONTROL AND COMPLEX SYSTEMS

The Institute is active in the field of automatic control and supervision of large-scale and embedded systems with a strong focus on developing fault tolerant and reliable technical systems. Some of these activities are integrated into numerous EU, German Research Foundation, industrial and international cooperation projects.

The courses offered by the institute are dedicated to the essential and advanced techniques and methods in the area of control engineering, theory and automation. This also includes modeling, simulation techniques, advanced control schemes, fault tolerant techniques, process automation, as well as non-linear, robust and intelligent control.

The research team mainly deals with the development of model-based and data-driven fault diagnosis and control schemes. They are dedicated to enhancing the fault tolerance and reliability of complex systems like networked or/and embedded control systems.

The main application areas include the on-board diagnosis (OBD) in engine management systems, advanced (fault) control schemes embedded in vehicles, process monitoring and asset management.

COURSES

- Control systems
- Automated technologies
- Failure diagnosis and failure tolerance

RESEARCH

- Failure tolerant systems
- Data based process surveillance
- Networked control systems
- Factory Management

APPLICATIONS

- Automobile Industry
- Processing Industry
- Energy Technology

CONTACT

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ELECTRICAL POWER SYSTEMS

COURSES

- Grid components
- System behavior
- Information technologies
- Energy markets and production

RESEARCH

- Simulation of energy grids
- Analysis of grid failures
- Integration of renewable energy
- Innovative grid management
- Wind energy research

APPLICATIONS

- Energy production
- Energy transport

CONTACT

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Prof. Dr.-Ing. István Erlich

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The Institute of Electrical Power Systems deals with the computation, control and operation of electrical power grids with a special emphasis on the integration of renewable energy especially wind power. Prof. Istavan Erlich and his 18 staff members work in close cooperation with various industrial partners and take part in the well-known Model Region Project (Projekt Modellregion E-De-Ma) which is to enable the Institute to take an active part in energy trade. The institute is also a partner in the electro-mobility project “cologne-mobil”.

The courses provide knowledge related to the primary and secondary components of electrical power grids and their characteristics. In addition, students will gain knowledge about IT, about energy markets as well as energy production. The importance of wind energy is exemplified through a specialized lecture which includes a class in an application lab based on a wind generator test rig.

Research activities concentrate on the simulation of energy grids, the analysis of grid failures, and the integration of renewable energies into the grid as well as innovative grid management technologies. Different software tools are available to support calculations of the static and dynamic state of the grid as well as measurement systems to determine the quality of the grid.

Practical applications include the improved connectivity of wind generators and wind farms to the grid as well as the optimization of the control systems of wind generators. Another comprehensive area of work is supporting the planning and operation of power plants and grids.

ELECTRONIC COMPONENTS AND CIRCUITS

Prof. Anton Grabmaier and his team are working in the areas of future technologies such as micro and nanotechnology or multi-physical sensor technology. The focus is on applikations such as medicine, automation and automotive. The Institute is closely linked to the Fraunhofer Institute of Micro-electronic Circuits and Systems which is also led by Prof. Anton Grabmaier.

Students will learn about analog and digital circuits, CMOS technologies as well as the design, layout and programming of embedded systems. Further competencies are in the areas of micro and nanosystem technologies, packaging and semiconductor device assembly, development methodology and within the area of medical technologies.

Research activities concentrate in the areas of sensor systems and simulation, design and technologies of integrated circuits, packaging and semiconductor device assembly, telemetrics and system interaction as well as in medical equipment technologies and sensor systems. This includes applied research, development and prototyping.

In cooperation with other research centers and industrial partners the Institute is developing new thermal time-of-flight sensors for the measurement of flow rates in fluids or the laser induced annealing of silicon and silicon germanium structures to be used in the post-processing of new semiconductors demonstrating different behavior and properties. The institute also works in the area of medical diagnostic technologies such as the mobile head and eye movement helmet known as Zerviton, wireless EEG concepts as well as on components and systems for medical functional furniture.

COURSES

- Analogue and digital circuits
- CMOS technologies
- Micro and nanosystem technologies
- Embedded systems

RESEARCH

- Sensor systems and simulation
- Design and technology of integrated circuits
- Packaging and semiconductor device assembly
- Medical technologies and sensor systems

APPLICATIONS

- Medical technology
- Industrial sensor systems
- Micro-electronics and micro-systems technologies

CONTACT

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ELECTRICAL POWER TRANSMISSION AND STORAGE

COURSES

- High voltage technologies
- Electromagnetic compatibility
- Performance technologies
- Cable technologies

RESEARCH

- High voltage technologies
- Electromagnetic compatibility
- Powerline Communications
- Power line communication

APPLICATIONS

- High voltage measurement and control
- Smart grids
- Environmentally friendly energy transport

CONTACT

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Institute of Electrical Power Transmission and Storage

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Prof. Dr.-Ing. Holger Hirsch
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Prof. Dr.-Ing. habil. Heinrich Brakelmann
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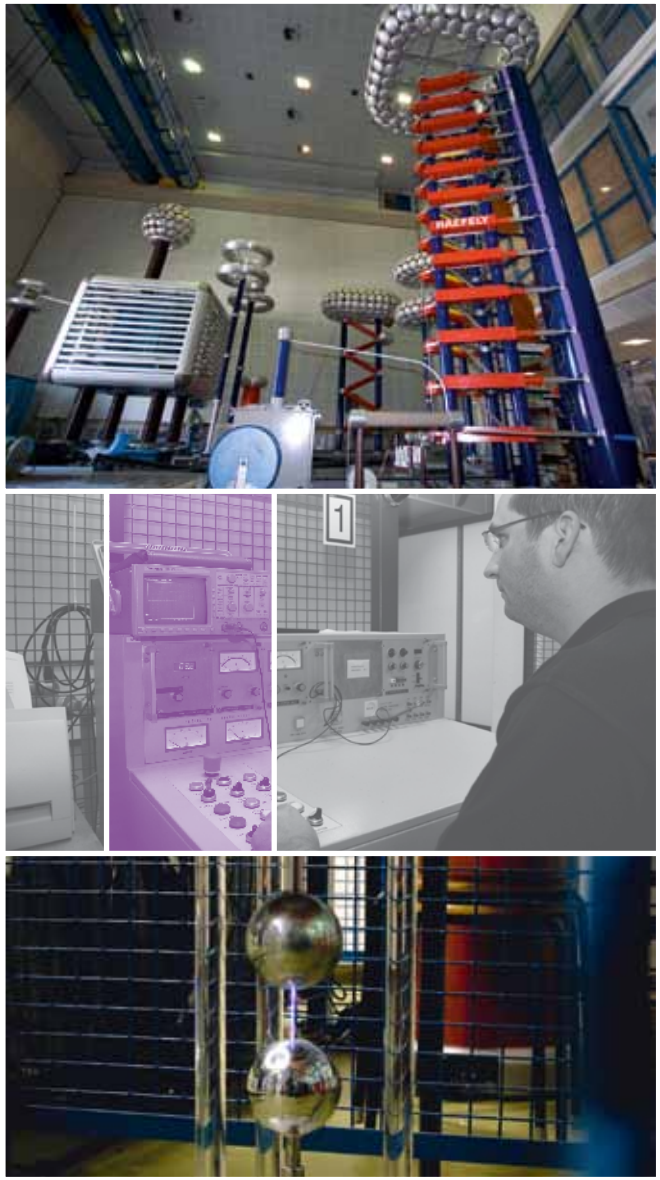
Reliable power grids, integration of off-shore wind parks, electromagnetic compatibility of gadgets as well as communication via power grids are all central themes of the Institute of Energy Transport and Storage. Prof. Holger Hirsch, his deputy Prof. Heinrich Brakelmann and the 15 team members are working on two E-Energy Model Regions and also on a federal project financed by the Ministry for the Environment, Nature Conservation and Nuclear Safety called “Innovative Concepts/Electrical Infrastructure”.

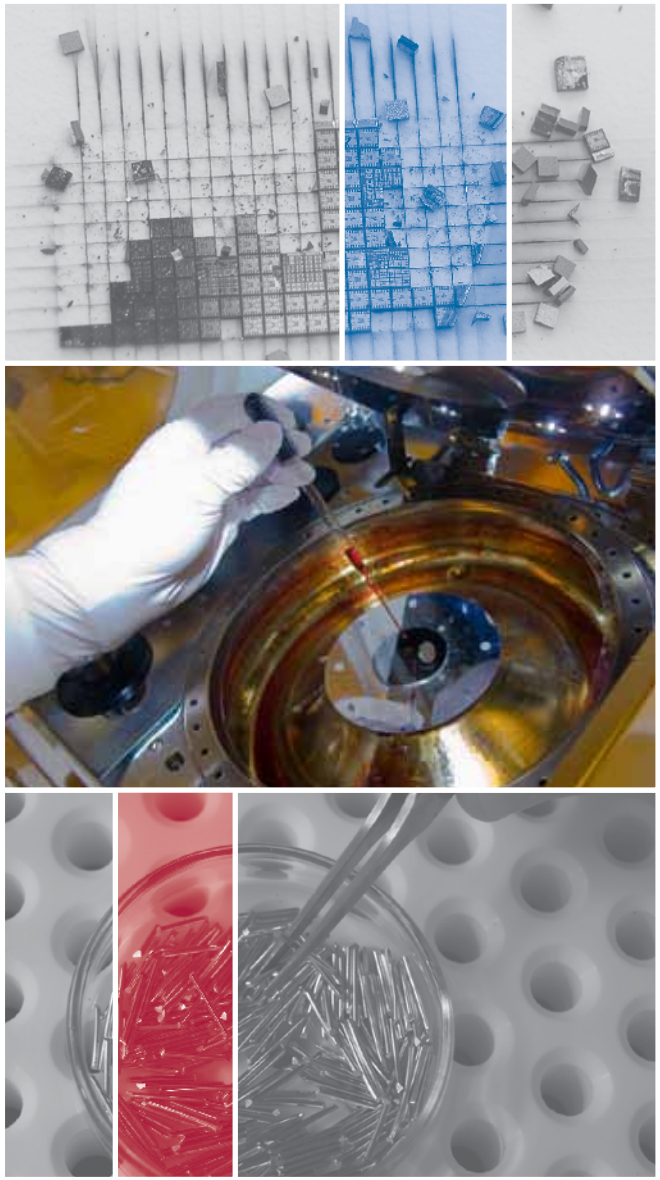
The students are taught about the problems and the solutions related to electromagnetic compatibility, electrical energy transfer, the application of electrical energy and they become familiar with the IT techniques used in power grids.

Main research areas include high voltage technology, electromagnetic compatibility, information technology as well as transport and distribution of electrical energy. These research projects often include issues related to constructional details and material science, for example in the development of sensors or new cable technologies, but also in the development of measurement and testing procedures for electromagnetic compatibility.

Practical applications include for example calculation of electrical and thermal field distributions, field management in high voltage equipment or high speed semiconductor switches. In the area of high voltage cables, the Institute is developing methods for optimizing the connectivity of off-shore wind parks, where monitoring and loading diagnoses of cables are now being applied world-wide. The marketing of power line communication production has been made possible by the Institute’s work on electromagnetic compatibility.



SOLID STATE ELECTRONICS



Modern semiconductors revolutionized electronics more than 50 years ago. Today integrated circuits, photovoltaic cells, sensors and optoelectronics would be unimaginable without semiconductor technology. Semiconductor research and its development are core areas of work of Prof Franz Josef Tegude and his 18 staff members. This team took part in the Collaborative Research Center SFB 445 “Nanoparticles from the gas phase”, and is a member of the Centre for Nano Integration of Duisburg-Essen (CeNIDE), and of the competence network known as OpTech-Net e.V.

The courses taught will provide fundamental knowledge of electronic components and circuits, solid state electronics, nanoelectronics and nanostructuring. The students are also trained on applications of electronic components and circuits as well as circuit simulation and circuit calculations for directed current, low and high frequency applications.

Areas of research include the development, production, simulation and characterization of high and highest frequency components and circuits on III-V Semiconductors preferably based on indium phosphide being applied in hetero-structure field effect and bipolar transistors, resonant tunneling diodes, and photodiodes. Further key research areas are the development, production, simulation and characterization of nanomaterials, nanostructures and nanocomponents like nanotransistors, solar cells and light emitters.

Applications are particularly in communication technology and in the field of renewable energies.

COURSES

- Components and circuits
- Nano electronics and nanostructures
- Fundamentals of solid state electronics
- Circuit simulation and calculations

RESEARCH

- High and very high frequency circuits
- Nano materials, nanostructures and nanocomponents

APPLICATIONS

- Communication technologies
- Energy technologies
- Renewable Energies

CONTACT

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MICROWAVE AND RF TECHNOLOGY

COURSES

- Electrical circuits and applications
- Radio waves
- Microwave and RF technology
- CAD and CAE tools

RESEARCH

- RF circuits for radio and radar
- Antenna designs
- RF components for 7 Tesla MRT

APPLICATIONS

- Mobile communications
- Radar
- Medical technologies

CONTACT

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Prof. Dr.-Ing. Klaus Solbach

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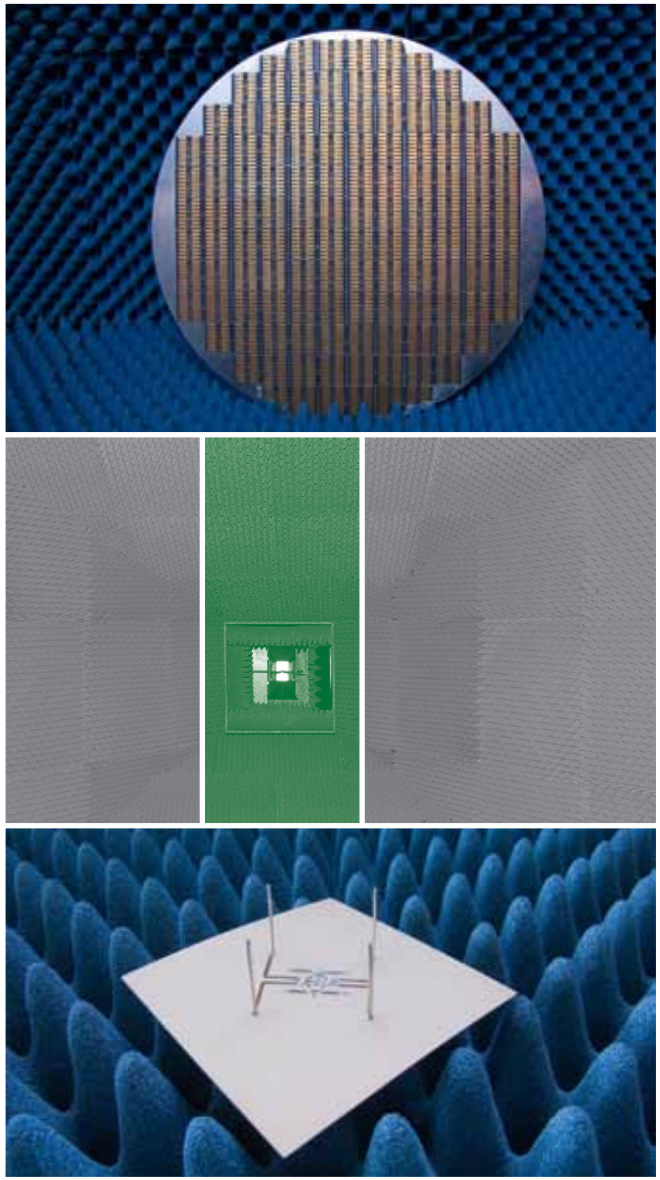
At the Institute of Prof. Klaus Solbach his 10 staff members are developing antennas and high frequency components. The Institute has a close cooperation with the Erwin L. Hahn Institute in Essen for Magnetic Resonance.

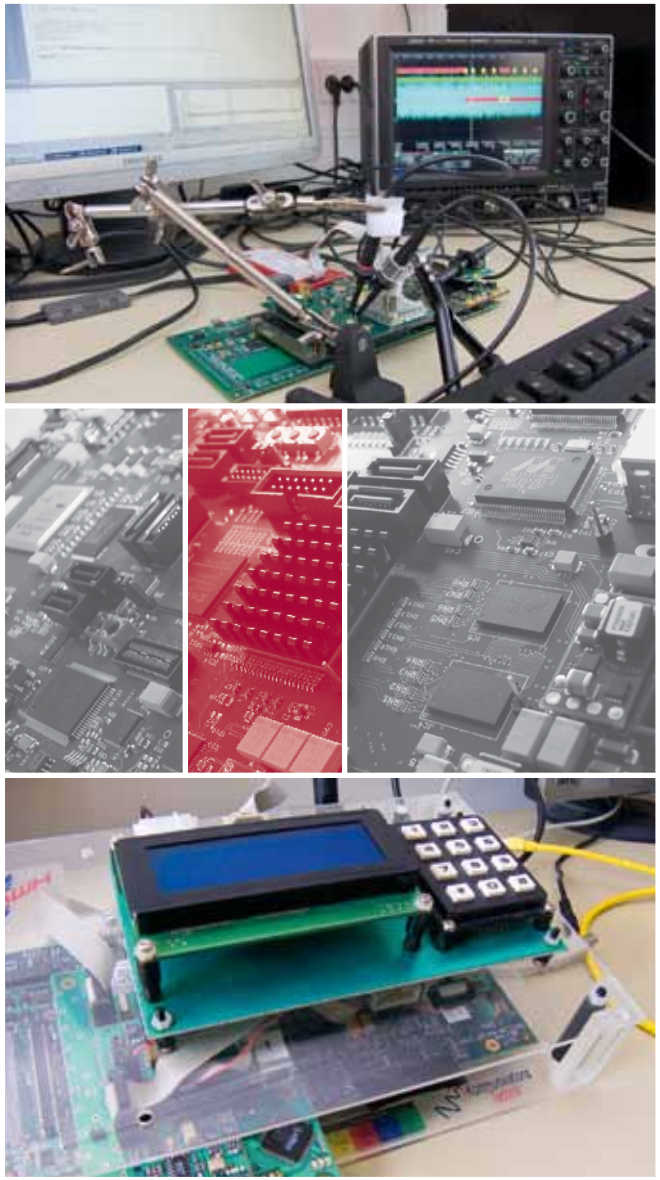
The students develop a fundamental understanding of electrical circuits for microwave and RF technology and in specialized mathematical methods related to RF electronics and microwave circuits. The behaviour of waves on transmission lines and of radiated waves in free space are also imparted. Students further benefit from the use of CAD and CAE Software, specialized microwave measurement equipment, computer based simulation tools and the facility to create printed circuit boards based on their own circuit designs.

The institute investigates specialized designs of antennas for communications and radar applications from the short range microwave systems to long range short-wave systems, such as the electronically controlled beam scanning antenna array. One aspect of this work is to understand the way currents on the antenna platform interfere with the radiation from the antenna elements. In addition, radio frequency apparatus and components are designed, simulated, built and calibrated for applications in magnetic resonance research. This helps to provide a high resolution magnetic resonance image in the new generation of 7 Tesla MR Tomography.

The results of these research activities are applied in various areas such as mobile communications, radar sensor systems and bio-medical technologies.



COMMUNICATION TECHNOLOGIES



The technical advancement of mobile communication systems is an important area of activity for Prof. Peter Jung and his team of 16 staff members at the Institute of Communication Technologies.

Students will learn the fundamentals of technical communication standards. Modeling and simulation of communication systems and networks, Hardware-Software-Co-Design, the realization of communication demonstrators as well as integrated chips for communication systems are part of the teaching curriculum. Additionally the students will be taught about software radio, the development of platform independent system software and applications as well as about embedded systems.

Research activities within the institute deals with the development and realization of multi-media applications, innovative protocols for communication networks, innovative transmitter and receiver concepts as well as solutions for software radio, software defined radio, cognitive radio and cooperative radio. Further topics of research are multi-sensor systems and innovative concepts for transmission technologies.

Typical industrial applications are found in communication technologies, microelectronics, the automobile industry, the production of sensors and batteries and in the area of grid operation and servicing.

COURSES

- Fundamental communication technologies
- Modeling and simulation
- Hardware/software design
- Software radio

RESEARCH

- Multimedia applications
- Protocol for communication networks
- Sender / Receiver concepts
- Software radio

APPLICATIONS

- Communication technologies
- Micro-electronic industries
- Automobile industry

CONTACT

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COMMUNICATION SYSTEMS

COURSES

- Mathematical basics
- Transmission techniques
- Coding theory
- Wave propagation

RESEARCH

- Multi-antenna radio systems
- Adaptive multicarrier transmission techniques
- Technical safety systems

APPLICATIONS

- Mobile radio communications
- Fire detection

CONTACT

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Prof. Dr.-Ing. Andreas Czylwik

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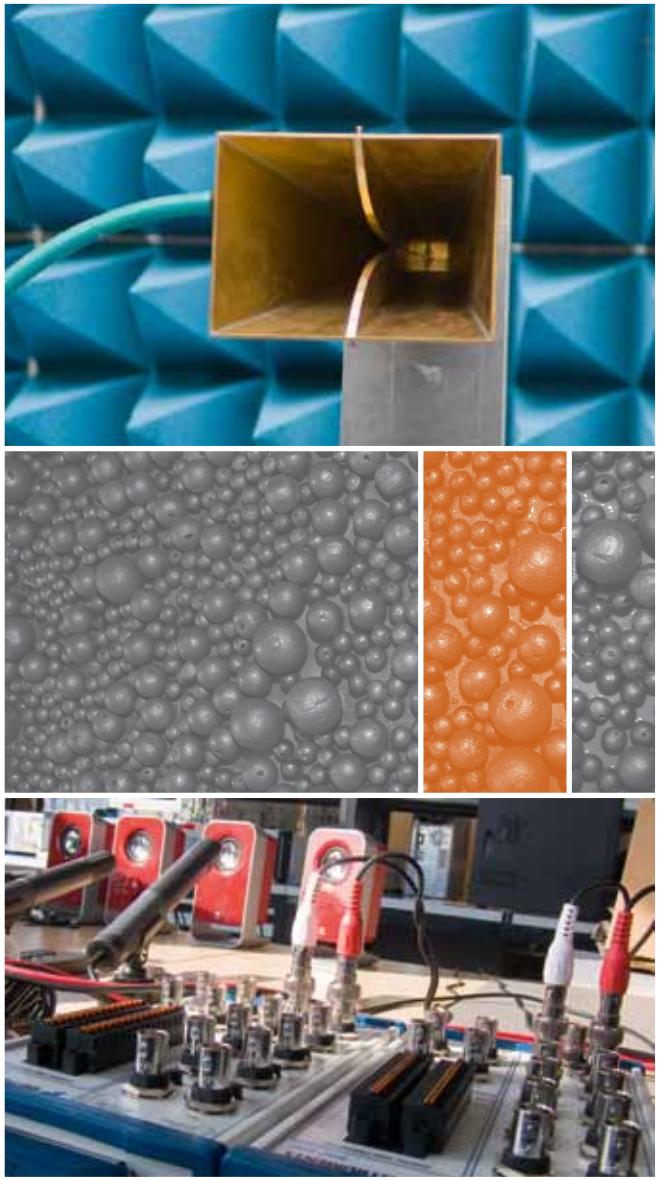
Prof. Andreas Czylwik and his 27 staff members at the Chair of Communication Systems are primarily working on the development of multi-antenna mobile radio systems and fire detection systems.

Fundamental mathematics to describe linear systems and stochastic signals are part of the curriculum of the Institute. Additionally, fundamental and specialized knowledge related to communication systems is also imparted. This includes transmission techniques, coding theory, radio wave propagation, OFDM systems as well as analogue and digital filters.

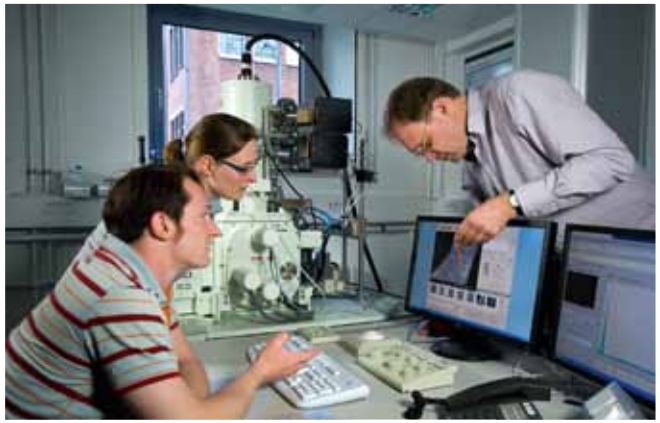
Research activities include mobile radio communication using multi-antenna systems (so-called MIMO systems – multiple input multiple output) where on the one hand focus is on single communication links. A deciding factor for the communication quality is the automatic adaptation of the transmission technique to the time varying transmission characteristics of the radio channel. On the other hand, whole cellular systems are investigated and optimized. The aim is to serve as many mobile stations per radio cell as possible. Further research areas include synchronization and ultra-wideband transmission technologies.

In the area of signal detection and signal processing for technical safety systems, a fire detection laboratory is available to develop, analyze, and test different sensor technologies. The fire detection laboratory is a unique facility at a university in Europe. In addition, ultra-wideband signals (UWB) are used for identification and localization of materials.

Research results can be applied in future mobile radio systems with higher data rates and higher reliability as well as in the area of fire detection technologies.



NANOSTRUCTURES TECHNOLOGIES



The Institute of Nanostructures Technologies (NST) deals with the synthesis and deposition of nanoparticles and their subsequent treatment into nanoscale thin films and bodies. Prof. Roland Schmechel and his team of 25 staff members investigate in particular the electrical, thermal and optical characteristics of the nanoproducts, to enable their use in specialized components.

The institute is part of the special research program SFB-445 “Nanoparticles from the Gas Phase” as well as the CeNIDE and NETZ networks. Prof. Schmechel is also the acting vice director of both these networks.

The courses offered by the Institute provide knowledge about the layout of plants for the production and deposition of nanoparticles and enables the characterization of their structure and morphology. Students will also learn how to produce functional thin films as well as the electrical, photo-electrical and thermo-electrical characterization of the nanostructures.

Research activities of the team concentrate on the development of electro-technical applications for nanoscale functional materials.

Practical applications range from the development of conductive plastics in the form of printable electronic thin films, photovoltaic development, emission-neutral production of energy from heat, and up to the broad areas of coating technologies.

COURSES

- Production deposition of nano particles
- Characterization of nano particles
- Production of functional thin films
- Characterization of thin films

RESEARCH

- Nano-scale functional materials in electronics

APPLICATIONS

- Printable electronics
- Thermo-electrical energy conversion
- Coating Technologies

CONTACT

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OPTOELECTRONICS

COURSES

- Fundamentals of optoelectronics
- Optical communications technology and signal processing
- Semiconductor technologies

RESEARCH

- Optical communications
- Ultra-fast photo detectors and mixers
- Micro light emitting diodes
- Nano particle based solar cells

APPLICATIONS

- Mobile communications
- Measurement and radar technologies
- Communication technologies

CONTACT

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Dr.-Ing. Andreas Stöhr
(Acting Head of Chair)

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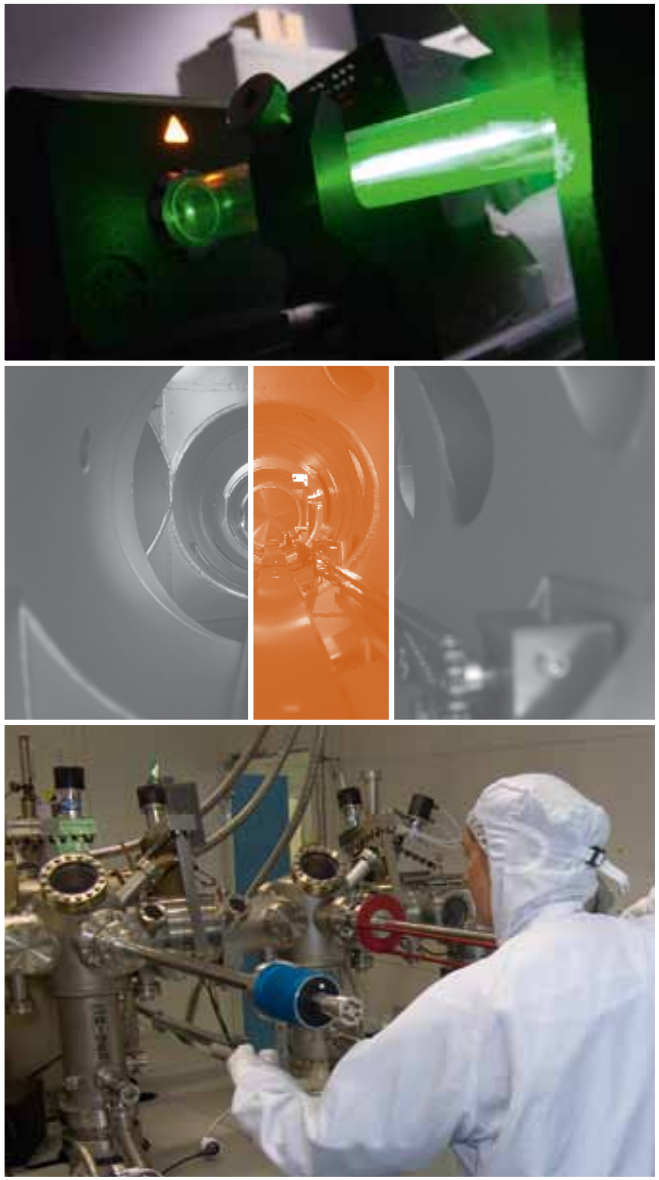
The institute, with its 25 staff members, belongs to the Centre for Semiconductor Technology and Optoelectronics and has access to a first class technical infrastructure, including a clean room with 470 m² area. The institute is involved in the Centre for NanoIntegration (CeNIDE) and in the NanoEnergy Technologies Centre NETZ.

Students learn the fundamentals of optoelectronics, optical communications technology, optical signal processing, and optical networks as well as semiconductor technology, optoelectronic components, and display and lighting technology. In addition, lasers and medical engineering, photovoltaics, as well as glass (GOF) and polymer optical fiber (POF) technology form part of the educational program.

In the area of micro- and millimeter-wave photonics, the Institute works on fiber-based optical signal generation and transmission (radio-over-fiber). The team investigates ultra-fast photo-detectors and photo-mixers as well as the development of micro light emitting diodes and photovoltaic cells for optoelectronic semiconductor components. Further research is in the field of solar cells based on silicon nanoparticles. Additionally, hard and software components as well as systems for POF-based in-house communication networks are being developed here.

The institute also cooperates with industrial partners in the development of fibre-wireless backhaul access networks for mobile communications systems beyond 3G, terahertz transmitters for short distance communication, measurement and radar technologies for earth and space surveillance systems, as well as components for domestic cabling using polymer optical fibres.



COMPUTER ENGINEERING

The Institute of Computer Engineering is strongly multi-cultural with courses offered mainly in English. Prof Axel Hunger and his team of 10 operate the Mercator Office and Global Engineering Labs in the University of Kebangsaan Malaysia (UKM) and the University of Indonesia as well as maintain the UKM International Office in Duisburg. They also participate in the Network of European and Global Engineering Education (EUGENE).

The courses offered by the institute will provide professional skills in the area of digital circuits and programming. In higher semesters, the topics dealt with will cover digital systems and computer technologies, operating systems and computer networks.

The Master's courses offer special themes such as computer-supported group work, reliability and testing of digital circuits and systems as well as advanced computer architecture. Research is characterized by the development and processing of inter-disciplinary research areas. The development of new tools and services for tele-cooperation is generally influenced by the background of other cultures, mentalities and markets. One of the central themes at the Institute currently is supporting the industry in the area of global engineering. To this the internet and special interaction mechanisms are employed to integrate key aspects of social and cultural communication into the technical tools.

Applications of research are therefore the development of methods and tools for use in global engineering, inter-cultural communication in engineering sciences and the internationalization of foundation and advanced curriculum for engineers.

COURSES

- Digital circuit technologies and programming
- Digital systems and computer architecture
- Operating systems and computer networks
- Computer Supported Cooperative Working

RESEARCH

- Global engineering
- Tele-cooperation services and tools
- Technologies and internationalization

APPLICATIONS

- Methods and tools for global engineering
- Inter-cultural communication
- Internationalization of engineering education

CONTACT

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Prof. Dr.-Ing. Axel Hunger

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ELECTRONIC MATERIALS AND NANOSTRUCTURES

COURSES

- Nano technologies
- Modern materials and measurement technologies
- Nanostructures
- Production and analysis of nanostructures

RESEARCH

- Nano materials and nano analysis
- Nano opto-electronics
- Innovative light emitters
- Spintronics

APPLICATIONS

- Material and component analysis at the nanolevels
- Innovative light emitters
- Nanoenergy technologies

CONTACT

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and Nanostructures

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Prof. Dr. rer. nat. Gerd Bacher

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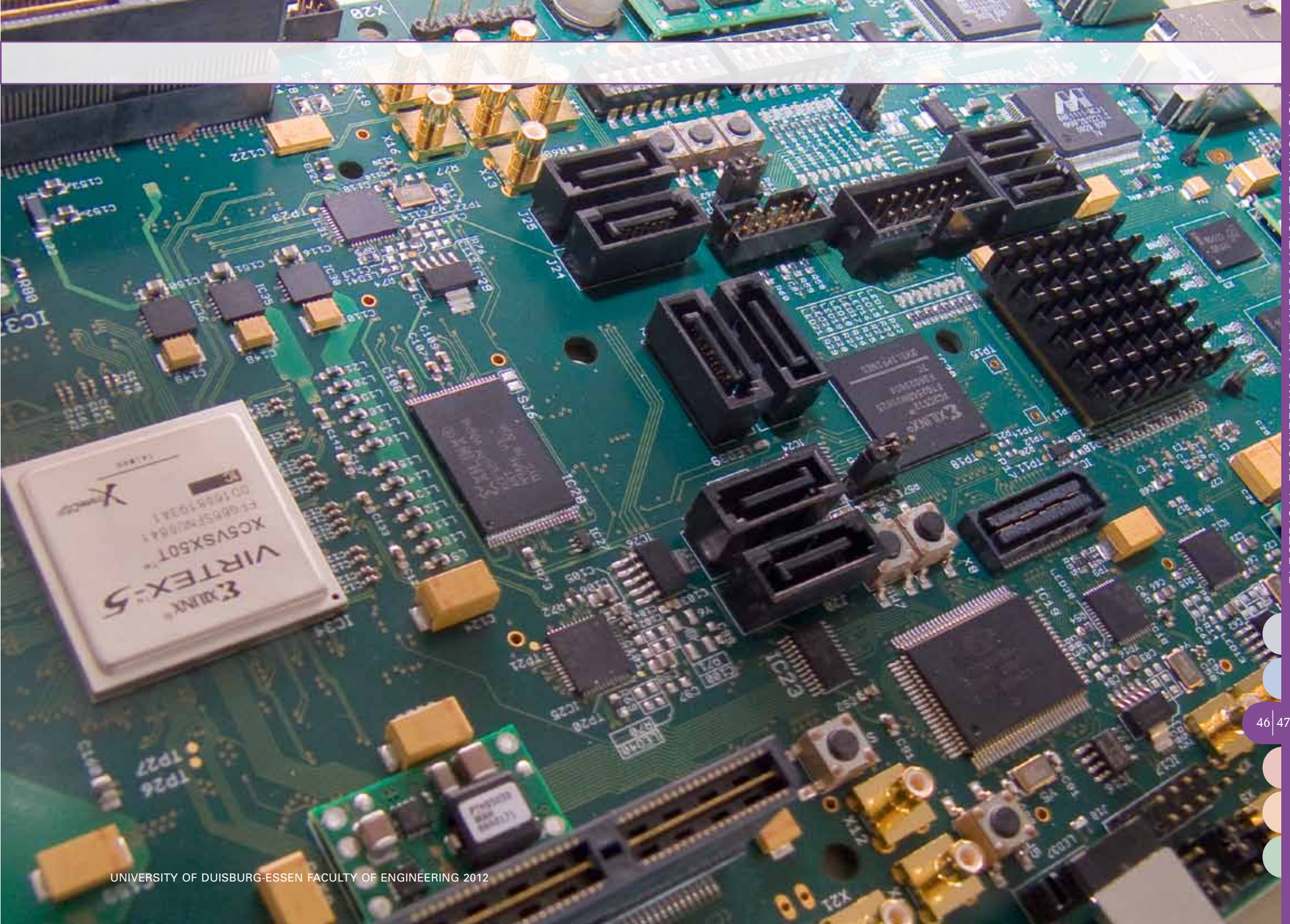
Prof. Gerd Bacher and his 25 staff members work on nanostructures mainly for applications in the opto-electronic field, spintronics and energy technologies. The team also takes part in the Collaborative Research Centres 445 and 491, the GRK 1240, the EU Program NaSoL, the DFG Program 1285, and the inter-disciplinary NanoNetwork known as CeNIDE based at the University of Duisburg-Essen.

The courses cover the fundamentals of materials and nanotechnologies as well as the utilization and application of nanoscale components. In addition to this the Institute introduces students to the broad areas of development, production and analysis of nanostructures. As part of this education extensive practical training is given to students on modern large-scale machinery, some of which are made available exclusively for students. Furthermore a number of projects at the Institute offer the students a chance to take active part in research topics.

The team works on the development of innovative light emitters based on nanoparticles, nanowires and quantum dots and is engaged in the structural, optical and electrical nanoanalysis of opto-electronics and nanoelectronic components. Further themes within the institute are magnetic semi-conductors and ferro-magnetic semi-conductor hybrids for use in spintronics as well as the optical and electrical controls of the spin states in semi-conductors for spintronics and quantum information technology.

The institute cooperates with a number of technological companies in the analyses of material and component at the nanometer scale. Innovative light emitters are used in general lighting and in special applications of communication technology.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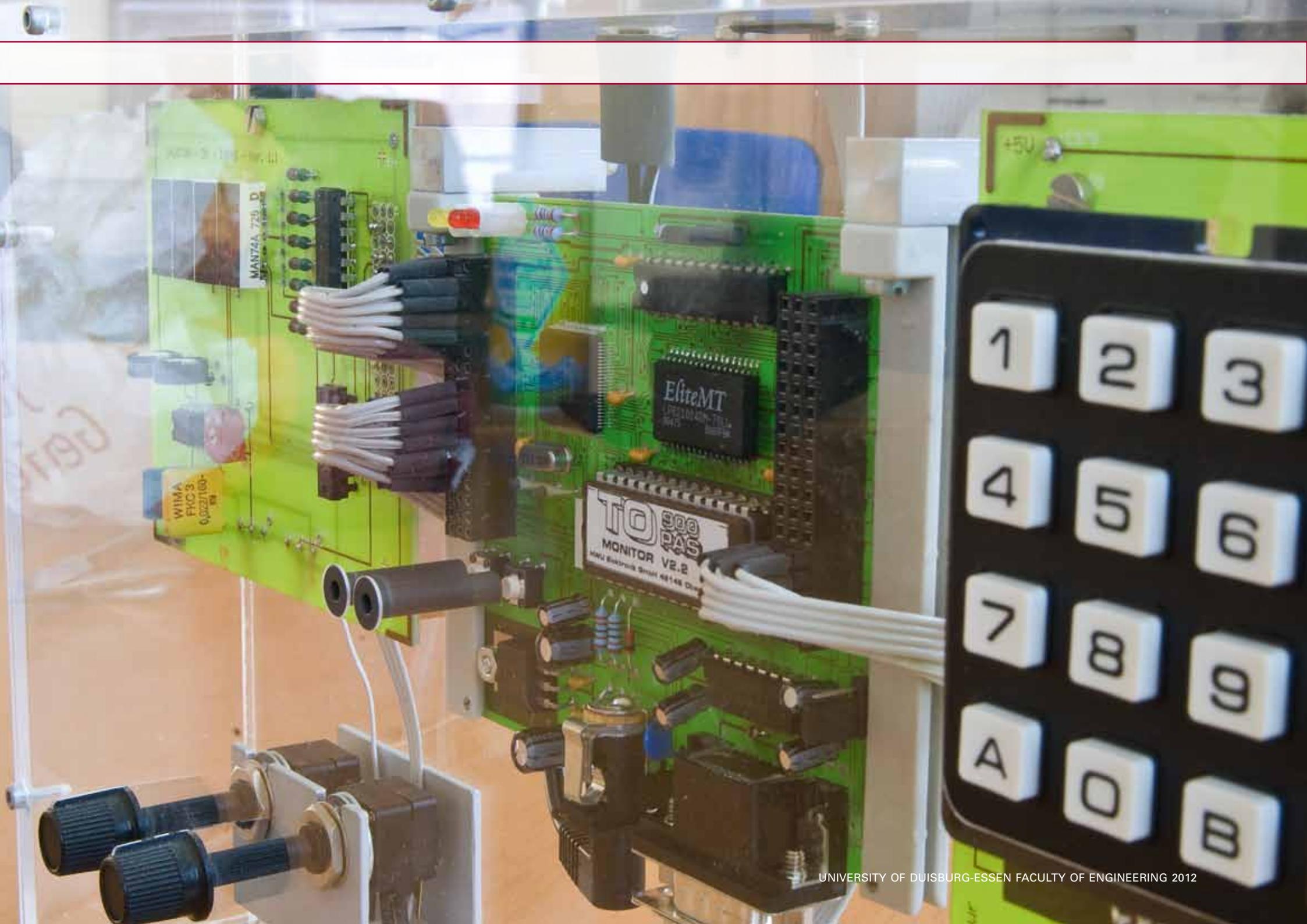
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COMPUTER SCIENCE AND APPLIED COGNITIVE SCIENCE

Information and communication systems are constantly becoming more powerful. For modern computer science, a major challenge consists in enabling users to exploit this potential in an easy and efficient manner. Innovative interaction techniques, well-designed user interfaces and user-oriented development processes are crucial for attaining the goal of human-centered information and communication technology. The Department of Computer Science and Applied Cognitive Science pursues this goal by its specific combination of research areas and interdisciplinary focus.

To create synergies between the different research areas, the department has taken an integrated, interdisciplinary approach by incorporating 12 professorships in computer science as well as 3 psychological research groups. Close cooperation is especially focused on the area of interactive systems and media which constitutes the major research area of the department.

The main application areas are found in the engineering and natural sciences as well as in interactive media technologies. The core theme of interactive systems is investigated in a broad range of fields, such as information retrieval and exploration, knowledge management, intelligent learning and tutoring systems, speech technology, adaptive web applications, or human-robot cooperation. A second key theme is the development of reliable distributed and embedded systems. Synergies between cognitive science and computer science are furthermore exploited in areas such as computer vision and neural networks.

The department offers three consecutive Bachelor's and Master's degree programs at present. Applied computer science provides a solid theoretical and practical training in informatics with a bias towards practical applications. Specializations in the areas of distributed reliable systems, intelligent technical systems and scientific computing, interactive and cooperative systems as well as information engineering are currently being offered by the Master's courses. The interdisciplinary study program Applied Cognitive and Media Science (Komedia) imparts knowledge and skills in computer science and psychology, complemented by courses in business administration. In this program, a central position is given to the theme of interactive systems and human-computer interaction. The program of Computer Engineering (Bachelor's/ Master's) within the framework of the International Studies Program (ISE) is more strongly orientated towards technical aspects.

COMPUTER GRAPHICS, IMAGE PROCESSING AND SCIENTIFIC COMPUTING

COURSES

- Scientific computing
- Algorithms and data structures
- Computer graphics and 3D modeling

RESEARCH

- Multi-media systems and interaction
- Interval methods

APPLICATIONS

- Robotics and material technology
- Biomechanics
- Virtual 3D environments

CONTACT

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Prof. Dr. Wolfram Luther

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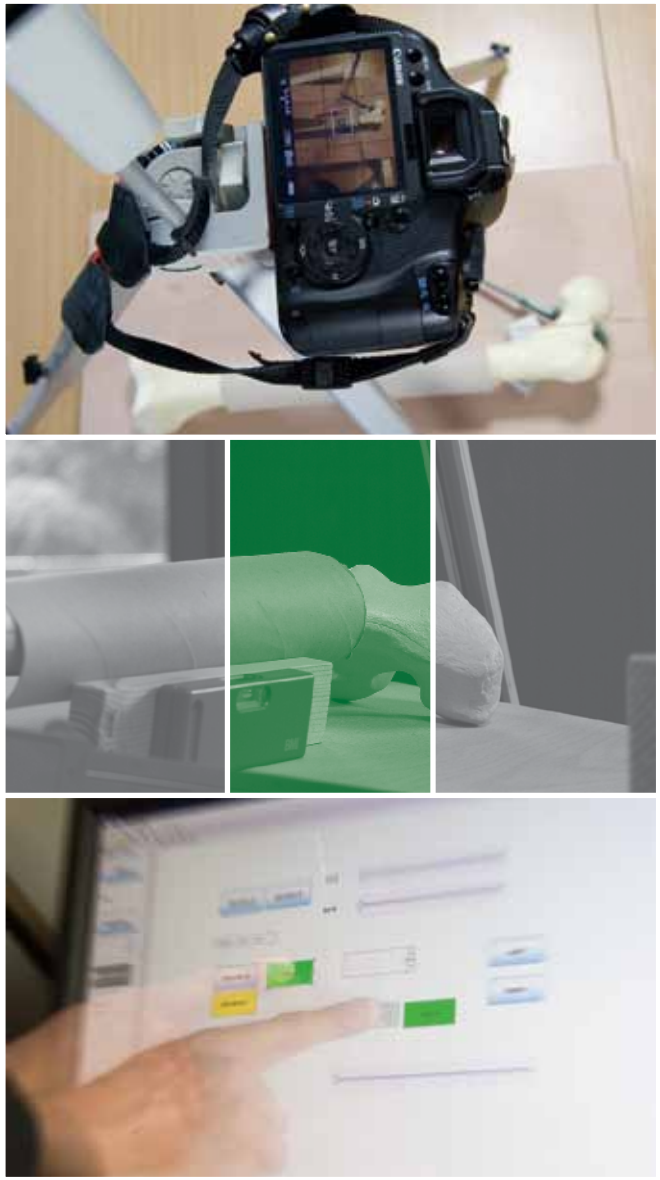
The main research areas of the chair are computer graphics and scientific computing with a special focus on the development of numerical algorithms for computer-based theorem proving and result verification. Prof. Wolfram Luther and his team of ten work on a number of subjects ranging from mechatronics to the creation of virtual museums. Additionally, the group participates in the international standardization of interval arithmetic.

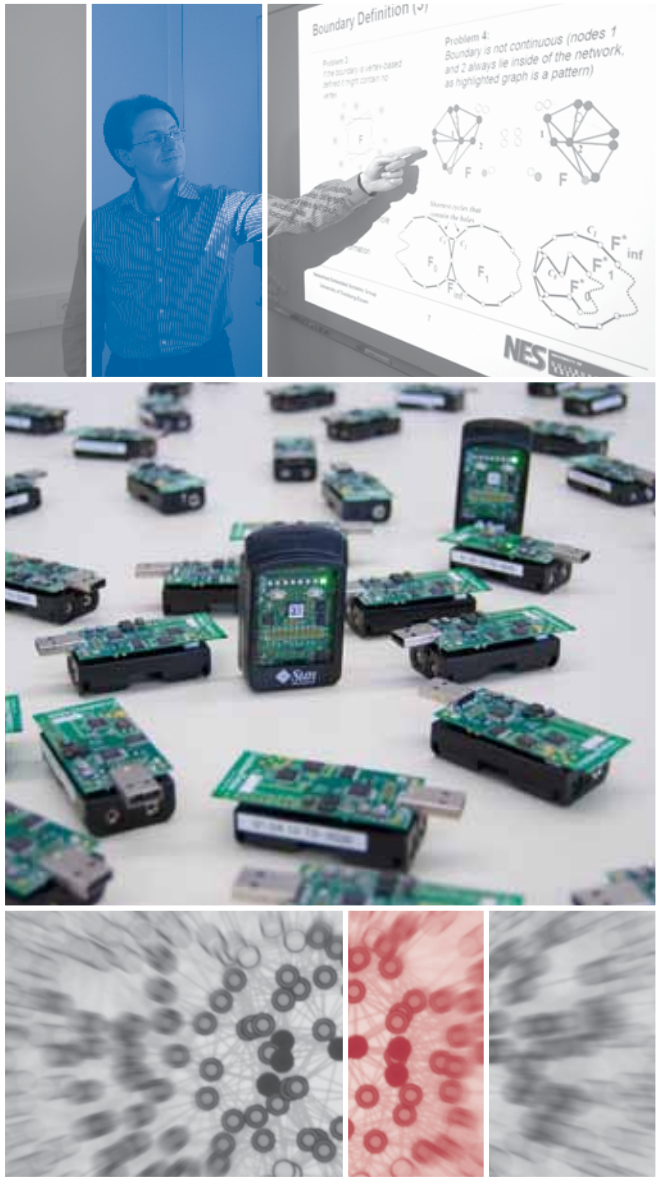
The teaching program comprises of the fundamental courses relating to operating systems and cryptography, algorithms and data structures as well as special lectures on computer arithmetic and scientific computing, computer graphics and image processing, 3D modeling and visualization.

The Institute is currently working on reliable numerical, geometrical and stochastic modeling. In one particular approach the models are stored in hierarchical data structures thereby allowing the visualization of larger data volumes in real time. Further activities relate to the development of formal methodologies for the description and reconfiguration of human-machine interaction as well as on the control and visualization of algorithms, protocols and complex processes.

Research results from this department can be used in the fields of mechatronics, control systems and biomechanics. Further areas of application are communication technologies, material technologies as well as virtual museums and laboratories.



NETWORKED EMBEDDED SYSTEMS



Embedded systems are already ubiquitous and will be increasingly interconnected in future. Equipped with sensors and actuators, they will perceive and manipulate their environment. As a fundamental building block for intelligent systems, they will, for example, be able to turn on and off or control different devices without human intervention. Such networked embedded systems is the research area of Prof. Dr. Pedro José Marron and his 13 staff members.

The institute offers lectures in embedded systems and sensor networks. Furthermore, they offer different courses in pervasive computing which aims at enabling distraction-free support for human tasks by means of networked devices that are embedded in everyday objects, including the specifics of software development for resource-limited devices. From a developer's perspective, networked embedded systems are introducing a new set of challenges. Instead of solving a well-defined task in a tightly controlled environment, they must be able to adapt to changing tasks and be able to detect and cope with imprecise or false information. This requires the improvement on existing as well as the development of new techniques to design, program and test such systems. To this end, the group is developing novel algorithms, platforms, models and tools to support the complete lifecycle of such networked embedded systems.

The application areas for networked embedded systems likely to be major drivers among others are home automation, smart cities or support systems for elderly people.

COURSES

- Embedded systems
- Sensor networks
- Pervasive computing

RESEARCH

- Development of new algorithms
- Platform development
- Modeling

APPLICATIONS

- Smart cities
- Localization
- Development of system software

CONTACT

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INFORMATION SYSTEMS

COURSES

- Information engineering
- Information retrieval
- Information mining

RESEARCH

- Information retrieval
- Digital libraries
- Web-based information systems
- User interfaces for information systems

APPLICATIONS

- Web search
- Enterprise search
- Business intelligence

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Prof. Dr.-Ing. Norbert Fuhr

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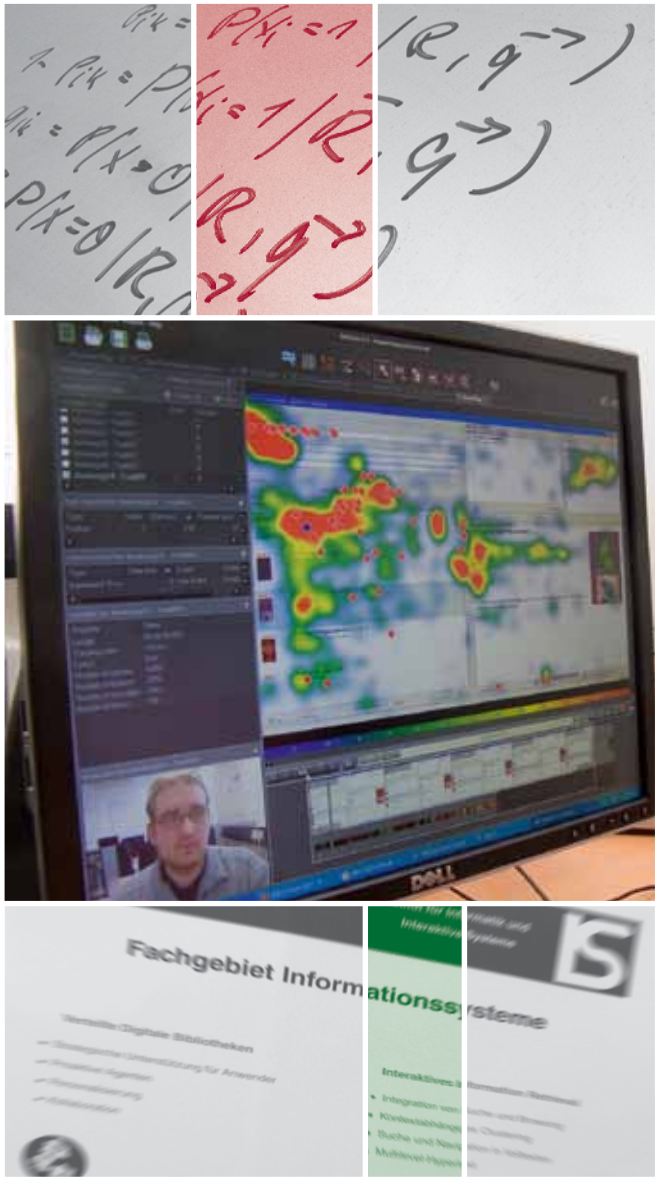
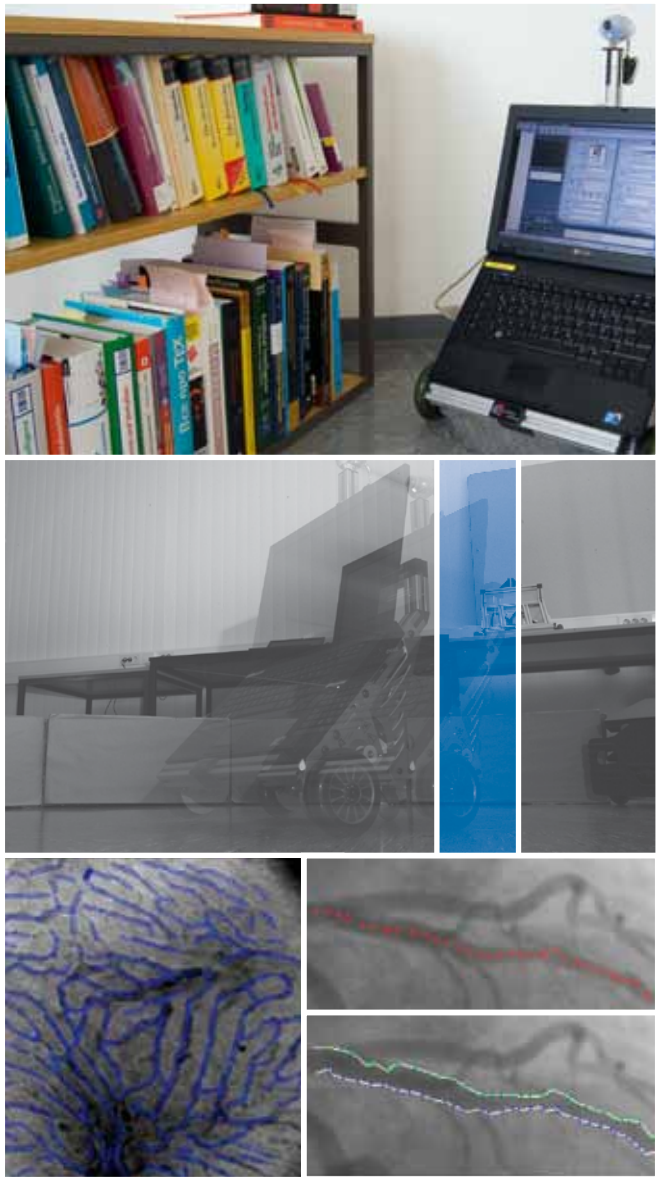
Collective knowledge is growing exponentially and this is mainly due to the digitalization of information occurring worldwide. The vast amount of information in companies is still available in text form. This large potential is hindered by the lack of user-friendly and effective methods of information access and retrieval. The Institute of Information Systems works on technical methods and solutions to enable more effective organization and access. Prof. Norbert Fuhr and his 6 staff members are also participating in the projects Khresmoi (Medical imaging analysis and information retrieval), CAIR (semantic Cluster Analysis in Information Retrieval) and HIR (High Interactive Information Retrieval).

Students will learn technologies related to the preparation, processing and distribution of information in a scientific environment. They will also work with models and methods to search for information in documentary archives, such as those found in companies or in the web, and apply methods for the extraction of implicit knowledge from raw data (Data Mining) or Text (Text Mining).

Key areas of research in the Institute include information retrieval, digital libraries and web based information systems, with a special emphasis on user-oriented research approaches. The research results have an influence in the areas of web search, enterprise search and business intelligence.



INTELLIGENT SYSTEMS



Many products and production processes today are already inspected and controlled by intelligent algorithms, which however are based on simple mathematical models suited for simple or restricted environments. Prof. Josef Pauli and his staff members are working on the conception and development of systems that can adapt their behavior in complex, dynamic environments: machines which can see, act and learn themselves beyond their basic programming. The group participates in research projects of product engineering and medical technology.

The curriculum at the chair of intelligent systems motivates the students to realize visual perception devices and intelligent acting systems. This includes data processing in real time as well as the processing of unreliable data and the automatic adaption of systems to changing conditions.

Research activities are concentrated in three main areas: machine vision, algorithmic learning and cognitive robot systems. The aim is to develop technical systems with extended cognitive abilities allowing a more autonomous and flexible behavior of the systems. These systems have a wide spectrum of applications and will ensure easier accessibility, handling and maintenance.

Applications can be found especially in semi-automatic guidance systems for tools, instruments and cameras as well as in the inspection and surveillance of plants, rooms and production processes, and in medical diagnostics and therapeutic support.

COURSES

- Computer/Robot vision
- Neural network learning
- Cognitive robotic systems
- Real time systems

RESEARCH

- Adaptive image processing
- Robotic learning
- Design patterns for intelligent systems

APPLICATIONS

- Product engineering
- Medical technology
- Process surveillance

CONTACT

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INTERACTIVE SYSTEMS AND INTERACTIVE DESIGN

COURSES

- Interactive system
- Human-computer interaction/usability engineering
- Intelligent user interfaces
- Electronic business

RESEARCH

- Multi-modal interactive technologies
- Intelligent context-adaptive Systems
- Information visualization

APPLICATIONS

- E-Commerce
- E-Services
- Entertainment/Serious Games

CONTACT

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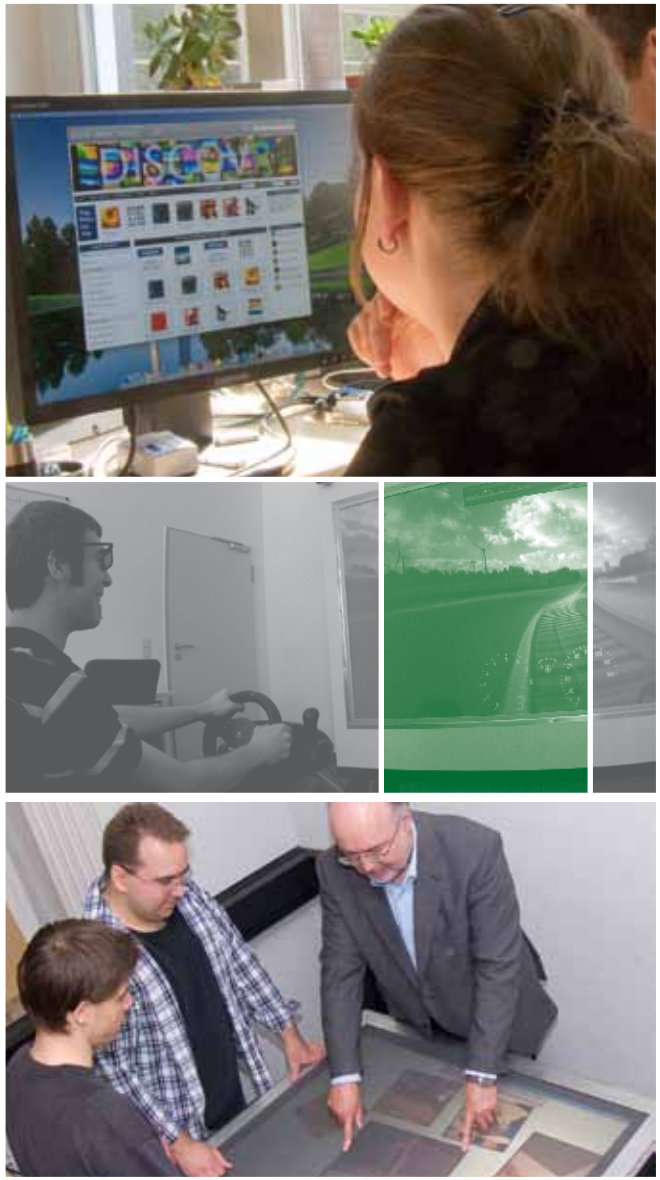
The Interactive Systems Research Group headed by Prof. Jürgen Ziegler works in the areas of human-computer interaction, engineering of interactive systems and context-adaptive user interfaces. The team consists of 15 staff members (graduate and postgraduate) and participates, among others, in the Joint Project "Context-adaptive interaction in cooperative knowledge processes" funded by DFG, a project in the area of electro-mobility as well as a European project on community orientated game technologies for elderly people.

The group places particular emphasis on teaching knowledge and methods for the development of user-friendly human-technology interaction. User-centered design and usability engineering are, therefore, of particular importance. In addition, methods and technologies for graphical and multimodal user interfaces as well as intelligent, context-adaptive systems are taught. The study program is completed by courses and projects conveying competencies in areas such as electronic business or knowledge management.

Research deals with human-computer interaction, intelligent context-adaptive systems and information visualization. Key research themes are interfaces using multi-touch and gestures, recommender systems based on semantic techniques and interactive visualization of semantic web data. Further themes are user interfaces and end-user programming of computer games.

Applications can be found in intelligent product recommendations in e-commerce, knowledge management in companies and communities, e-services in the areas of energy-efficient mobility and entertainment applications such as serious games.



COLLABORATIVE LEARNING IN INTELLIGENT DISTRIBUTED ENVIRONMENTS - COLLIDE

The Institute deals with information analysis and modeling of social networks and related interests especially from the research and academic point of view. Prof. Heinz Hoppe and his team of 17 are currently coordinating the BMBF project KoPIWA at the intersection between Competence Development and "Open Innovation" and is also a major contributor in the EU project "Science Created by You".

Central themes of the courses taught are computer-based analysis of communication and interaction in social networks and learning groups, designing interactive teaching and learning systems as well as distributed cooperative systems (CSCW, CSCL). Further courses offered are in the areas of programming techniques, didactics of informatics as well as practical and student projects.

The Institute develops concepts for computer-aided collaborative learning (CSCL), cooperative modeling tools for science based and technical lectures, distributed computer-integrated learning environments/classrooms and intelligent learning support systems. Further themes are computer-aided analysis and social networks, learning process modeling and "Learning Design", semantic models (Ontology) for learning support systems and for competence management.

A network of associated teachers and lecturers in schools and universities work closely with the tools developed within the Institute (especially in conjunction with digital black-boards and mobile appliances). Further research is related to knowledge management in companies. Applications are, among others, innovation management (trend monitoring) and competence development (linked to personnel management).

COURSES

- Interactive teaching and learning systems
- Distributed cooperative systems
- Communication analysis

RESEARCH

- Social network analysis
- Cooperative modeling tools
- Computer integrated learning environments

APPLICATIONS

- Schools
- Universities
- Companies

CONTACT

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Prof. Dr. Heinz Ulrich Hoppe

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DIGITAL COMMUNICATIONS GROUP

COURSES

- Cryptography
- Coding techniques
- Information theory
- Digital systems

RESEARCH

- Digital communications
- Coding techniques

APPLICATIONS

- Power-line communications
- Biometrics
- Digital communications

Prof. Han Vinck and his team are involved in fundamental research in digital communications and data security. The areas of interest include communication theory, multi-user communications, coding techniques, data security, cryptography and the use of biometrics in authentication processes.

Results of actual research are used in the areas of power-line communications, communication - and secure biometric systems.

Prof. Vinck is an IEEE Fellow since 2004.Results of research are used in the areas of digital communication, biometrics, cryptography and data security.

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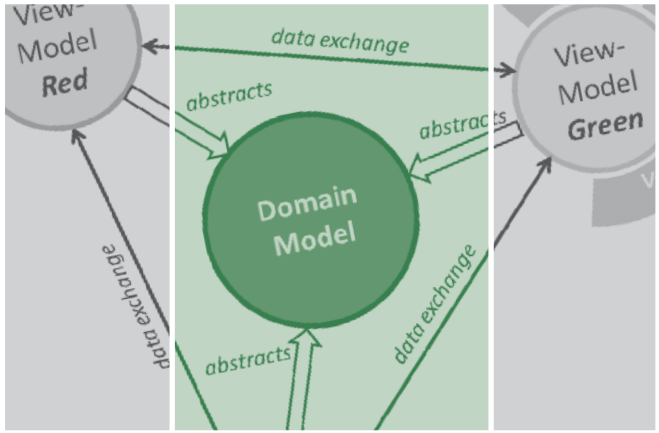

The Entertainment Computing Group, part of the Department of Computer Science and Cognitive Science of the Faculty of Engineering at the University of Duisburg-Essen, is actively involved in research and teaching of multimedia technology with a special focus on digital games.

Founded in October 2008, the group of researchers and students led by Prof. Dr. Maic Masuch, a pioneer of German computer game research, works on innovative ideas for game design/game development and explores the connection between learning and playing. Research topics include stereoscopic 3D in entertainment applications, intelligent tools for the creation and design of interactive worlds and interactive stories, as well as on novel 2D and 3D user interfaces for gaming and non-gaming applications. The group's approach aims both at academic excellence as well as applicability to commercial solutions. Working closely together with game developers, producers, and technology providers, they provide their network with fresh ideas and technical innovations through joint research projects as well as through the support of startups and excellence initiatives.

The courses taught by the Entertainment Computing Group cover a broad range from fundamentals of interactive application and game development, including programming and media design basics, up to more advanced techniques taught at Master's level. Additionally, students are supported in practicing what they have learned through a large number of research projects and seminars, often resulting in innovative interaction concepts and game prototypes. Providing a basic understanding of application and interaction design through the example of digital games is at the heart of this group's teaching.

COURSES

- Digital Media
- Multimedia Systems
- Game Architecture and Design
- Advanced Game Interfaces
- Projects in Digital Game development

RESEARCH

- 3D Stereoscopic Gaming
- User Experience Design
- Game Authoring
- Interaction Design
- Serious Games
- Multimedia Environments for Children and Elderly

CONTACT

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SOFTWARE ENGINEERING

COURSES

- Software engineering
- Pattern and component-based software development
- Development of safe and secure software
- Formal specification of software systems
- Presentation techniques, teamwork

RESEARCH

- Requirements engineering
- Pattern and component-based software development
- Quality-aware software design
- Software security and safety
- Software evolution

APPLICATIONS

- Development of high-quality software
- Certification

CONTACT

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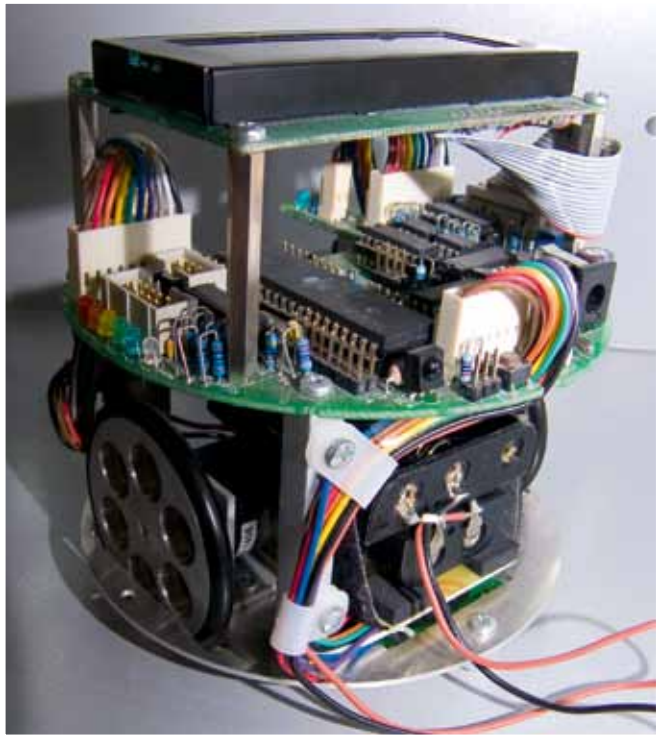
Software development is a complex process. Software Engineering is concerned with the entire process from the analysis of the problem through the solution modeling to the implementation, validation, and maintenance of programs.

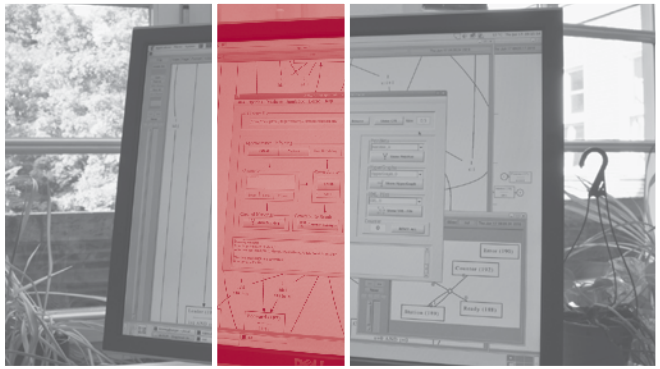
Prof. Maritta Heisel and her team work on principles and systematic methods that aim to develop high quality software. The courses taught comprise the principles of pattern and component-based software development, aiming at the use and reuse of tried and tested solutions and existing software components in the development of new software. In addition to the lectures, seminars and practical courses are also part of the study program. Seminars offer students a first insight into scientific work and a chance to develop their presentation skills. By means of practical courses, theoretical knowledge is applied practically, and the correct use of the necessary tools is trained. Additionally, “soft skills” such as teamwork and time management are also trained.

Research areas include pattern and component-based software development, requirements engineering, quality-aware software design, development of safe and secure software as well as software evolution.

Application areas include the professional development of software solutions as well as software certification according to the international standards “Common Criteria” (ISO/ IEC 15408) and “Functional Security” (ISO/IEC 61508).



THEORETICAL COMPUTER SCIENCE



The Institute of Theoretical Computer Science is led by Prof. Barbara König since 2006. Together with her four staff members, she is working on fundamental techniques for the analysis and verification of computer programs and systems. A key area of her work lies in systems where the structure and topology change dynamically, for which the internet is a typical example.

The courses offered by this institute provide knowledge in the areas of theoretical computer science and logics. In addition, students learn about verification and analysis techniques for software, get acquainted with the theory of concurrent systems and gain foundational knowledge in mathematics.

The Institute of Theoretical Computer Science develops fundamental techniques for the verification of software systems. A big challenge is to approximate the behavior of systems with different models. It is therefore necessary to develop new modeling and analysis techniques as well as semantic foundations of program verification.

Verification techniques for software programs are only slowly becoming more widespread in industry. Hence the research of the institute is more theoretical and there are only a few industry contacts. In the long run however the results will become relevant for the industrial practice.

COURSES

- Theoretical computer science and logics
- Verification and analysis techniques
- Concurrency theory

RESEARCH

- Verification of software systems
- Modeling and analysis techniques
- Semantic foundations of program verification

APPLICATIONS

- Basic research

CONTACT

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DISTRIBUTED SYSTEMS

COURSES

- Distributed systems
- Peer to peer systems
- Cryptography

RESEARCH

- Location-based P2P protocol
- CrypTool2
- MMVEs

APPLICATIONS

- Pervasive/Ubiquitous computing
- IT security
- Game industry

CONTACT

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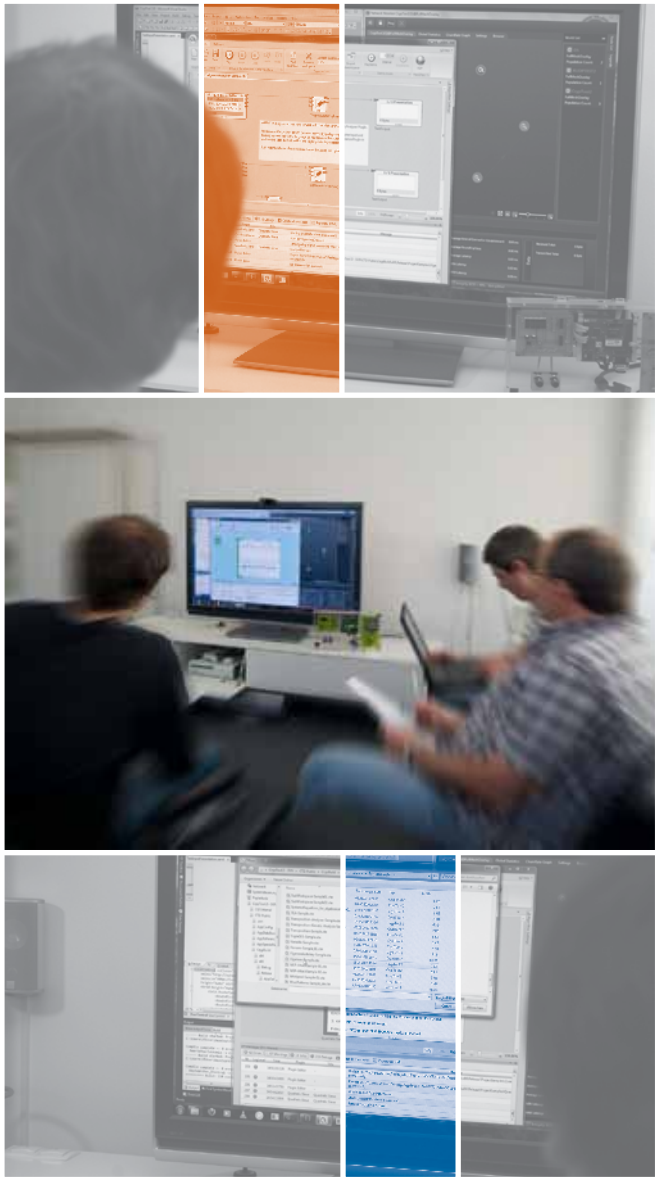
Distributed systems consist of a number of computers working together to find solutions for common problems. One of the largest distributed systems today is the internet. This is the working area of Prof. Torben Weis and his 9 staff members. As part of the DFG (German Research Foundation) 1183 “Organic Computing” they are working in the area of self-organizing systems of the future.

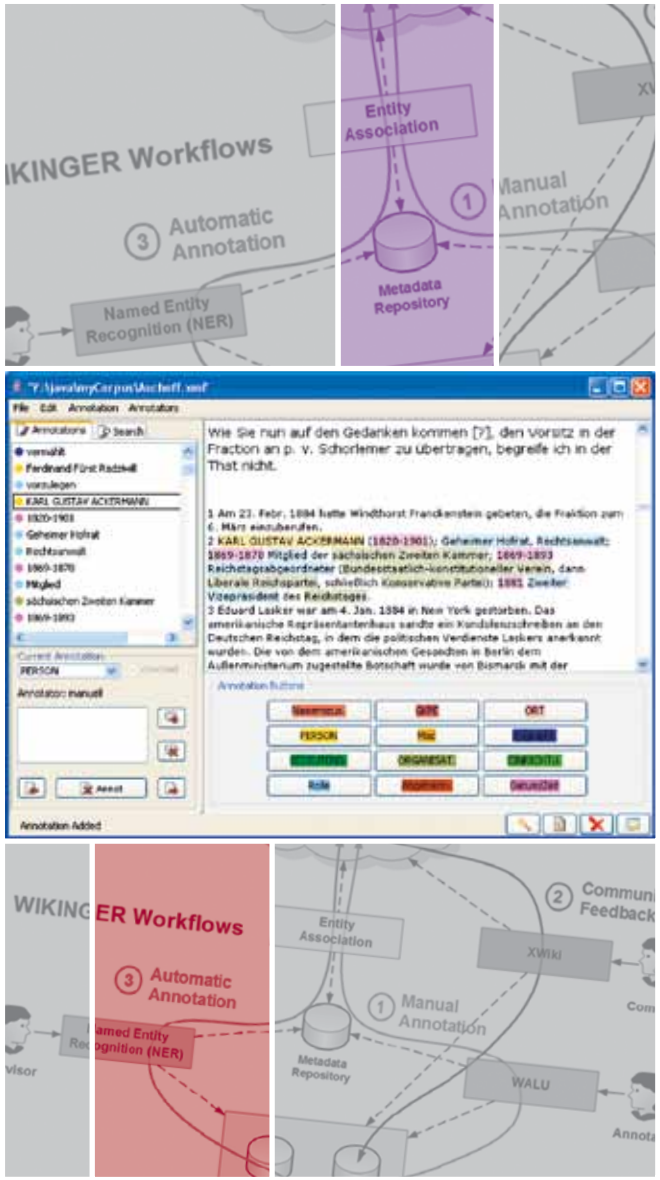
The courses offered by the institute are related to the design and implementation of distributed systems, internet technologies, peer-to-peer systems as well as cryptography and security in computer networks.

Innovative peer to peer protocols are developed and simulated in the Institute, with special interest in location-specific systems through which information about objects and events of the real or virtual world are stored. Based on this, the scientists investigate the so-called MMVEs (Massively Multiuser Virtual Environments) to which several popular online games belong. In addition, the Institute is developing the e-learning software CrypTool2, which improves the knowledge and use of cryptography and cryptographic protocols.

P2P systems from Duisburg are important for the game industry due to the fact that they allow the realization of large online games without using expensive servers. Location specific systems are interesting for the areas of pervasive and ubiquitous computing. They provide information about where persons or objects are located, comment on local attractions and determine where ones friends are frequenting to. CrypTool2 is important for companies which would like to teach its staff the fundamentals of IT-security.



COMPUTATIONAL LINGUISTICS



Prof. Wolfgang Hoeppner and his team of two deal with methods to describe and analyze the syntactic, semantic and pragmatic phenomena of natural linguistics. Practices from the field of artificial intelligence contribute significantly to the research of this department which is extended through cognitive and empirical approaches.

The courses provide fundamentals to develop formal representations of knowledge in technical systems. This includes logic-based languages and the semantic web. Students will learn computer linguistic and speech technology methodologies and their applications.

The Institute of Computer Linguistics in Duisburg develops methods for the thematic text analysis. Key areas are automated learning methods related to semantic annotation from unstructured and semi-structured texts as well as the practical use of semantic analytical methods for the extraction of relevant terminology and proper names. Further areas of research are the investigation of representation of similarities in languages, practical implementation of semantic annotations for key words and proper names as well as the development of tools for efficient communication with knowledge bases.

The Institute has developed a domain neutral platform within the framework of the BMBF (Federal Ministry of Education and Research) projects known as WIKI Next Generation Enhanced Respositors (WIKINGER) with other partners. This platform enables scientists to research and collaborate within their respective areas of interest independent of their location via the internet to generate new content.

COURSES

- Knowledge representation
- Computer linguistics methods
- Speech techniques methods

RESEARCH

- Semantic text analysis
- Automated learning processes
- Terminology extraction

APPLICATIONS

- Analysis of digital databases
- Development of knowledge bases

CONTACT

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GENERAL PSYCHOLOGY: COGNITION

COURSES

- General psychology
- Experimental methods
- Statistics

RESEARCH

- Internet addiction
- Economic decisions
- Moral decisions
- Decisions under stress

APPLICATIONS

- Market research
- Neuro-economy
- Usability
- Clinical settings/addiction

CONTACT

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Prof. Dr. Matthias Brand

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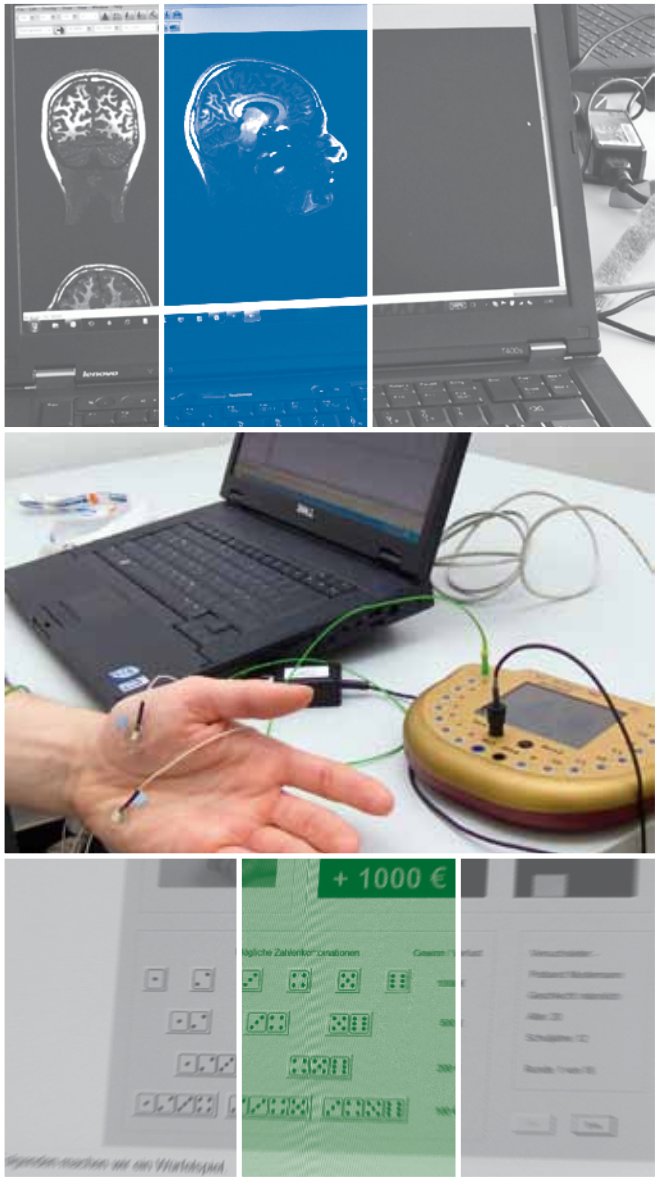
The main focus of the section General Psychology: Cognition is research into the understanding of human decision-making processes. Prof. Matthias Brand and his 20 staff members are especially interested in the decision making process in individuals with excessive/addicted Internet use, in moral decisions and in economic/consumer decisions. Prof. Brand is a member of the board of directors of the Erwin L. Hahn Institute for Magnetic Resonance Imaging, where part of the section's research is conducted. Here, the link between functional brain activity and decision-making behavior as well as with other cognitive functions is investigated with functional brain imaging techniques.

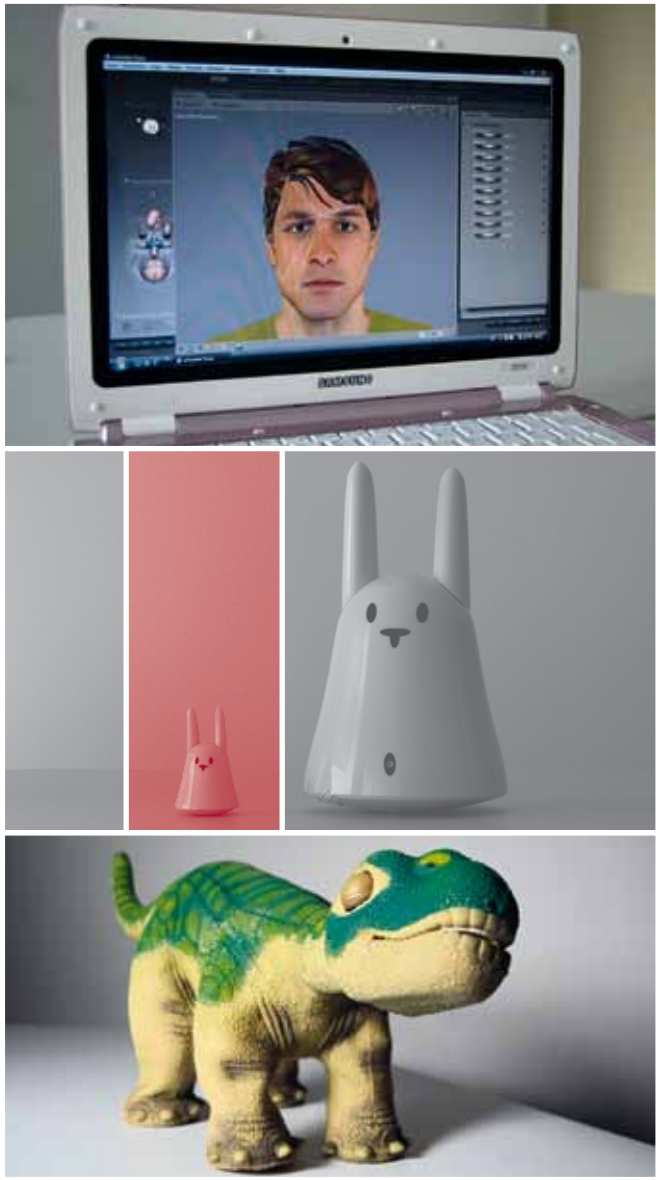
In it's teaching activities, the section provides courses in general psychology (which include topics like perception, attention, memory, emotions, motivation, problem solving and action), experimental methodology and statistics.

The section's key area of research is the understanding of human decision-making in the context of new media. Besides fundamental research in cognitive and emotive components of decision-making processes, there is a special interest in internet addiction. In cooperation with GFK-Nürnberg e. V., the section also investigates how economic decisions are influenced by recommendations. In addition, the team investigates the influence of society's expectations and of stress on decision-making processes.

Research results have impact on fields of market research, neuro-economy and usability. The results also have an impact on the design of decision-making situations as well as on the treatment of people with Internet addiction.



SOCIAL PSYCHOLOGY: MEDIA AND COMMUNICATION



E-mail, World Wide Web, DVD, entertainment robots – interactive new media, their influence and their usage are the research focus of Prof. Nicole Krämer and her team of 13.

The students initially study social psychology and communication psychology. After these fundamentals, the students are taught practical skills related to media psychology and human-technology-interaction. They also will learn presentations skills, conflict management in teams, as well as leadership skills.

Research focus is on people dealing with new media. Differentiation is made between computer-based communication and human-technology interaction. The investigation of non-verbal communication is of particular interest in the institute. In addition to the research conducted with regard to social psychological principles, some of the projects deal with pedagogical and psychological aspects for example in the area of computer-aided teaching and learning. Practical applications of the research are in media and pretesting research and usability research related to the emotional aspects of human-technology interactions.

COURSES

- Social and communication psychology
- Media psychology
- Human-machine interaction

RESEARCH

- Computer-based communication
- Human-technology interaction
- Non-verbal communication

APPLICATIONS

- Media research
- Pretest research
- Usability research

CONTACT

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BUSINESS AND ORGANIZATIONAL PSYCHOLOGY

COURSES

- Business psychology
- Consumer psychology
- Organizational Psychology

RESEARCH

- Simulator training
- High responsibility teams
- Safety culture
- Knowledge management and organizational learning from errors

APPLICATIONS

- Aviation
- Large industries
- Disaster relief and emergency first responder teams

CONTACT

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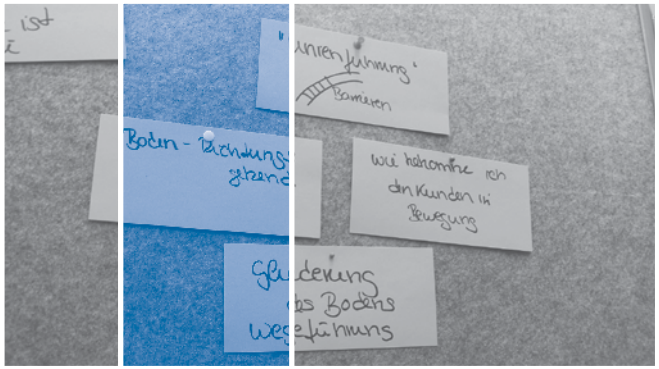
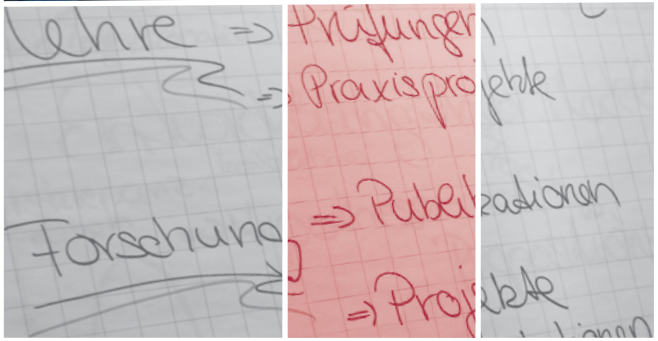
Behavioral studies of people in sensitive interfaces such as operating complex machinery on ground and in air as well as of those in emergency units are the center of the research activities of Prof. Annette Kluge and her team of 13 members.

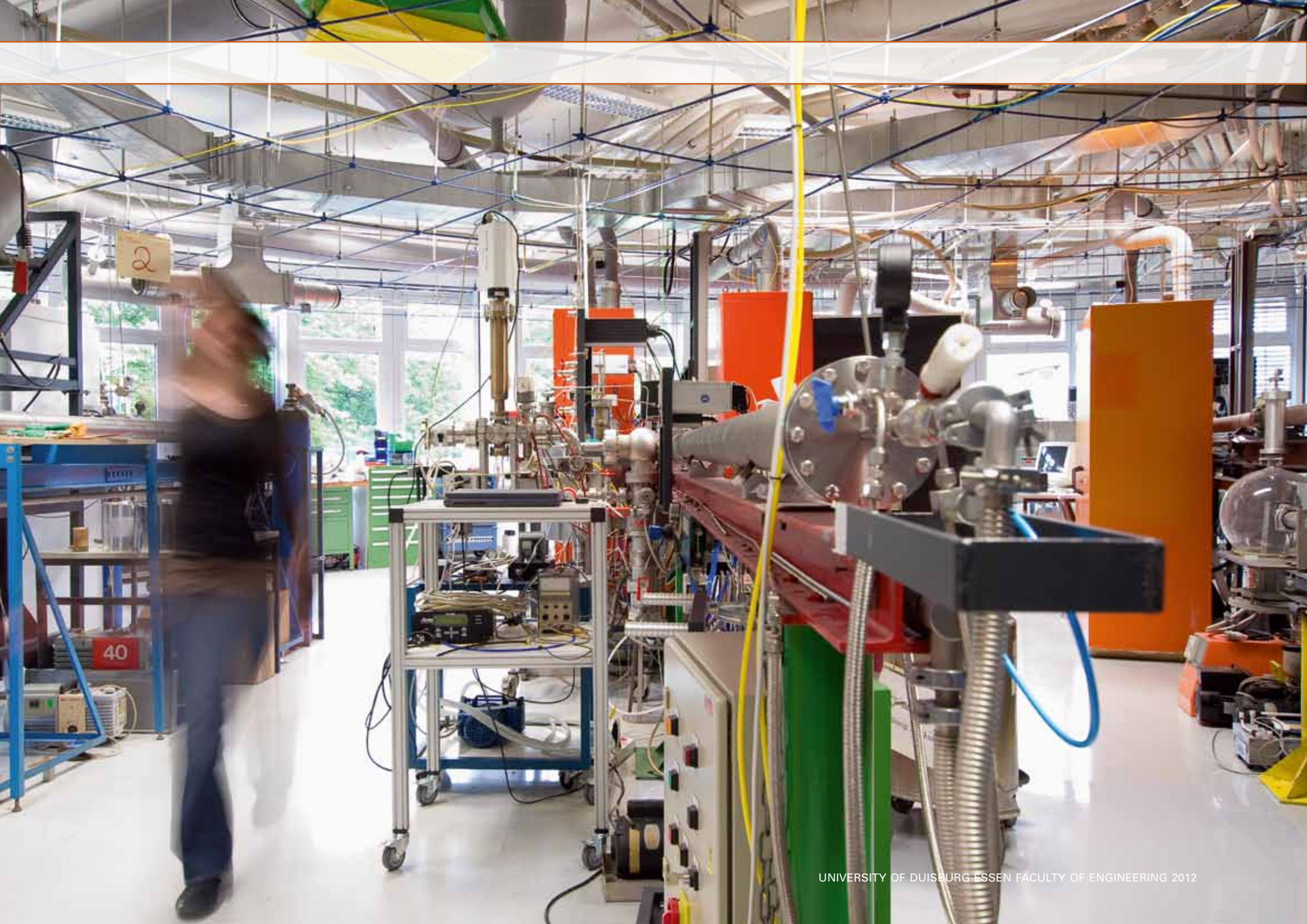
The courses offered by this group teach about market, consumer and organizational psychology. They are related to how consumer behavior can be influenced, what cognitive and emotional processes are involved in purchase decision making, what effect information technology has on motivation, emotion and abilities, how new media can be deployed in job selection and training as well as for virtual team work and leadership skill development.

The institute develops and evaluates simulator training programs in high reliability organizations such as in aviation. It also deals with the development and support of high responsibility teams, such as aircraft maintenance, fire departments or in hospitals. The Institute investigates safety cultures and management commitment in high-reliability organizations within the areas of organization development and safety at work. Learning from errors and the influence of production goals whilst complying or violating rules during the operation of complex machinery are also areas of investigation.

The results of the research projects have an influence on the work of Swiss International Airlines, the German Air Force, the Fire Departments in Essen and Munich, on HKM as well as in refineries in German-speaking countries. They are also being used more and more in space research for designing refresher trainings.



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MECHANICAL AND PROCESS ENGINEERING

The Department of Mechanical and Processing Engineering is well prepared for the technological challenges of the future. The 1800 students of Mechanical Engineering and Business Management benefit greatly from the wide range of subjects covered by the 24 Professors in the department.

The range of disciplines on offer is related to the extensive academic and research areas of the department. These areas include Energy and Processing Engineering, Product Engineering and Logistics, Mechatronics, Automobile technologies, Ship technologies and Nanotechnology. The institutes of the department work closely with the four associated institutes as well as the university-wide Centre for Logistics and Traffic and demonstrate the application oriented character of the engineering science research.

The research activities of the department are supported by the German Research Foundation (DFG), by of the government of North Rheine Westphalia, the Federal Ministry of Economics and Technology, the European Union as well as by industrial partners.

The Department of Mechanical and Processing Engineering is also part of major cooperative research bodies. An example of this research is in the Collaborative Research Center (SFB) 445 “Nanoparticles from the Gas Phase” in which the formation of nanoparticles from the gas phase is investigated both theoretically and experimentally. The aim is to characterize the correlation between particle structure and particle behavior with respect to their structural, physical and chemical characteristics. Particle formation, gas phase synthesis and charge transmission are also areas of research.

The long term goal of the research program in the Graduate College 1240 (GRK 1240) is the development of components which are able to transform energy into light and light into energy. The components are produced from dispersed systems on the basis of inorganic nanoparticles acting as optical materials. This work has opened up new opportunities in the areas of printable optoelectronics and photovoltaic.

Since the winter term of 2007/2008 the degrees offered by the department are consecutive Bachelor’s and Master’s Degrees. These degrees cover the areas of Mechanical Engineering, Technical Logistics, Business Management as well as the dual course of Steel Technology and Metal-forming which includes an apprenticeship as an industrial mechanic as the start of the course and finally the Industrial Engineering.

Additionally courses are also provided in the international degree program known as International Studies in Engineering (ISE). The department places great emphasis on close links between the theoretical and practical education and supports this through various options such as practical experience, projects and research opportunities.

MECHANICS AND ROBOTICS

COURSES

- Technical mechanics
- Kinematics and multibody dynamics
- Robotics
- Finite element methods
- Biofluid mechanics

RESEARCH

- Kinematics
- Multi-body dynamics
- Biomechanics of motion
- Robotics

APPLICATIONS

- Machine and facility design
- Medicine
- Environmental technology

CONTACT

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Prof. Dr.-Ing. Wojciech Kowalczyk

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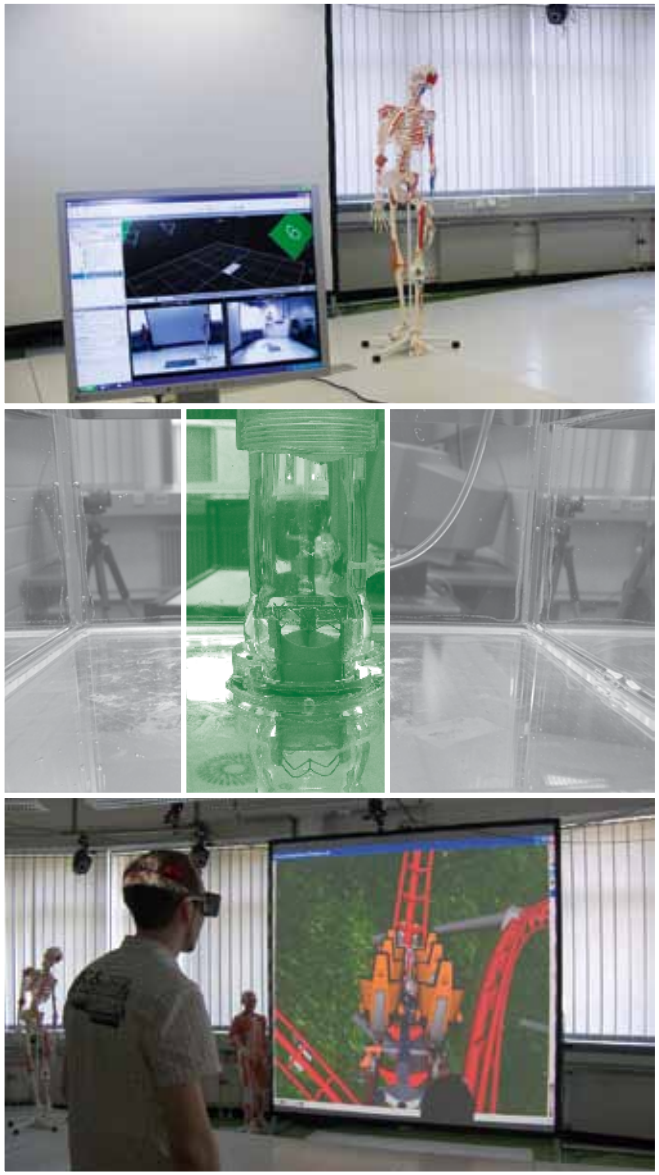
Mechanics in one of the most creative areas of Engineering and a fundamental part of mechanical engineering. The chair offers a large number of classes. Prof. Andrés Kecskeméthy and his colleague, Prof. Wojciech Kowalczyk and their team of 15 research assistants are dealing with a wide range of research projects and offer a large number of engineering services.

The foundation classes are related to the fundamentals of mechanics. After their completion, students can gain additional knowledge and competence in the field of kinematics, multi-body dynamics, fluid dynamics, finite element method, bio-mechanics and robotics in additional courses.

The key research areas of the chair are kinematics, multibody dynamics, simulation of motion, robotics and virtual reality as well as biomechanics, biofluid mechanics and continuum mechanics.

Some examples of practical-based projects, which are connected to modeling, simulation and control of complex mechatronic systems, are: motion simulation using an industrial robot; software for the automated design of roller-coasters; efficient calculation tools for the control of large machines for structural engineering; models for human muscle and skeleton systems as a support for medical diagnosis, therapy planning and rehabilitation; experimental and theoretical investigation of fluid flow in biological systems, e.g for improvement of surgical procedures during heart valve replacement.



MECHATRONICS

Mechatronics is a relatively young discipline of engineering; one which has however established itself very well within contemporary engineering sciences. It deals with the interaction between the mechanical, electrical and information technology components in systems. The Chair at the University of Duisburg-Essen is one of the oldest mechatronic institutes in Germany. Prof. Dieter Schramm and his team of 20 are primarily dealing with applications related to mobility.

The courses provide the fundamental knowledge in mechatronics, vehicle dynamics, and sensor systems as well as in mobile robotics. The students will also learn about the use of numerical methods in simulation as well as about the design and planning of mechatronic systems and components.

A central theme at the chair is vehicle technology. Key areas of research are electrical vehicle power systems, energy-efficient vehicle systems, e-mobility, driving simulators and the modeling and simulation of vehicle dynamics. The chair also develops modern assistance systems and investigates issues related to their acceptability. Direct practical applications can be found in the automobile and associated supply industries, in particular in the areas of active and passive safety in vehicles as well as the vehicle electrical systems.

An important research area in the field of robotics is in tendon based robotics. Application fields of this technology are in the areas of industrial assembly, physiotherapy and storage technologies. Further activities of the chair are related to walking machines and the control of manipulators.

COURSES

- Mechatronics
- Vehicle technologies
- Robotics
- Sensor systems
- Modeling and simulation

RESEARCH

- Driving assistance systems
- Driving simulators
- Energy-efficient vehicles
- E-mobility
- Robotics

APPLICATIONS

- Automobile industry
- Mechanical and plant construction
- Actors and manipulators

CONTACT

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Prof. Dr.-Ing. Dieter Schramm

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DYNAMICS AND CONTROL

COURSES

- System dynamics, Control technology, Control theory, Modern methods of control
- Emergency mode and diagnosis of mechatronic systems, Cognitive Technical Systems
- Qualitative methods of control I and II

RESEARCH

- Modeling, control, and diagnosis of mechanical systems
- Safe mechatronic systems
- Powertrain and drive technologies
- Cognitive Technical Systems
- Human-Machine- and Autonomous Systems

APPLICATIONS

- Machinedesign, -control, and supervision
- Safety critical systems
- Supervision and Assistance
- Robotics

CONTACT

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Chair of Dynamics and Control

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Prof. Dr.-Ing. Dirk Söffker

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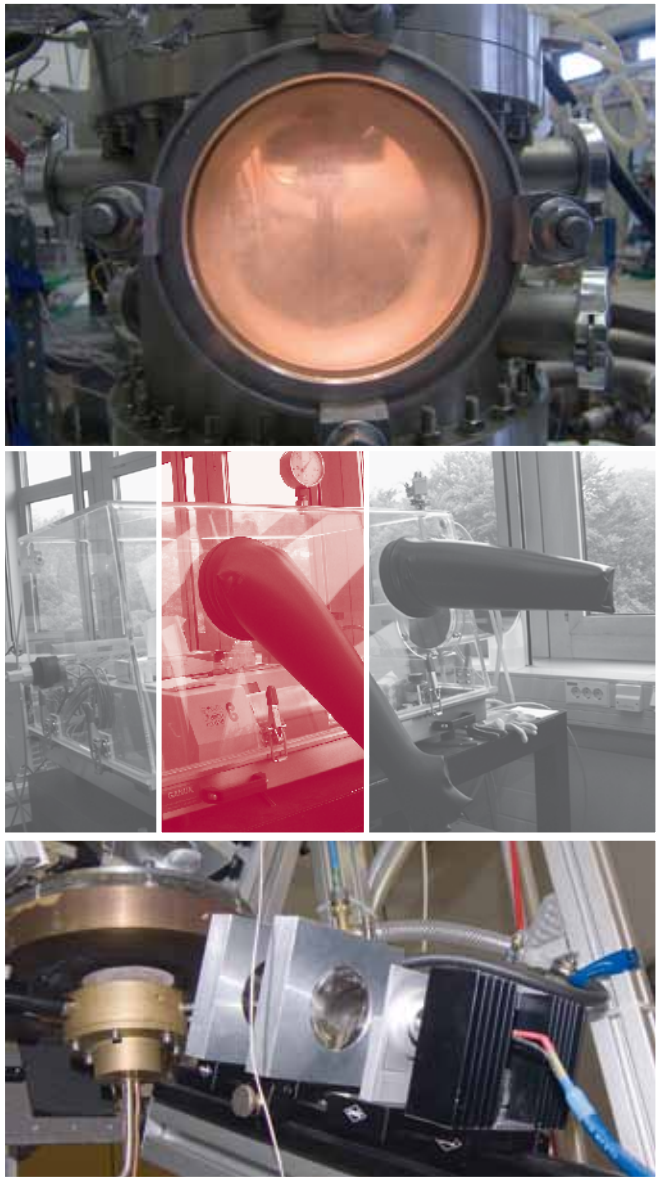
The main research areas of the Chair of Dynamics and Control headed by of Prof. Dirk Söffker are on current and challenging problems related to mechatronic and dynamical systems as well as in automation technologies. He and his team of 20 international staff members work on various projects related to control, among others in the electro-mobility project CologneE-mobil in the development of electro-hybrid powertrains based on fuel cells and/or modern batteries.

Students learn the theoretical fundamentals required to solve current problems related to dynamic systems in the areas of mechatronics and automation. The Bachelor's and Master's degree projects offer them numerous opportunities to use and deepen their theoretical knowledge.

Key areas of research are currently modeling, simulation, and control of mechatronic systems, the improvement of robust control and diagnosis algorithms and the design of new cognitive methods of control and diagnosis. Further areas of research are electrical and hydraulic hybrid engines including energy recovery, power management, and topology optimization. The Chair also develops cognitive technical systems starting from knowledge-based assistance of human-systems and interaction to technical diagnostics up to the autonomous behavior of mobile systems or vehicles. Currently further topics of interest are the systematic optimization of mechatronic systems from the reliability and safety point of view through the integration of model-based diagnostics.

THERMODYNAMICS



Thermodynamics deals with the conversion and transformation of different forms of energy and the related material characteristics. This is a fundamental field required by many areas of engineering sciences. Prof. Burak Atakan and his 15 co-workers are also working on the inter-disciplinary nanotechnology projects CeNIDE and NETZ.

The courses offered by the institute provide the fundamentals about the laws of energy conversion, their utilization as well as knowledge about heat and material transfer, and the modeling of reactive mixtures. Students are also taught in the usage of modern experimental techniques.

The group works on the development of functional thin-films and infiltration processes out of the gas phase (CVD Processes) and with sol-gel processes. Combustion processes are investigated with regard to pollutant formation and the influence of additives as is heat transfer in combustion processes. Also the thermodynamic properties of organo-metallic compounds like their sublimation pressure, stability and diffusion coefficients are studied for pure compounds, as well as the properties of solutions. Also, thermodynamic cycles and new approaches to energy and material transformation are investigated.

COURSES

- Engineering and chemical thermodynamics
- Heat and material transfer
- Thermal systems: analysis, modeling, design

RESEARCH

- Thin films and infiltration processes
- Heat transfer in combustion processes
- Pollutants from combustion
- Thermodynamic s of organo-metalllic compounds
- Thermodynamic cycles, energy conversion
- Mass spectrometry and optical diagnostics

APPLICATIONS

- Energy technologies
- Thin film technologies
- Reaction technologies
- Semi-conductor technologies

CONTACT

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COMBUSTION AND GASDYNAMICS

COURSES

- Combustion science
- Internal combustion engines
- Nanomaterials synthesis
- Laser-based diagnostics
- Chemical reaction kinetics

RESEARCH

- Nanomaterials synthesis
- Non-intrusive diagnostics
- Chemical kinetics at high temperatures

APPLICATIONS

- Internal combustion engines
- Functional nanomaterials
- Measurement techniques
- Energy technologies

CONTACT

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Prof. Dr. Christof Schulz

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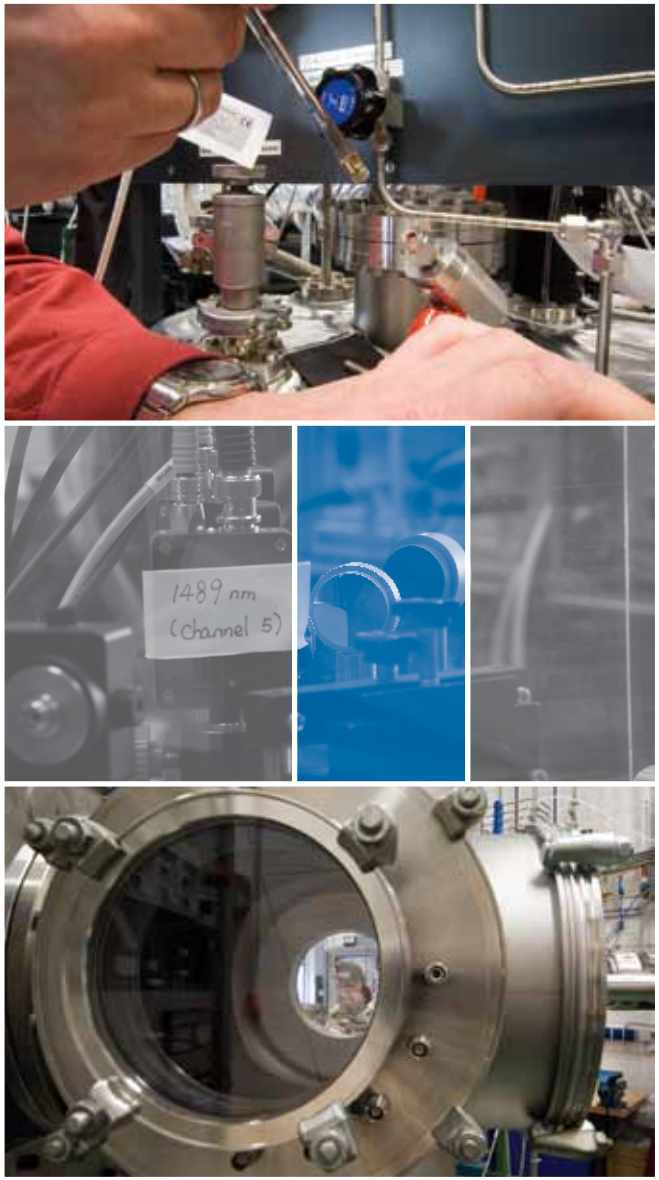
One major research interest of the research group is to understand and control combustion processes and nanomaterials synthesis in the gas phase starting from the microscopic level. Prof. Christof Schulz and his research group of more than 40 scientists carry out work in collaborative research projects related to nanoparticle synthesis in the gas phase and optical in-situ diagnostics in combustion processes. Prof Schulz is also director of CENIDE and the initiator and Director of the NanoEnergyTechnologyCenter, NETZ. In addition he is one of the scientific directors of the IUTA Institute.

Students learn how to describe reactive flows in the combustion technology and materials synthesis as well as the kinetics of processes in the gas phase at high temperatures. Part of the study program also deals with combustion and internal combustion engines as well as laser optical diagnostics in reactive fluids.

The research group synthesizes nanoparticles with tailor-made properties in flames, plasmas, as well as wall-heated reactors. A further topic is the development and use of laser-based techniques for non-intrusive measurements of concentrations, temperature, droplet and particle sizes, as well as velocity in reactive fluids. In addition, the scientists investigate reaction rates and mechanisms of combustion, ignition, and particle formation in shock-tube facilities.

The research results are used for the optimization of practical combustion processes, the production of specific nanomaterials, the development of new materials especially for applications in energy technologies, and the development of measurement techniques for non-intrusive measurements in reactive fluids.



NANOPARTICLE PROCESS TECHNOLOGY

Nanotechnology already influences the development of entire technology fields currently and the future potential is very bright. Prof. Markus Winterer and his team of 20 scientists investigate processes related to the synthesis and structuring of nanoparticles. The chair is participating in the SFB 445 “Nanoparticles from the Gasphase” as well as in the cooperations known as CeNIDE and NETZ, and in the Graduate College 1240 “Nanotronics – Photovoltaic und Opto-electronics from Nanoparticles”.

The Institute teaches courses related to nanotechnology and nanomaterials. This includes methodologies pertaining to measurement technology, reaction technology, colloid and aerosol process technologies.

Research activities are focused on the synthesis, preparation and characterization of nanomaterials. Particular emphasis is on ceramic nanocrystals which can be used as passive and active luminescence materials, insulation materials, filters and catalysts. Another area is the aerosol research in air cleaning and filtration.

Functional materials based on nanotechnologies are already in use in many applications of electrical, mechanical and chemical engineering. The range of applications is expected to increase significantly in the near future.

COURSES

- Nanotechnology
- Measurement techniques
- Reactive technologies
- Aerosol technologies

RESEARCH

- Synthesis of nanomaterials
- Characterization of local structures, crystal and micro-structuresr
- Ceramic nanocrystals and aerosol research

APPLICATIONS

- Electro-technologies
- Mechanical Engineering
- Chemical industriese

CONTACT

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TURBOMACHINERY

COURSES

- Fundamental theory of turbomachines
- Centrifugal pumps and compressors
- Gas and steam turbines

RESEARCH

- Investigation of flow in rotating cavities
- Acoustic modes
- Determination of axial thrust in high pressure radial compressors
- Multi-phase flows in turbomachines

APPLICATIONS

- Design of efficient fluid machines

CONTACT

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Prof. Dr.-Ing. Friedrich-Karl Benra

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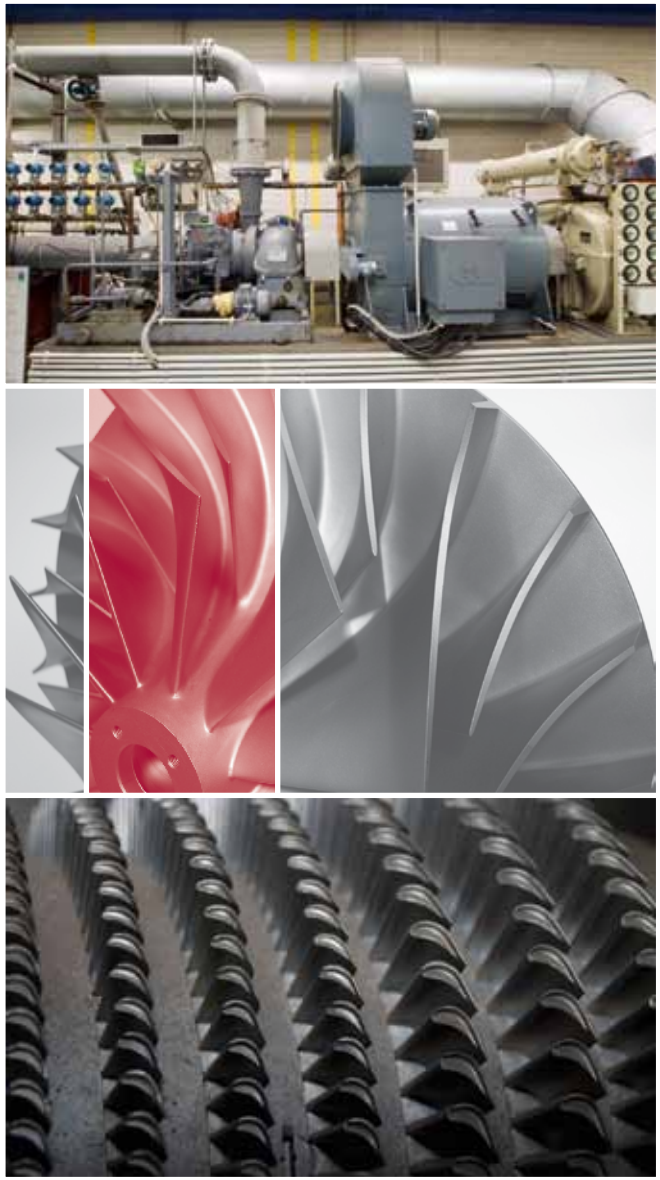
Turbomachines are widely used in energy conversion processes. Generally liquids, gases or steam are applied as energy transfer medium. Prof. Friedrich-Karl Benra and his team of 15 scientists are conducting research in the field of gas turbines, steam turbines, turbo-compressors and centrifugal pumps.

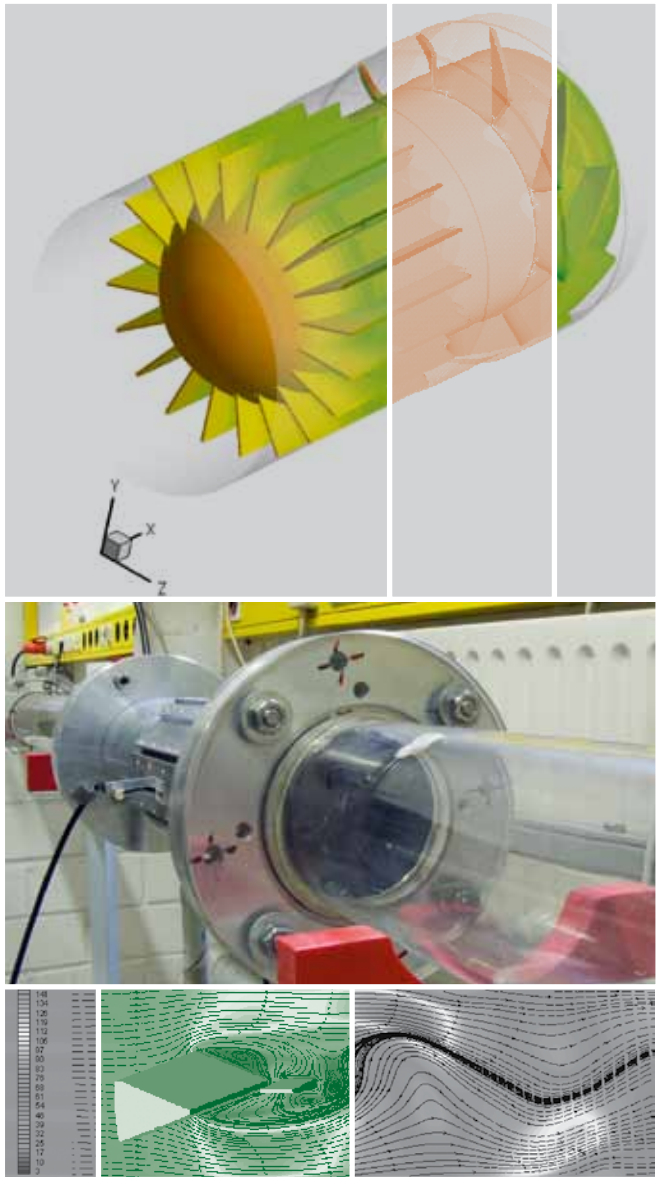
Students learn the fundamentals of fluid machines both in theoretical and in practical courses in the compulsory part of the curriculum. Applications such as centrifugal pumps, compressors, gas and steam turbines are taught as elective courses. Besides the lectures, exercises and application labs the chair of turbomachines also organizes field trips to manufacturers of fluid machines as well as negotiates internships and projects with the regional turbomachinery industry.

Flow characteristics of the above mentioned fluid machines are investigated at the institute both experimentally and numerically. A particular focus is set on the investigation of fluid dynamics in rotating cavities formed by the rotor and the casing of a turbomachine. Examples of research projects are hot gas ingress into gas turbine cavities or the evidence of acoustic modes in radial compressors. Furthermore, research is carried out in the field of multiphase flows in turbomachines.

Research results are used to improve the design methods of fluid machines. One example is the efficiency enhancement of cooling systems of gas turbines which is based on the gained knowledge about fluid mechanisms during hot gas ingress. Furthermore, determination of flow mechanisms in cavities is required to improve the calculation of the axial thrust of high pressure radial compressors.



FLUID MECHANICS



Fluid dynamics investigates the physical behavior of fluids and gases. Prof. Ernst von Lavante and his team of 4 scientists deal in particular with problems related to flow measurement techniques and process technology as well as with different aspects of aero-dynamics. The chair specializes in the calculation and development of fluid dynamics fundamentals in vortex frequency, rotor and turbine meters and was involved in re-formulation of the ISO Standards Norm 9300 for critical venturi nozzles.

The courses provide knowledge about fluid dynamics, aero-dynamics, gas dynamics and the numerical flow simulation.

The chair carries out investigations in the areas of flow measurement techniques, aero-dynamics, fluid mechanics, optimization and numerical methods of fluid dynamics. An example is the research done related to the flow in venturi nozzles. These nozzles are ideal for the calibration of other measurement devices because of the constant gas volume flowing through them. Numerical calculations and simulations are carried out in this area, followed by experiments to determine the transition from constant flows into turbulent flows.

The research results are used in the areas of fluid measurement techniques, the automobile industry, process and energy technologies as well as in the development of turbo-machinery. The chair cooperates with a number of industrial partners in the area of research and development.

COURSES

- Fluid dynamics
- Aero dynamics
- Numerical flow simulation

RESEARCH

- Flow measurement techniques
- Aero dynamics
- Fluid dynamics
- Numerical methods for fluid dynamics

APPLICATIONS

- Flow techniques
- Automobile Industry
- Automobile Industry
- Energy technology

CONTACT

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THERMAL PROCESS ENGINEERING

COURSES

- Process engineering
- Thermal process engineering
- Process and plant technology
- Environmental technologies

RESEARCH

- Technical adsorption processes
- Absorption flue gas cleaning

APPLICATIONS

- Process industries
- Energy technologies
- Environmental technologies

CONTACT

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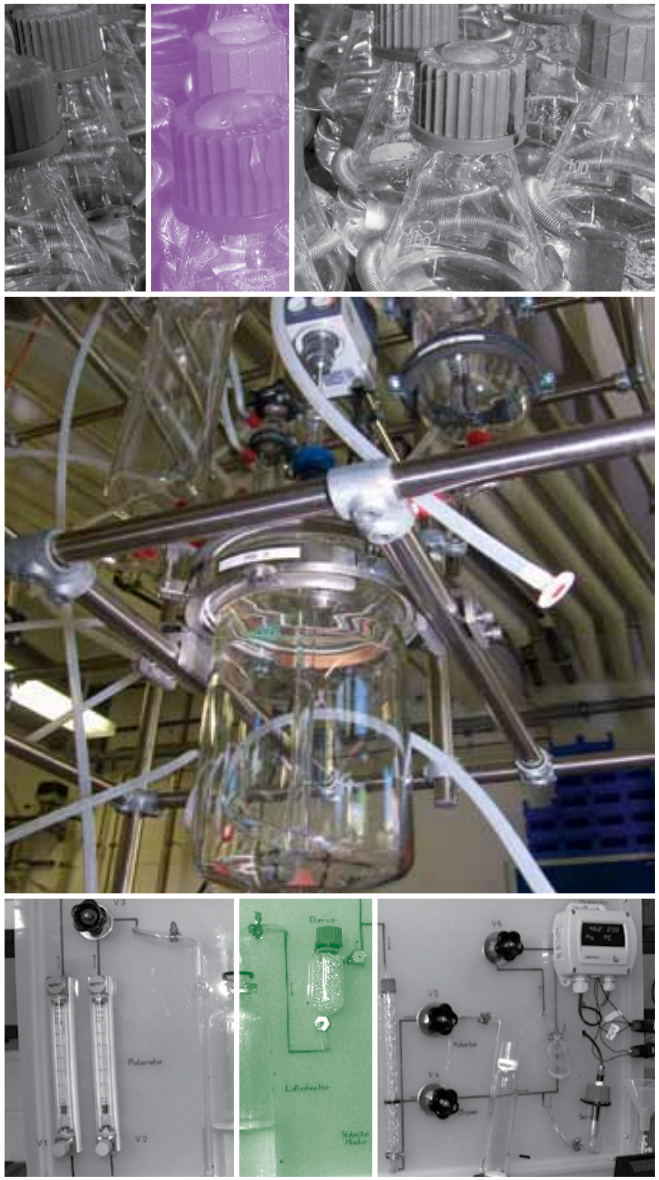
The Chair of Thermal Process Engineering was created in 2007 by fusing the former chairs of Environmental Technologies and Waste Management technologies. The chair is closely linked to the Institute for Energy and Environmental Technologies (IUTA), which is also led by Prof. Bathen. His team of 20 scientists participates among other things in an €8 million project "Centre for filtration research and functionalized surfaces ZF".

The chair teaches the students fundamentals of process engineering in the earlier semesters. Higher semesters deal with lectures and practical courses in thermal process engineering, process and plant technologies, process simulation as well as environmental and specialized areas of process engineering.

Research activities concentrate on industrial applications of thermal separation processes based on adsorption and absorption. In the working field of adsorption processes, the chair investigates all aspects of technical adsorption from gas and liquid phase. This work is unique in Germany. Examples of research activity are the removal of sulfur toxins from natural gas or the removal of water from organic solvents in ppb range. The main research activity in absorption technologies is the removal of CO_2 and mercury out of flue gases.

Applications for these processes can be found in the consumer area and in almost all branches of the process industries. This ranges from protective clothing, the cleaning of toxins contained in exhaust fumes from factories and power stations to the production of highly pure chemicals for the pharmaceutical and electronics industries.



ENVIRONMENTAL PROCESS ENGINEERING AND PLANT DESIGN

The chair deals mainly with applied research and development in the area of environmental process engineering and plant design. Prof. Klaus Görner and his team of 24 members are working in the area of environmental-friendly energy process engineering, waste and residue management, separation of harmful components, environmental monitoring technologies and services.

The team participates in various projects which are developed in different fields such as modeling of combustion chambers, CO_2 absorption processes, development of a mobile CO_2 separation plant and production of synthetic fuels in collaboration with other universities, research institutes as well as related companies.

The students learn about environmental process technologies, thermal treatment of waste, energy and environment as well as computational fluid dynamics and environmental chemistry.

Research activities take place in the areas of thermal treatment of waste, CFD simulation of plants and components, combustion and gasification technologies, industrial gas cleaning as well as CCS processes. The chair also provides a large technical testing hall at its disposal for this purpose as well as numerous laboratories and workshops.

The research results are used for plant and process design, optimization of plant performances and operational processes on large as well as on small scale.

COURSES

- Environmental technology
- Thermal waste management
- CFD calculation methods

RESEARCH

- Thermal treatment of waste
- CFD simulation of plants
- Combustion and gasification technologies
- Industrial gas cleaning

APPLICATIONS

- Plant and equipment design
- Power station technologies
- Energy technologies

CONTACT

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Institute of Environmental Process Engineering and Plant Technology

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ENERGY TECHNOLOGY

COURSES

- Energy technology and systems
- Renewable energy technology
- Fuel cells and hydrogen technology
- Alternative engines

RESEARCH

- Membrane fuel cells
- Hydrogen production
- Li Batteries
- Production technologies

APPLICATIONS

- Energy technologies
- Automobile technologies

CONTACT

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Prof. Dr. Angelika Heinzel

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The activities of the Chair of Energy Technology are concentrated on fuel cells and hydrogen technologies. Prof. Angelika Heinzel is head of the Institute and is also the Managing Director of the Centre for Fuel Cell Technology GmbH (ZBT). Prof. Heinzel and her team of 15 scientific members also participate in various projects including NETZ and colognE-mobile.

The courses offered by the chair deal with energy technology and energy systems, renewable energy technologies, fuel cells, alternative engines and hydrogen technologies.

Research activities, which are partly carried out on an interdisciplinary basis, deal with the development of membrane fuel cells, the development and testing of components and systems and the generation of the necessary hydrogen from fossil and biogenic fuels. Development of Li batteries takes place in collaboration with the University of Münster and other partners. The chair investigates production technologies for fuel cell components and systems in cooperation with Prof. Dr.-Ing. habil. Gerd Witt from the Chair of Product Engineering.

Fuel cells and hydrogen technologies are key technologies for the future. Applications are in combined heat and power production for houses, emission-free transport based on hydrogen as the energy source, emergency power supply, decentralized electricity supply and micro fuel cells for electrical appliances.

PROCESS ENGINEERING AND WATER TECHNOLOGY

Well trained process engineers are required to secure the supply of high quality drinking water. The Chair of Water Technology at the Institute of Energy and Environmental Process Engineering led by Prof. Rolf Dieter Gimbel fulfills this mission in a variety of ways. To this end he and his 16 staff members participate in a large number of projects. The main collaboration partner is the IWW Water Centre in Mülheim, an associated institute of the University Duisburg-Essen. Other project partners are for example, the Chair for Mechanics and Robotics of the University Duisburg-Essen and the Department of Chemistry, Bio-chemistry and Environmental Protection in the University of Novi Sad in Serbia.

Students will get an insight into current water treatment processes and will learn about the physical and chemical characteristics of water and the interaction of water compounds in aqueous solutions. They will master the fundamentals of process technologies related to water and waste water treatment systems. The curriculum also imparts background knowledge pertaining to water treatment, analytical waste water parameters and assessment competencies.

The research activities are focused on the development of new and the optimization of existing water treatment technologies. Special areas of investigation are: membrane technology, fixed bed and sorption processes, artificial neural network, fluid flow simulation, biotechnologies, xenobiotics and nanoparticles in the environment. Close research cooperation exists between the Institute and IWW Water Centre in the areas of water technology, process related analytics, micropollutant analysis and microbiology. Main areas of application are in the design, assessment and optimization of fixed bed, adsorption and membrane processes for drinking and industrial water treatment.

COURSES

- Fundamentals of water treatment
- Fundamentals of process technologies
- Waste water treatment

RESEARCH

- Membrane technology
- Fixed bed and sorption processes
- Artificial neural networks
- Bioprocess technology

APPLICATIONS

- Adsorption process technologies
- Membrane process technologies

CONTACT

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ENGINEERING DESIGN AND PLASTICS MACHINERY

COURSES

- Machine elements 1 + 2
- Plastics technology
- Plastics processing and machinery 1 + 2

RESEARCH

- New machinery concepts for plastics processing
- Energy efficiency analysis
- Machine diagnostics and optimisation

APPLICATIONS

- Plastics processing industries
- Machinery production

CONTACT

University of Duisburg-Essen
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Prof. Dr.-Ing. Johannes Wortberg

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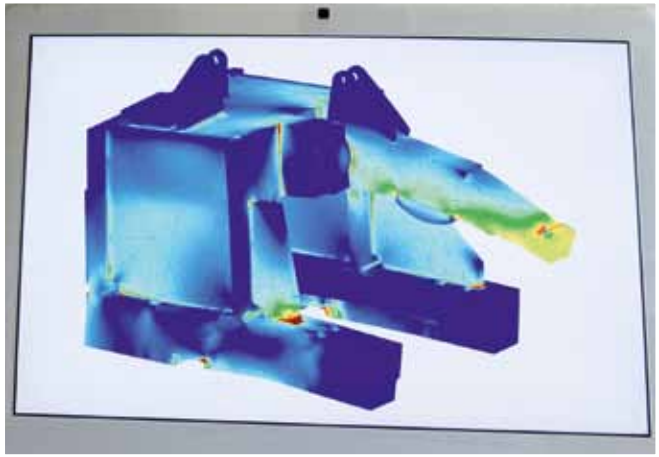
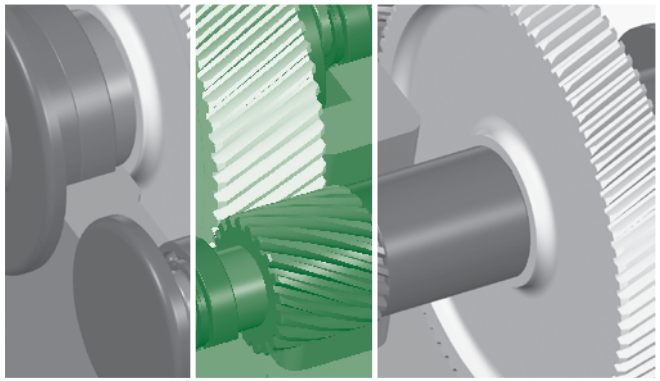
Almost 1,000 companies with about 85,000 employees are employed in the plastics industry in North Rhine Westphalia. That is why this branch is one of the largest employers between the rivers Rhine and Weser. This importance of plastics technologies has been acknowledged by the Engineering department of the university and is the focus of the Chair of Engineering Design and Plastics Machinery led by Prof. Johannes Wortberg, a well-known scientist and engineer in the area of plastics technology and plastics machinery with outstanding experience in plastics processing via extrusion, blow-moulding and injection-moulding as well as in process, machinery and tool development, efficiency improvement and quality management.

At the chair, prospective engineers learn about the fundamentals of engineering design, plastics technology, plastics machinery technologies as well as special topics such as engine technologies and machinery diagnostics. The chair concentrates on applicable fundamental research as well as on commercially relevant solutions. The researchers in the chair develop concepts for new extrusion and blow-moulding machines to ensure more efficient production of plastics products in the future. “What we need is a more intelligent and efficient use of resources in production technologies with highest performance” said Prof. Wortberg, who is also board member of the Scientific Alliance of Polymer Technologies (WAK).

The numerous prizes received, such as the Brose, Brunnhofer and the Schauenburg Prizes prove how innovative the plastics experts are at the University of Duisburg-Essen.

COMPUTER AIDED ENGINEERING





The efficient integration of knowledge in engineering processes and the development of entire CAE process chains are the research focus of Prof. Peter Köhler and his scientific team. A special emphasis is put on the optimization of the product design in terms of function and manufacturing.

The courses offered deal with the fundamentals of technical drawings, the methodical and computer-based product development and the information management in engineering processes. Exercises and application labs enhance the skills pertaining to the use of CAD-, Design-, Simulation- and Product Data Management Systems.

The chair develops methods for the qualification and acceleration of computer-based development processes.

This includes the comprehensive linking of diverse software systems for design, computation, analysis and simulation regarding multidisciplinary design processes and the investigation of the related effects on the entire development process. Concepts to the cross-system use of product model data are also explored.

The chair collaborates with the Chair of Manufacturing Technology and with the Chair of Engineering Design and Plastic Machinery in the field of effective use of manufacturing technologies.

Potential applications for industrial companies lie in the development of specialized solutions for product design and optimization, for example in the development of tailor-made product configurations based on CAX and PDM systems. Further application fields are the layout of continuous CAD-CAM process chains as well as the staff qualification.

COURSES

- Engineering Drawing
- Computer Aided Engineering
- Product Design and PLM
- Virtual product optimization
- Information Technologies for KBE

RESEARCH

- Knowledge-based engineering (KBE)
- Virtual prototyping
- Product Lifecycle Management (PLM)
- CAD-CAM process chains

APPLICATIONS

- Machinery and apparatus design
- Product engineering
- Rapid manufacturing

CONTACT

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Prof. Dr.-Ing. Peter Köhler

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MATERIAL SCIENCE AND ENGINEERING

COURSES

- Material science
- Tribology
- Fatigue and endurance
- Material selection
- Failure analysis
- Heat treatment of metals

RESEARCH

- Friction and wear
- Fatigue and corrosion
- Development of new materials

APPLICATIONS

- Tooling, mechanical, automotive and biomedical engineering

CONTACT

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Prof. Dr.-Ing. Alfons Fischer

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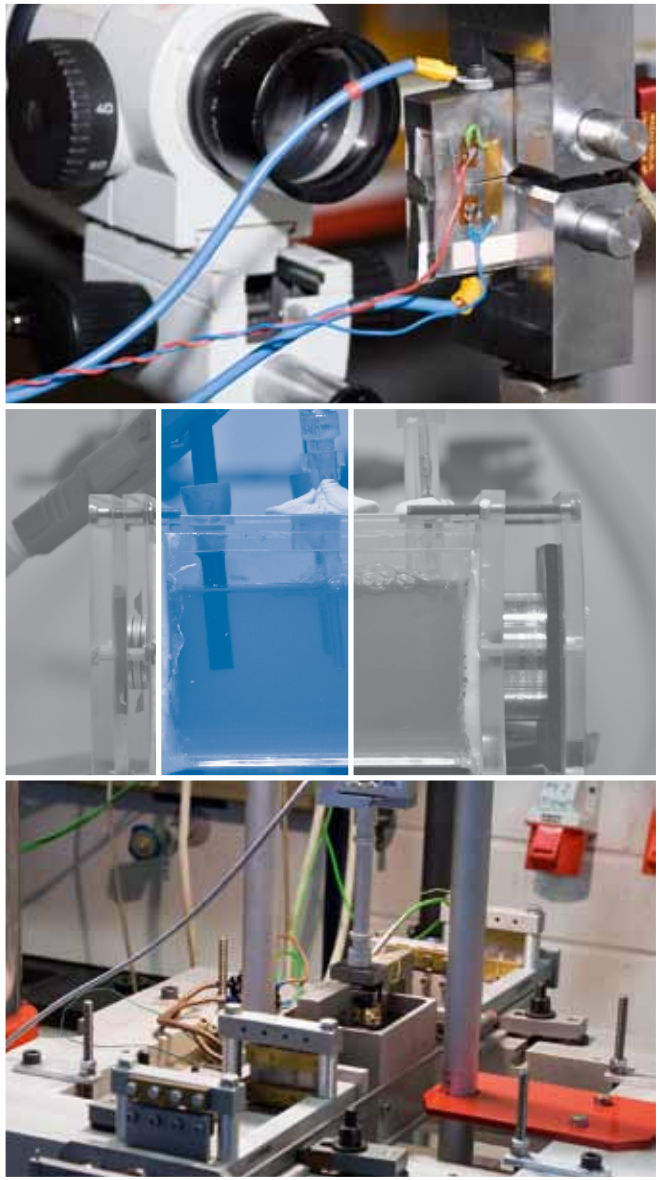
Material Science deals with the relation between the internal structure and the processing and structural properties of metallic materials. The main work focuses on the alterations of the microstructure at the micrometer- and nanometer-scale during processing and application. The latter range from machinery and plant design over tool design, automotive and aviation technologies up to biomaterials for instruments and implants. Prof. Alfons Fischer and his team are members of the interdisciplinary Center for Nanointegration of the University of Duisburg-Essen (CeNIDE).

The courses provide fundamental knowledge in material science and engineering as well as materials selection. The program offers a deeper understanding of tribology, failures analysis, and heat treatment. Further areas of specialization are product engineering, metal physics as well as material characterization.

The team of 25 staff members works on the mechanical, tribological and chemical behavior of ferrous and non-ferrous alloys, composites and compounds. The main aim is to understand the relation between the behavior of materials and its micro- and nanostructure of the bulk and the surfaces in order to extend the life time of products.

The research results are relevant for mechanical, plant, automotive, tooling, aviation, consumer products, and biomedical engineering.



MANUFACTURING TECHNOLOGY

As a result of the rising demands in product development, new concepts are required in the area of manufacturing methods. Specifically the method “Additive Manufacturing” is the center of research and development of Prof. Dr.-Ing. habil. Gerd Witt and his 15 staff members. In addition, work is carried out in the optimization of assembly processes with respect to the demands for flexibility, automation, variety and output.

The courses deal with production technology and systems, manufacturing technology as well as machine tools. The chair also provides modern manufacturing and welding methods as well as MTM training courses in collaboration with industrial partners. Furthermore, students are able to complete their bachelor and master thesis internally on a current research project at the chair or externally in one of the 30 industrial partners.

Research topics related to “Additive Manufacturing” are found in different fields of application such as lightweight vehicles, individual and small-series productions or in the development of medical instruments. In the area of assembly technologies research is carried out on the integration of hybrid systems to improve the flexibility of the processes and the simulation of assembling processes.

Practical applications of the research results can be found in the automobile industry for the production of prototypes or lightweight constructions, in the medical technology for the production of individual parts as well as in the fuel cell technology whenever new concepts for hybrid assembling are required.

COURSES

- Manufacturing technology and science
- Production technology and systems
- Machine tools
- Cooperative events with industrial partners

RESEARCH

- Additive manufacturing
- Hybrid assembly systems and simulation

APPLICATIONS

- Mechanical engineering
- Medical technology
- Fuel cell technology
- Systems engineering
- Automobile industry

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PRODUCTION TECHNOLOGY AND PRODUCT DEVELOPMENT

COURSES

- Production management
- Rapid/Virtual prototyping
- Product development
- Measurement and testing techniques

RESEARCH

- Process optimization
- Rapid prototyping
- Virtual prototyping

APPLICATIONS

- Mechanical engineering
- Medical technology

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Prof. Dr.-Ing. Diethard Bergers

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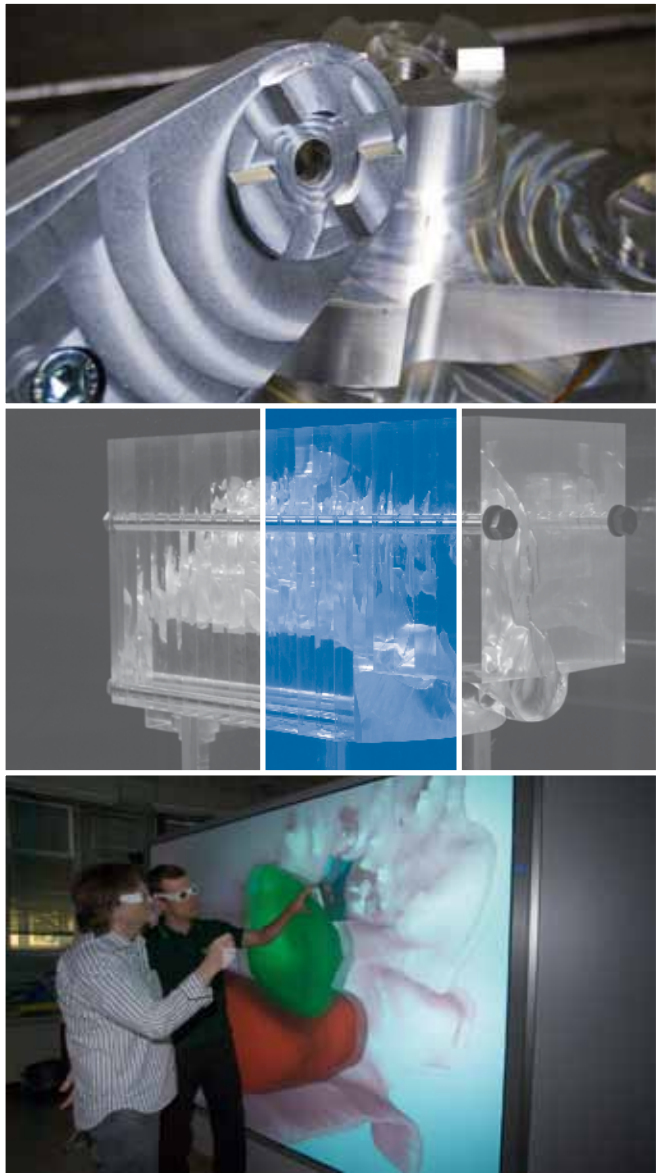
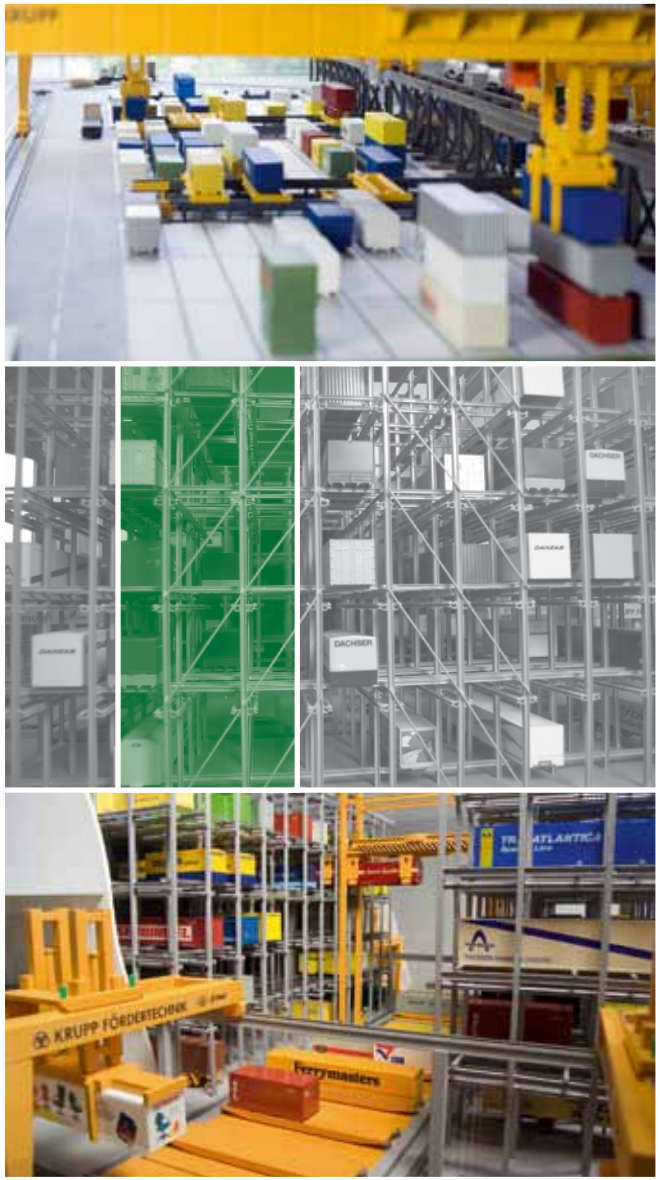
The main focuses of Prof. Diethard Bergers and his team are the optimization of product development processes, success factors in product development, production technology, rapid and virtual prototyping in particular for medical system components, and the production measurement techniques.

Prof. Bergers lays great value on process-oriented and interdisciplinary thinking. The chair thus covers a wide spectrum of topics, from the product development, the rapid and virtual prototyping and the project and production management, up to the characteristics of machine tools.

The main areas of research are in process optimization, rapid prototyping especially for metallic materials and virtual prototyping which are applicable in the fields of mechanical engineering and medical technologies. The chair successfully developed the Critical Care Board for the Essen Clinic. These specialized stretchers can carry a load up to 800kg and are made of carbon-fiber and as such are very light weight. They reduce the hassle of changing beds for emergency patients from the rescue operation up to the diagnosis in hospitals. The chair has also developed a special database of individual and exact 3-dimensional models of noses using virtual prototyping allowing ENT doctors to efficiently and effectively plan operative and therapeutic measures. An innovative, automatic diagnostic system developed by the researchers enables the precise and patient-friendly removal of suspicious tissue samples from patients with probable breast cancer using vacuum biopsy. This prototype uses an automatic guidance system, direct feedback through imaging and an optimal implementation of the biopsy for the doctors.



TRANSPORT SYSTEMS AND LOGISTICS



The chair of Prof. Bernd Noche carries out research in the area of computer-aided planning, realization and operation of distribution systems as well as the layout of distribution networks. The team of 23 scientists participates in various projects such as cognE-mobil, the Efficiency Cluster LogistikRuhr and the project known as “Sustainable urban cultural landscapes in the Ruhr area”.

The courses encourage the students to carry out independent scientific work, to critically evaluate technical know-how and to make responsible decisions. The study program imparts, in particular, know-how and analytical abilities to solve complex technological and organizational problems in the areas of logistics and traffic.

Research areas of the chair cover technological systems for intra-logistics, the application of modern information technologies in logistics, the development of simulation techniques for the analysis of logistical systems and the design of complex supply chains and distribution networks. Further areas of research deal with the development of algorithms and systems in the area of scheduling, the design of software solutions for advanced planning and operation, construction logistics, the development of new qualifications concepts and into the logistical concepts for urban systems.

The research results have an influence in the areas of product engineering, production planning and preparation of work, planning and operation of intra-logistical systems, the layout of distribution networks, the building of supply chains and also on the practical use of software developments.

COURSES

- Technical logistics
- Logistical systems
- Traffic systems
- Business management

RESEARCH

- Intra-logistics
- Information technologies
- Simulation techniques
- Supply chain design

APPLICATIONS

- Industrial and product engineering
- Production planning
- Intra-logistical systems
- Supply chains

CONTACT

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METALLURGY AND STEEL PRODUCTION

COURSES

- Chemistry of iron and steel production
- Process technology
- Recycling

RESEARCH

- Eutectoid conversion processes
- Flue gas turbo machine from cast iron
- Cavity free casting of iron
- Recycling of oxide and metallic residues

APPLICATIONS

- Iron and steel production
- Casting plants
- Construction of engines

CONTACT

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Prof. Dr.-Ing. Rüdiger Deike

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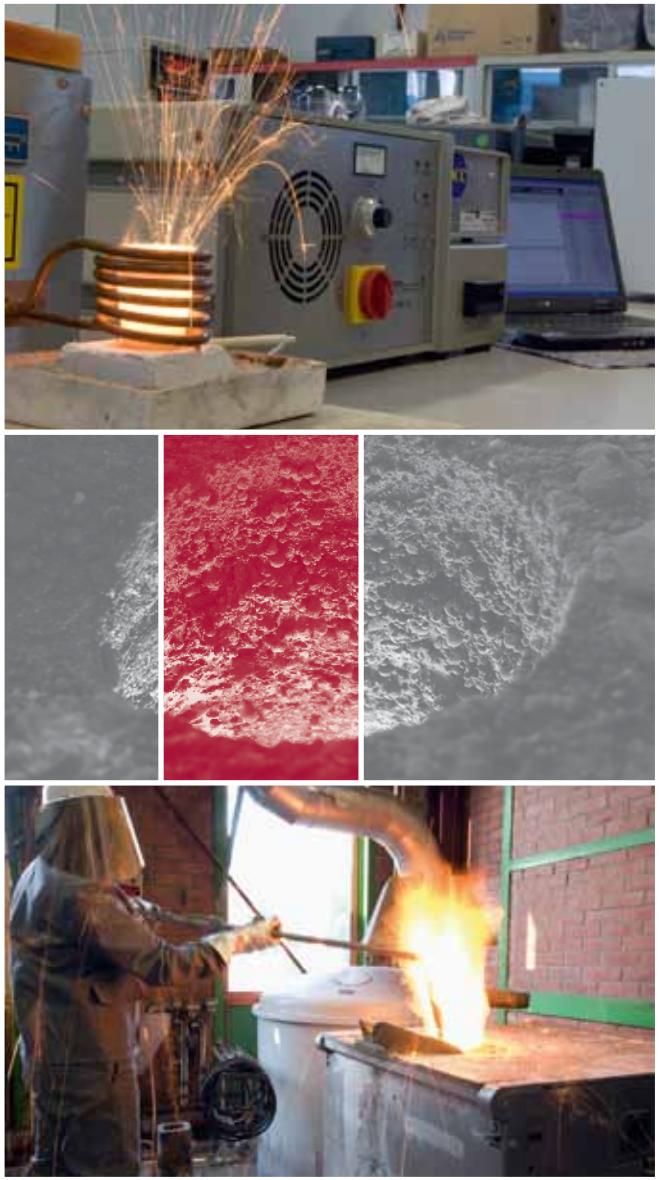
The production and processing of all kinds of metals requires an increasing number of highly-qualified engineers. The integration of new process technologies to maximize resources efficient production also contributes to the demand. Under the guidance of Prof. Rüdiger Dieke, the Chair of Iron and Steel Production is geared to fulfill this obligation.

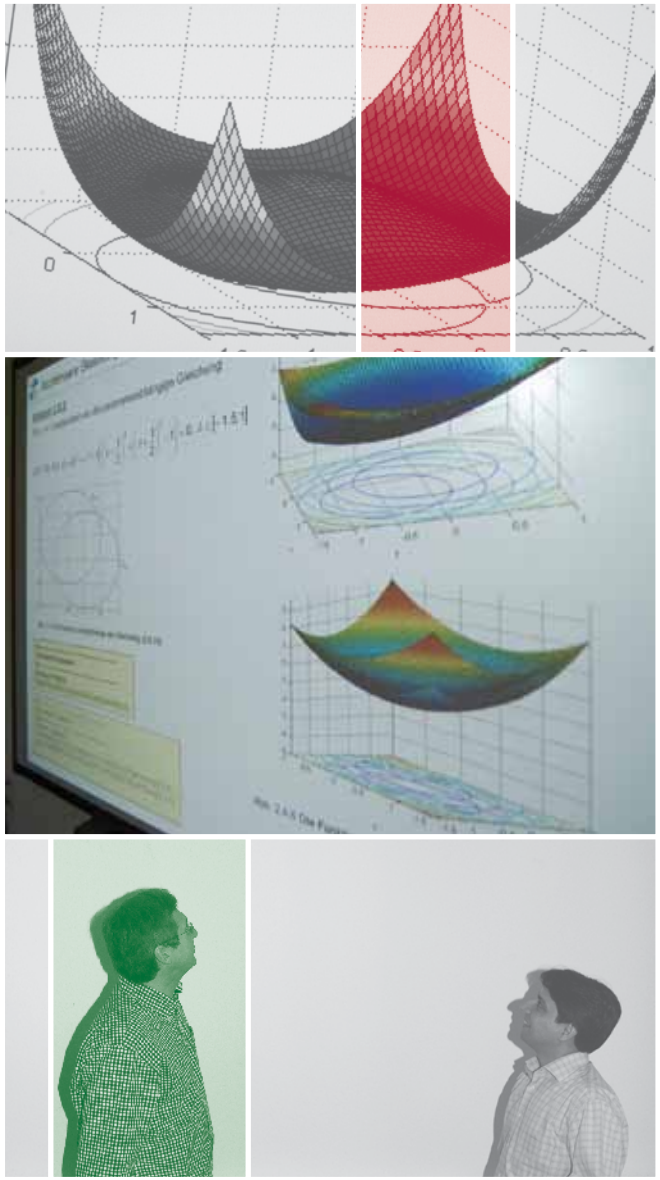
Students learn about the physical chemistry of iron and steel production as well as process technology of un-treated iron and steel production. They also learn about casting and hardening of steel, the recycling of oxidized and metallic secondary products and modern management methods.

Prof. Deike and his 4 member team investigate the influence of trace elements on the eutectoid conversion of iron-carbon alloy and they are working on a simulation model for the computation of the eutectic conversion of steel. Further areas of research are the development of metallurgy and process technology for flue gas turbo chargers made from cast iron, the development of metallurgy for riser-free casting of iron as well as the development of processes for the recovery of zinc and tin out of scrap and dust.

The research results are used in the improvement of the mechanical behavior of FE-C alloys. The simulation models are used to optimize the heat treatment processes in hardening units. The turbocharger project optimizes an innovative high temperature material for industrial applications. Other results are used reduce costs in steel plants, cast iron production and material recycling.



MATHEMATICS FOR ENGINEERS



Mathematics is a very important fundamental discipline for all branches of engineering. Applied fundamental mathematics and data processing are the core topics of Prof. Johannes Gottschling. He and his two staff members lay great emphasis on the practical applications of their work.

The courses offered by the chair impart applied fundamentals in mathematics and data processing as well as in process simulation and statistics.

Research activities of the team focus on mathematical methods to describe warm and cold flow curves of metallic materials, on machine-based learning, the simulation molding processes and casting techniques. Further research topics are data analysis using methods based on machine learning to optimize industrial processes as well as the development of software, which can be used in the industrial applications of the Chair of Metallurgy and Molding.

The strong emphasis on a hands-on approach in research can be seen by the variety of practical applications possible. The chair develops software for trademark and patent research in public internet domains and portals, and algorithms of investigating similarities between words and brand images. The so-called Flow Curve Management System deals with the computation and archiving of flow curves. Flow stress plotters are programs for the graphical presentation and calculation of flow curves on the basis of neuronal networks. Both are based on the research done at the Institute.

COURSES

- Engineering Mathematics
- Data Processing
- Process Simulation
- Engineering Statistics
- Computer Based Engineering Mathematics

RESEARCH

- Mathematical Flow Curve Description
- Machine Learning
- Process Simulation
- Software Development

APPLICATIONS

- Intelligent Process Control
- Flow Curve Management Systems
- Flow Stress Plotters

CONTACT

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METAL FORMING

COURSES

- Design theory/machine components
- Material testing
- Plasto-mechanics
- Molding technologies
- Computer applications

RESEARCH

- Flow curve investigation
- Testing of new ceramic rollers materials
- Material tests and metallurgical investigation
- Analysis and optimization of roller processes

APPLICATIONS

- Roller production
- Cold and warm roller plants
- Mechanical engineering for roller plants

CONTACT

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Prof. Dr.-Ing. Paul Josef Mauk

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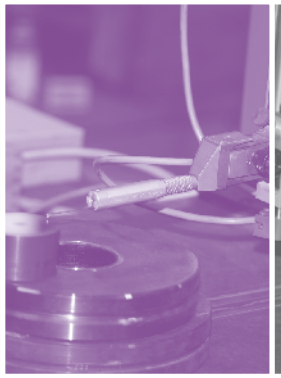
The Chair of Metal Forming deals with the chipless forming of metals in a solid state. Besides the process of forging and extrusion, key areas of research at the institute under the guidance of Prof Paul Josef Mauk are also the investigation of warm and cold rolling technologies of flat and profile steel.

In addition to the fundamental courses on machine components and material testing, the chair offers lectures related to molding technologies including their theoretical foundations as well as lectures about component and fatigue strength. The contents of the lectures are always linked to practical work in the laboratories. A further area of research is the process simulation and vibration analysis of the production plants.

Six scientific staff members are working on the experimental and theoretical analysis of roller technologies, the development and testing of ceramic materials for rollers as well as process simulation and vibration analysis of metal forming plants. Additionally, the chair operates laboratories for material testing, metallography and a grid electron microscope for the characterization and modeling of important material behavior.

Industrial application of the research results are in the technological and economic optimization of production processes. An example is the reduction of the number of passes required in rolling through the adoption of ceramic rollers in the rolling of metal foil. Another example is the production of thinner end products through the targeted use of the heat produced in cold forming of stainless steel spring steel.



ENERGY REQUIREMENT IN PROCESS ENGINEERING

Prof. Wolfgang Bauer and his team at the chair are dealing with energy related aspects of high temperature processes and the necessary materials.

The chair imparts knowledge pertaining to energy intensive plants which are typical for the cast iron industry and metallurgy. This includes the fundamentals of thermodynamics and heat transfer, fuels and combustion, fire-resistant materials as well as high temperature technology for melting, heat retaining, hot and heating plants. Thermo-physical understanding of high temperature processes and plants as well as their layout is provided by the chair. The students become competent in judging, selecting and optimizing the layout of energy-intensive, high temperature processes and plants.

The research activities extend from investigating the thermo-physical characteristics of metals, ceramic materials and foundry sand for high temperatures, the thermal calculations and optimization of plants and standard tests and corrosion tests of fire-resistant materials to the drying of monolithic fire-resistant deliveries.

Research results enable better models for the dimensioning and process management of high temperature plants. They improve the energy efficiency of plants and help to optimize the behavior of fire-resistant materials. The research also provides thermo-physical material properties for the simulation and allows determining emissions levels of ceramic and metallic materials for optical temperature measurements.

COURSES

- Thermodynamic basics
- Heat transfer
- Fuels
- Fire-resistant materials
- High temperature technologies

RESEARCH

- Determination of thermo-physical material data
- Thermal plant optimization
- Testing of fire-resistant materials
- Drying of monolithic fire-resistant materials

APPLICATIONS

- Calculation models for high temperature plants
- Energy efficiency of high temperature plants
- Material optimization

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FOUNDRY MACHINERY AND MOULDING MATERIALS

COURSES

- Planning/design of casting plants
- High Pressure Die casting technologies
- NF Metallurgy/melting technologies
- Moluding materials

RESEARCH

- Emission-free casting
- Moulding materials for titanium casting

APPLICATIONS

- Casting plants
- Processing technologies
- Chemical industry

CONTACT

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Prof. Dr.-Ing. Thomas Steinhäuser

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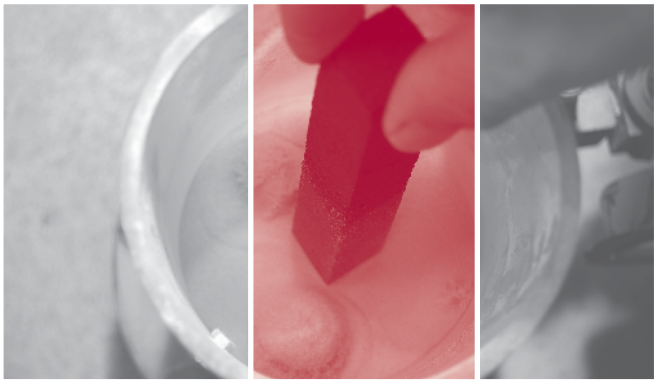
Moulds and Cores, the processing of liquid metal, melting points, thermal and mechanical stresses during casting are some of the areas being researched by the Chair in Foundry Machinery and Moulding Materials. Prof. Thomas Steinhäuser and his team of scientists also put particular emphasis on the aspects of economics and environmental protection.

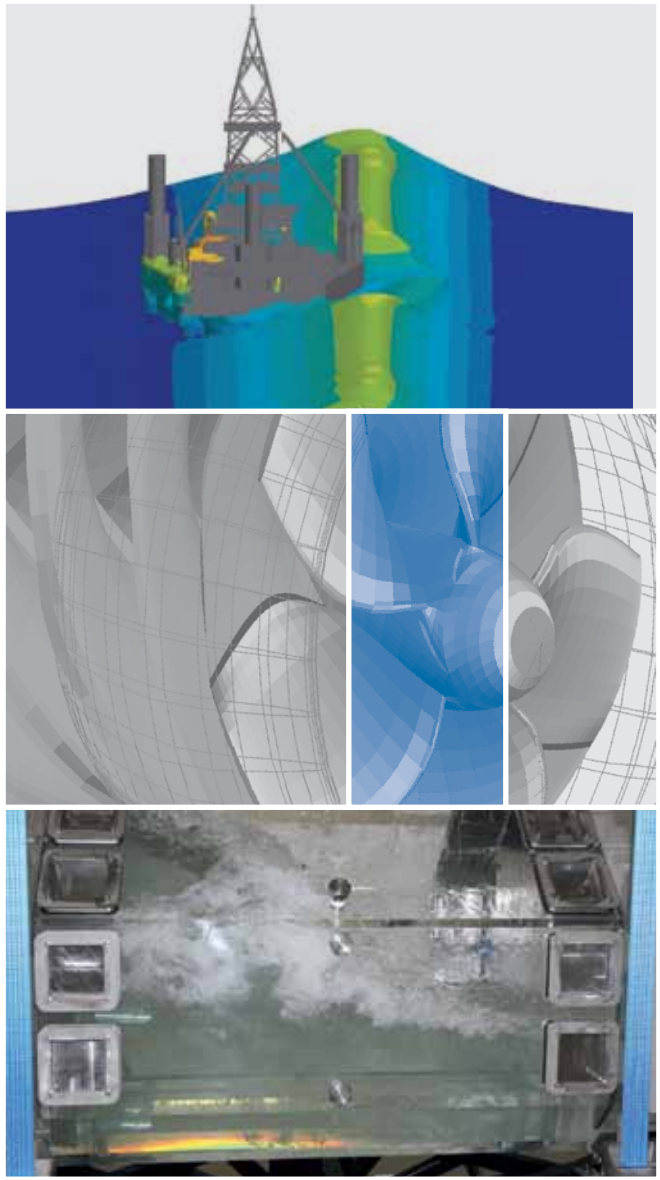
Students will learn all kinds of machinery and production units for different types of cast ferrous and non ferrous metals and they will gain knowledge in planning and layout of casting plants. The study program provides competence in pressure die casting technology and also in NF metallurgy, melting technology, as well as specialized knowledge in the selection, utilization and testing of moulding materials for the production of castings.

Research activities are centered around two main areas. The first is the development and optimization of inorganic binders for the production of moulds and cores for casting production. These binders enable a practically emission-free casting and improve the working and environmental conditions in the production process. The second main area of research is the BMWi funded SME project for the development of the molding materials for casting titanium.

The mould and core production using inorganic binders in iron and NF metals in casting plants has already been adopted by industry. In the area of casting titanium the research will enable the production of complex titanium casts to be more economical in the future.



SHIP TECHNOLOGY, OCEAN ENGINEERING AND TRANSPORT SYSTEMS



Ship Technology and Ocean Engineering offer a wide field of research activities, linking researchers, shipping companies, shipyards, suppliers, and many more in a worldwide network. With its research projects involving national and international cooperation, the Chair of Prof. Bettar Ould el Moctar and his 18 staff members are well integrated into this network.

Projects focus on numerical and experimental investigations of seakeeping, manoeuvring, ship efficiency, fluid-structure-interaction, ocean energy, offshore technology and LNG transportation. Numerical simulations (CFD and FE-Methods) are carried out on the institute's computer cluster, while experiments are performed in a circulation tank with access for optical measurements and high speed imaging. Fluid loads on LNG tanks and containment flows under seaway conditions in general are addressed to in a sloshing laboratory, which includes a 6-DoF motion platform, pressure measurement devices and a stereo PIV system. Many projects also benefit from the close cooperation with class societies, shipping companies, shipyards, manufacturers and model basins.

Apart from research activities, the chair is dedicated to the education of students in bachelor and master degree courses. Lectures, exercises and practical courses range from ship design via strength assessment, hydrodynamics and ship machinery to numerical methods in fluid dynamics. External lecturers also share their competence and passion in subjects like submarine design and wave theory, supporting the Chair in the education of qualified and motivated engineers.

COURSES

- Design and construction
- Hydrodynamics
- Numerical methods
- Strength assessment
- Risk assessment

RESEARCH

- Seakeeping & sea loads
- Fluid-Structure-Interaction
- Manoeuvring
- Offshore systems & Ocean energy
- LNG transportation

APPLICATIONS

- Shipbuilding
- Ocean engineering
- Shipping & Authorities

CONTACT

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BUSINESS ADMINISTRATION AND OPERATIONS MANAGEMENT

COURSES

- Procurement and production
- Production management and controlling
- Operations management
- Models and methods

RESEARCH

- Industrial engineering
- Supply chain management
- Multi-level production and service provision systems
- Modeling and optimization

APPLICATIONS

- Production and process optimization
- Lean management
- Multi-site optimization

CONTACT

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Prof. Dr. Rainer Leisten

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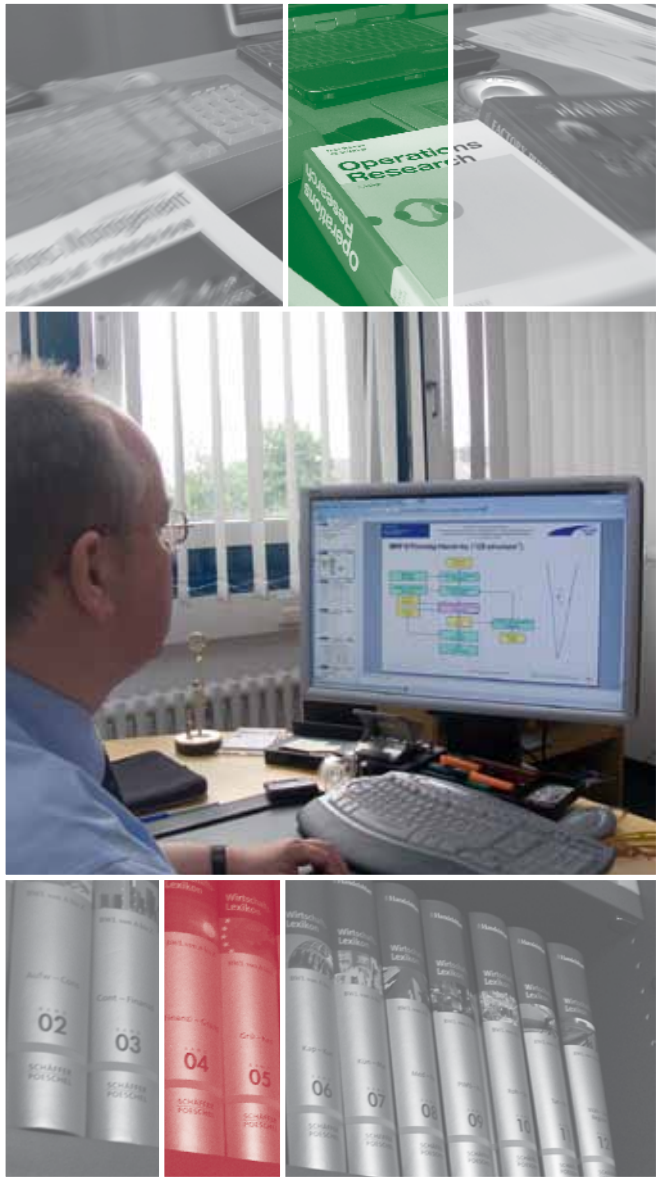
Prof. Rainer Leisten and his team are dealing with the analysis of the production and service processes as well as their integration within and beyond a company's activities. The chair is a member of the Center for Logistics and Transport (ZLV).

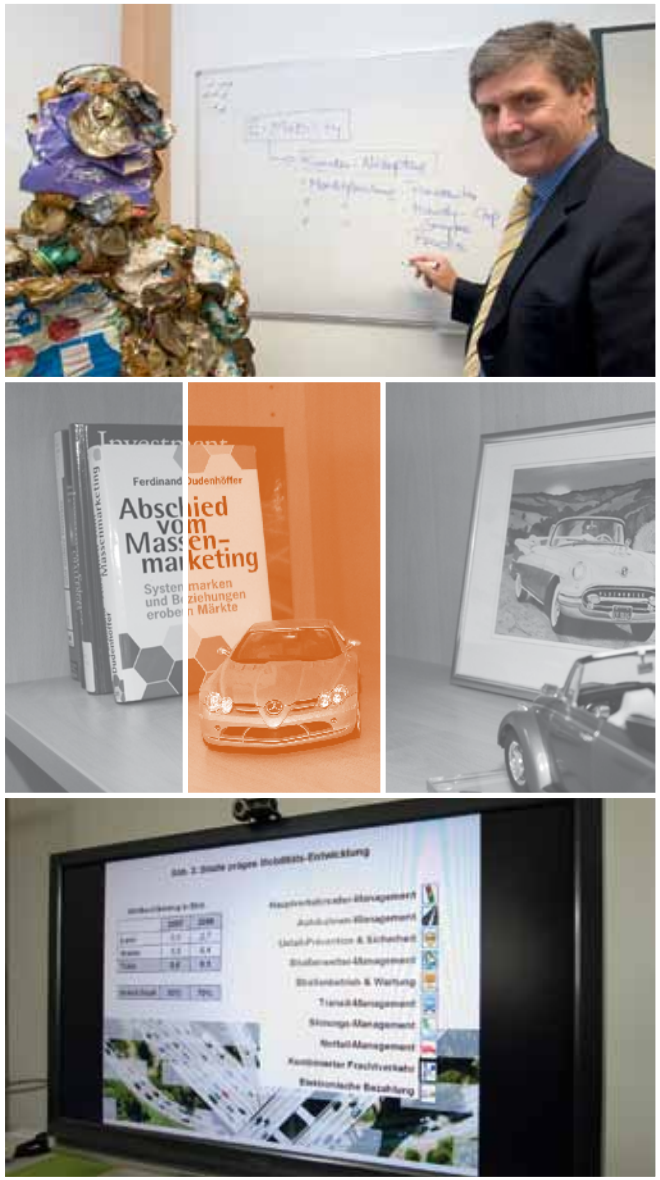
The study program offered by the chair enables the student to analyze, judge and improve processes performance, especially in production from the engineering and the management point of view, and also included is the implementation of scientific principles of lean management principles. The students will also be shown how different the same subject will be viewed from the engineering and the management point of view and how these differences can be integrated. Of particular importance is the integration of production management and controlling principles.

The research areas of the chair cover primarily supply chain management and supply chain controlling, the coordination of multi-level production and service systems as well as planning of the job sequences and layout of machines within a production system.

This provides a sound foundation for the optimization of production planning and operation in practice. Further areas are the design, modeling and improvement of the internal and external supply chains and networks, the applied quantitative modeling and planning solutions. The results are valid for a broad spectrum of production and service industries. Areas of application can be found in many different fields such as in manufacturing and services, in the service industries, unit production industries and in small and medium sized enterprises.



BUSINESS ADMINISTRATION AND AUTOMOTIVE ECONOMICS



The main focus of Prof. Ferdinand Dudenhöffer and his chair, which also houses the Center Automotive Research – CAR, is the global automotive and associated supplier industry. In addition to CAR, the ÖkoGlobe Institute has been established by Prof. Dudenhöffer and the Action Artist HA Schult. The ÖkoGlobe Institute hands out every year important prizes for sustainable innovations in the area of mobility.

The chair and CAR work closely together with companies within the automotive sector. CAR has many widely published studies regarding trends found in the automotive industry and their implications for the component industries, car manufacturers, mineral oil companies, car banks and leasing companies. Prof. Dudenhöffer and his team have built up the well-established annual CAR Symposium, an important congress within the sector with top international managers as speakers, and with about 1000 participants. Preceding the Symposium, a recruiting fair known as “Car Connects” attracts over 2000 job applicants to this annual event. CAR participates in many joint projects of the department such as electro-mobility project colognE-mobil.

The courses offered by the chair cover the inter-relationship and success factors in the global car industry. The branch is one of the most important areas of industrial activity in Germany producing more than 6 million cars and providing over 700,000 jobs. The whole economic chain of the car industry is analyzed within the study program – starting with the component suppliers industry, followed by the automobile manufacturing, up to distribution and financial services. Further key aspects of the courses are marketing, investment and financial decisions.

COURSES

- General business administration
- Automotive economics and management

RESEARCH

- Studies of product and market trends
- Studies of automotive services and component supply development
- Monthly price analysis of the car market in Germany
- Studies of alternative motors and fuels

APPLICATIONS

- Automobile and component industries
- Financial Services in the automotive industries

CONTACT

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Prof. Dr. Ferdinand Dudenhöffer

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GENERAL BUSINESS ADMINISTRATION & INTERNATIONAL AUTOMOTIVE MANAGEMENT

COURSES

- Planning and organization
- Automotive value chain
- Automotive management

RESEARCH

- Dynamic automotive management
- Automotive management in growing markets
- Automotive management in transition to electro-mobility

APPLICATIONS

- Analysis
- Prognosis
- Strategy
- Studies

CONTACT

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Prof. Dr. Heike Proff

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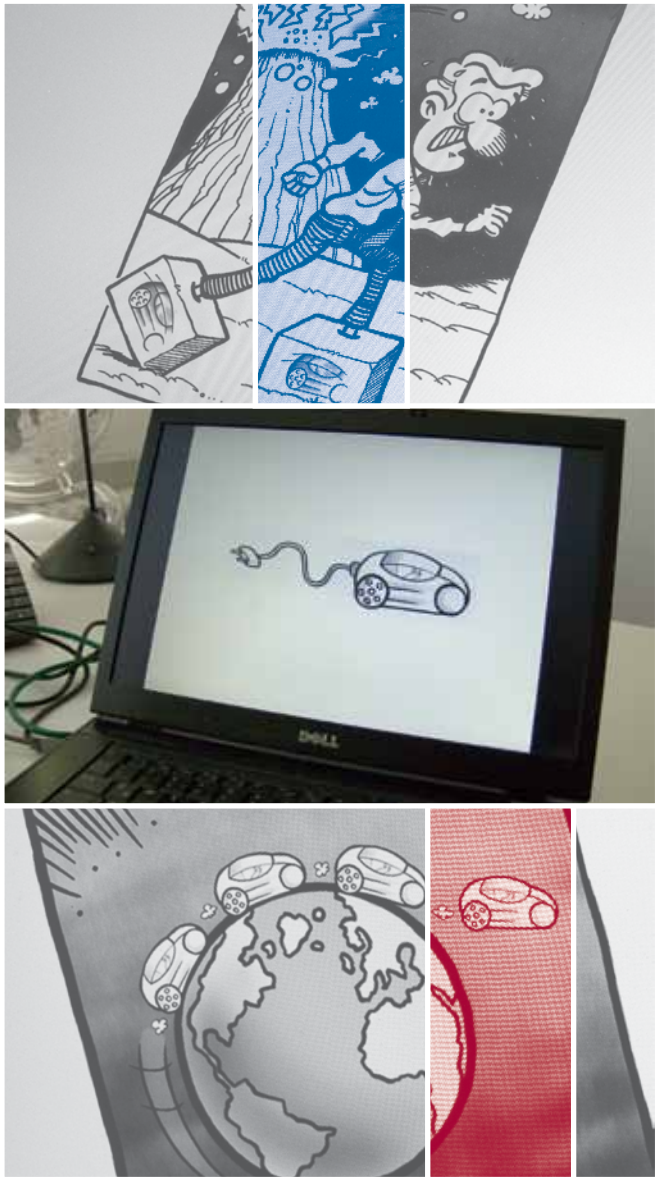
The Chair of General Business Administration and International Automotive Management is looking for lateral thinkers with broad competences to interface between the different functional areas of the automotive industry.

Students will learn about sound decision-making practices and company strategies. This includes the ability to evaluate strategic decisions as well as know-how related to the international and inter-cultural automotive management. In addition, students will learn all the necessary aspects of engineering and business management required for the inter-disciplinary problem solving and cooperation in technologically orientated companies.

Prof. Heike Proff and her team of six deal with the theoretical and empirical research of international and inter-cultural management as well as company strategy. This includes research strategies for the growing BRIC markets; Brazil, Russia, India and China. They also look at strategies related to the transition to electric-mobility, dynamic strategies to deal with changes in the surroundings, in competition interaction and competency challenges. The chair participates in the research project colognE-mobile and carries out work in a "Ziel2-NRW"Project regarding new business models in the transition to e-mobility. Furthermore the chair is a lead partner of 19 chairs in the EU-Tender „Competitiveness of EU Automotive Industry in Electric Vehicles". The new Dynamic Strategy Laboratory Duisburg is being built to support experimental activities.

Companies will be supported by the Centre for Automotive Management (CAMA) in their attempts to tackle changes to their environments as well as be provided with impetus to embrace new ideas and approaches.



AFFILIATED AND COOPERATING INSTITUTES

The associated institutes of the department are independent private research institutions, in terms of organization and legal status, attached to the University of Duisburg-Essen.

These institutes associated with the Department of Engineering play a key role at the interface between university research and their commercial applications. Their main effect is to speed up knowledge transfer of academic research into commercially viable applications. Due to their close contact with their respective industries, the institutes are important driving forces attract industry funding for the Department.

The Department of Engineering is closely linked with four associated institutes and two cooperating institutes. These institutes carry out high-level applied research in close cooperation with the university and partners from industry. All six institutes are very well known internationally.

The Institute of Energy and Environmental Technologies e.V. (IUTA) in Duisburg is one of the largest institutes working in the area of Energy and Environmental Technologies in Germany.

The IWW Center of Water in Mülheim / Ruhr counts as one of the leading German institutes for research, advice and services in the area of water supply.

The Development Center for Ship Technology and Transport Systems e.V. in Duisburg holds a leading position worldwide in the research of shallow water hydro-dynamics.

The Center for Fuel Cell Technology (ZBT) GmbH, located on the Duisburg Campus, provides services in the area of applied research, development and innovation and develops technologies in the area of low temperature fuel cells (PEM).

The IMST GmbH in Kamp-Lintfort is a competence center and a professional development institute for high frequency circuits, radio modules and communication systems.

The Fraunhofer Institute for Micro-electronics Circuits and Systems in Duisburg is active in the areas of research, development and pilot production of micro-electronic solutions for applications for industry and society.

The institutes strengthen the research and applications potential of the department to a large extent and contributes to the reputation of the University of Duisburg-Essen as a center of research and excellence.

INSTITUTE FOR ENERGY AND ENVIRONMENTAL TECHNOLOGIES E. V. (IUTA)

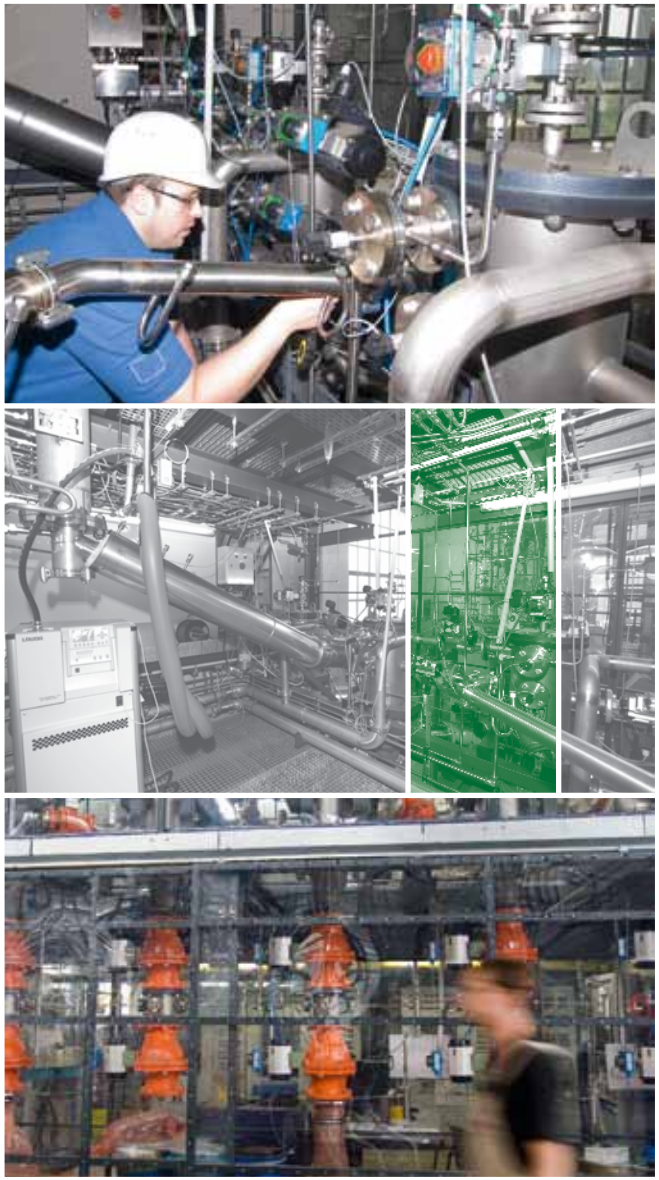
KEY ACTIVITITES

- Aerosols and fine particles
- Sustainable nano technologies
- Functional surfaces
- Future energy supply
- Highly toxic substances

IUTA was founded in 1989 and has about 160 staff. With a total project turnover of about €7.5 million annually in the area of energy and environmental technologies it is one of the largest institutes in the field of energy and environmental engineering in Germany. The focus is to collaborate with industrial partners on applied research and development projects to transfer academic research into new or better products and processes. Prof. Dieter Bathen and his staff are dealing with the technical and scientific issues related to aerosols, fine particles, sustainable nanotechnologies, functional surfaces, future energy supply and highly toxic substances.

IUTA holds a unique position in all these fields. Examples are the European-wide unique technological plant for the production of highly specific nanoparticles, the leading role in the risk investigation in nanotechnology and the Centre for Functional Surfaces and Filtration Research which is currently under construction. The center owns unique technical testing plants in the area of filtration and adsorption technologies, and the largest testing unit for CO_2 recovery from flue and bio gas in Germany. In addition to these testing units, IUTA also owns a well-known measurement unit and a research analysis laboratory.

The inter-disciplinary research team made out of engineers, physicists, chemists, and many other disciplines have offices, laboratories and technical areas of about 6,500m² at their disposal.



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IWW WATER CENTER

The IWW Water Center is one of the leading institutes in Germany in the areas of research, consultancy and services for all aspects of water supply. The associated institute of the University of Duisburg-Essen employs about 80 members of staff at the three locations Mülheim as der Ruhr, Biebesheim am Rhein (IWW Rhein-Main) and Diepholz (IWW Nord). Services provided by IWW are used by water supply agencies, industries, swimming pool operators, government agencies, engineering companies and other institutes. Through Prof. Rolf Gimbel (Institute of Process Engineering and Water Technology) who is a speaker and member of the scientific board of IWW there exists an active cooperation mechanism between IWW and the Department of Engineering.

IWW carries out inter-disciplinary research related to water; starting with fundamental research up to practical applications. The current research program of IWW covers the areas of desalination, harmful trace elements, climate change and water management, water cycles, management of sustainable water supply systems, hygiene and safety, quality control, maintenance and renovation of water systems as well as optimized water treatment processes.

A particularly interesting aspect of IWW's research s its work on new processes for desalination which is of particular importance considering the growth in the world's population, increasing use of water by industry and climate change issues. Other research projects deal with the optimization of high performance membrane technologies, the influence of climate change on the water cycle as well as with issues of hygiene in technical water systems.

KEY ACTIVITITES

- Water resource management
- Water technology
- Water networks
- Water quality
- Applied microbiology
- Management consultancy

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DEVELOPMENT CENTER FOR SHIP TECHNOLOGY AND TRANSPORT SYSTEMS E. V. DUISBURG DST

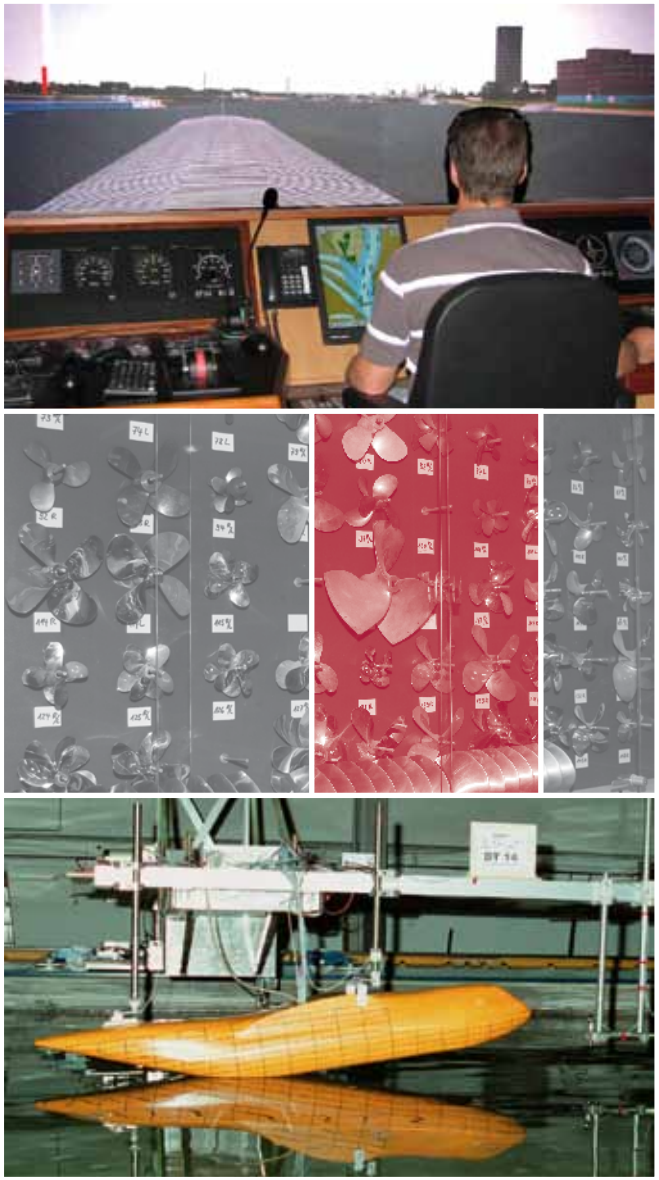
KEY ACTIVITITES

- Inland and coastal shipping
- Shallow water dynamics
- Simulation of ship movements
- Transport logistics
- Shallow water steering simulation
- Ship safety
- CO_2 reduction

DST was founded in 1954 as a simple ship construction testing site and has now developed into a broad-based development center for inland and coastal shipping. The center offers services to transport services operators, industry and government in all technological and economic issues which deal with the development and implementation of market-orientated transport concepts for inland and coastal shipping. DST is an associated institute of the University of Duisburg-Essen since 1989. DST holds a worldwide leading position in all questions related to shallow water hydrodynamics. The center investigates the behavior of ships on rivers, channels, canals and in coastal areas in very large model tanks using advance computer simulation on the basis of computational fluid dynamics (CFD) under special consideration of the influence of shipping on waterways, water channels and shore and bank protection. DST has amassed a large amount of knowledge and data banks in this specialized area.

Since 1992 DST has widened its areas of activities into transport logistics with the aim to make inland shipping more competitive. In order to achieve this aim, the whole system including ships, harbors, waterways and the complete transport chain between the sender and receiver of cargo must be taken into consideration. In addition, DST employs a shallow water simulator since 2008 which has brought in new perspectives into the research activities as well as enabling basic and advanced training of onboard staff to be carried out.

DST carries out a large number of research projects in the areas of economic viability, environmental protection, safety aspects in transport systems, simulation, fleet modernization as well as water flow analysis and wave formation with funding from local and national governments as well as the European Union.



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CENTER FOR FUEL CELL TECHNOLOGIES GMBH (ZBT)

The Center for Fuel Cell Technologies (ZBT) was founded in 2001 and has established itself as a service provider in the area of applied research, development and innovation. ZBT provides the bridge between fundamental university research and the demands of industry in the development and use of fuel cell technology with funding from NRW and the European Union.

Prof. Angelika Heinzel together with Dipl.-Volksw. Günter Schöppe supported by 95 staff members are working in the areas of gas process technologies, fuel cells and systems technologies, electro-chemistry and film technologies, quality control and testing, micro systems and fluid dynamics, hydrogen and batteries as well as production technologies. In addition, ZBT operates a certified testing laboratory (PBT) for fuel cell technology.

Research activities are carried out over the whole spectrum of fuel cell technologies. They deal with the development of bi-polar plates, fuel cell stacks, hydrogen production units and components. As a result of the wide range of possible applications using the polymer electrolyte membrane fuel cell (PEM) this technology is one of the key areas of research and development within the center. ZBT is concentrating on the development of small, mobile electricity production units. In the meantime the center can demonstrate a series of prototypes for different applications, for example in the area of emergency power supply or leisure activities.

ZBT is based in a modern building complex with about 2,500m² of laboratories and technical workshops and 1,500m² offices and seminar rooms.

KEY ACTIVITITES

- Bi-polar plates and material and blow-molding
- Electro-chemical characterization
- Fuel cell stacks
- Assembling technologies
- Hydrogen production units, gas process technology and electrolytes
- Development of Li-ion batteries
- Demonstration systems
- Testing techniques

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IMST GMBH

KEY ACTIVITITES

- Micro/nanoelectronics
- Aviation and space travel
- Automobile electronics
- Medicine technologies
- Antenna and radio networks
- Active antennas
- Wave propagation
- Connected Car ™ Radio Networks

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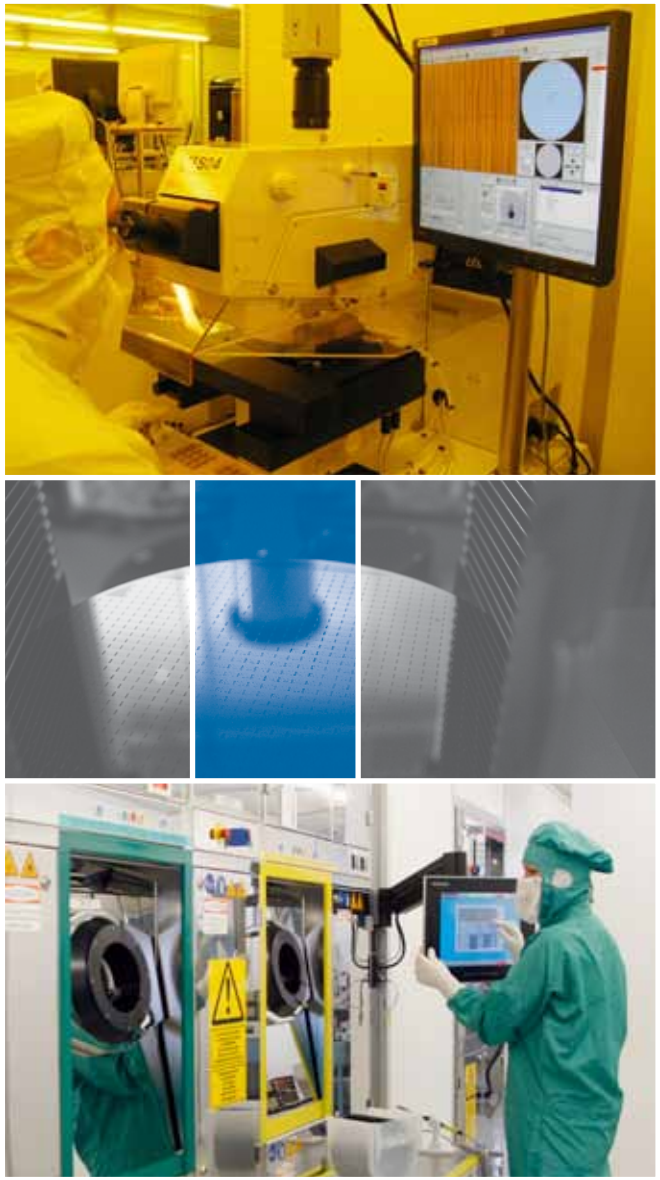
IMST GmbH, founded in 1992 in Kamp Lintfort, is an associated institute of the Faculty of Electronics and Information Technology. The institute is one of the world's leading development centers for high frequency circuits, radio modules and communication systems. Prof Ingo Wolff together with Prof. Peter Waldow, together with a staff of 150 members, are working in the four areas of research, development, products and testing.

The development of high performance antenna is a primary activity of the Institute. A further key area of competence of IMST lies within the development of micro-electronic circuits and chip design. Circuits developed by IMST can be found in radio communication, radar technologies and industrial measurement techniques. Wireless communication systems developed in Kamp Lintfort are successfully used in process automation, the building and medical technologies, the automobile industry and safety control systems.

One of the greatest challenges facing us in the near future is the production of clean air and clean energy through innovative technologies. This is why IMST GmbH is also working in the area of sustainable CO_2 reduction. This includes innovative concepts for the optimization of the wireless energy transfer and new propulsion concepts for vehicles. In addition to the necessary hardware, IMST GmbH also develops and sells its own specialized computer software programs for use in different applications and areas.

Since 2008, the Institute has been building up a competence center for automobile technologies known as "the KAT". Communication and localization technologies as well as wireless energy transfer are central development activities in KAT.

THE FRAUNHOFER INSTITUTE FOR MICRO-ELECTRONICS CIRCUITS AND SYSTEMS IMS



The Fraunhofer IMS founded in 1984 deals with applied research, development and pilot production of micro-electronic circuits for use in industry and public organizations. IMS is closely linked to the Department of Engineering: The head of IMS is Prof. Anton Grabmaier who is also head of the Institute of Electronic Components and Circuits.

Consisting of a staff of 240 members, the IMS has different areas of activity namely pressure sensor systems, CMOS imaging, wireless and transponder systems, ASICs, ambient intelligence systems, devices & technology, IR imaging and bio-hybrid systems. The in-house innovation center is located in the main building and has at its disposal most modern equipment for research and development at its disposal. ICs based on CMOS are produced in clean rooms covering an area of more than 1,300m² and in addition the micro-systems technology laboratory with over 600m² clean room area complement the facilities for post processing activities. Completely new sensors are under development such as those based on the integration of bio materials.

Current development activities are taking place in the field of ambient assisted living systems and deal with assistant systems for an aging society. Further areas of development include energy efficient operation of buildings, automation of industrial process and environmental and safety technologies.

Practical applications include sensor-based retina implants in intelligent medical technologies as well as RFID systems using sensors. The developments of the Fraunhofer Institute can be found, among others, in driver-assisted systems, sensors or in building controls.

KEY ACTIVITITES

- Ambient assisted living systems
- Energy efficient building systems
- Environmental technologies
- Safety technologies
- Automation of industrial processes
- Semiconductor technologies
- Imaging sensors
- Intelligent implants

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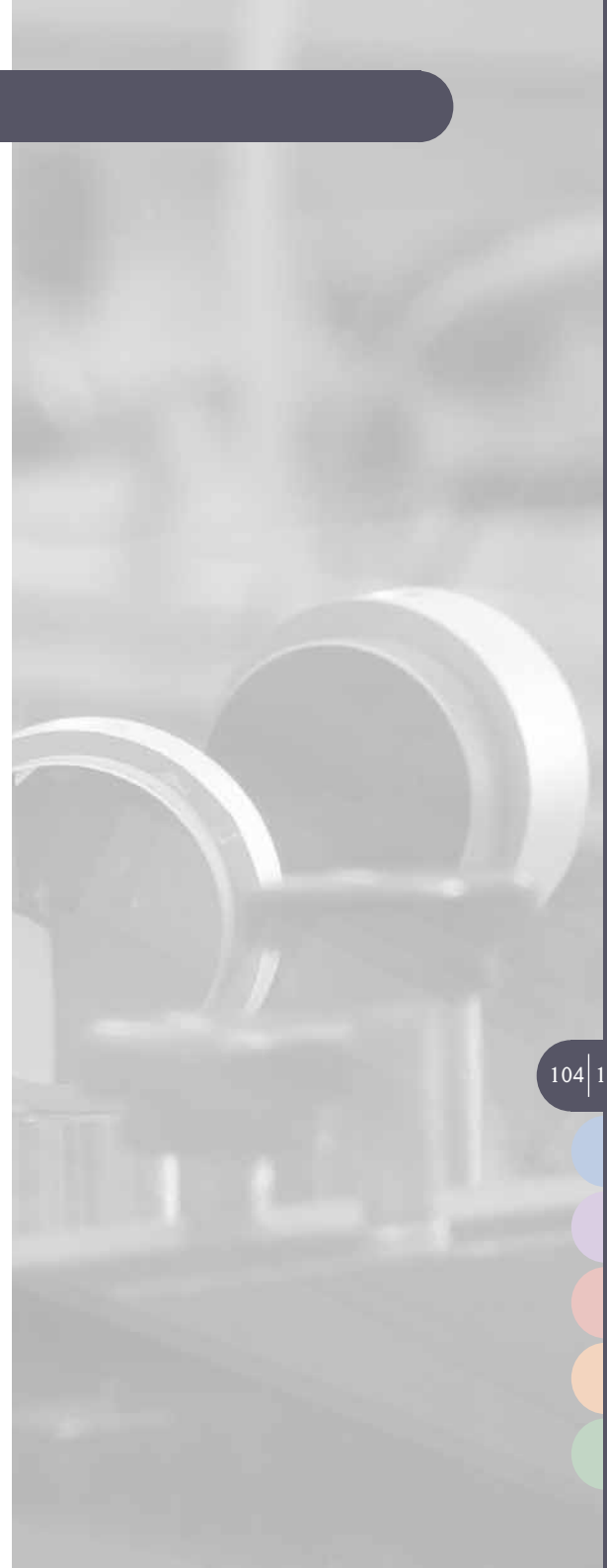
Key words



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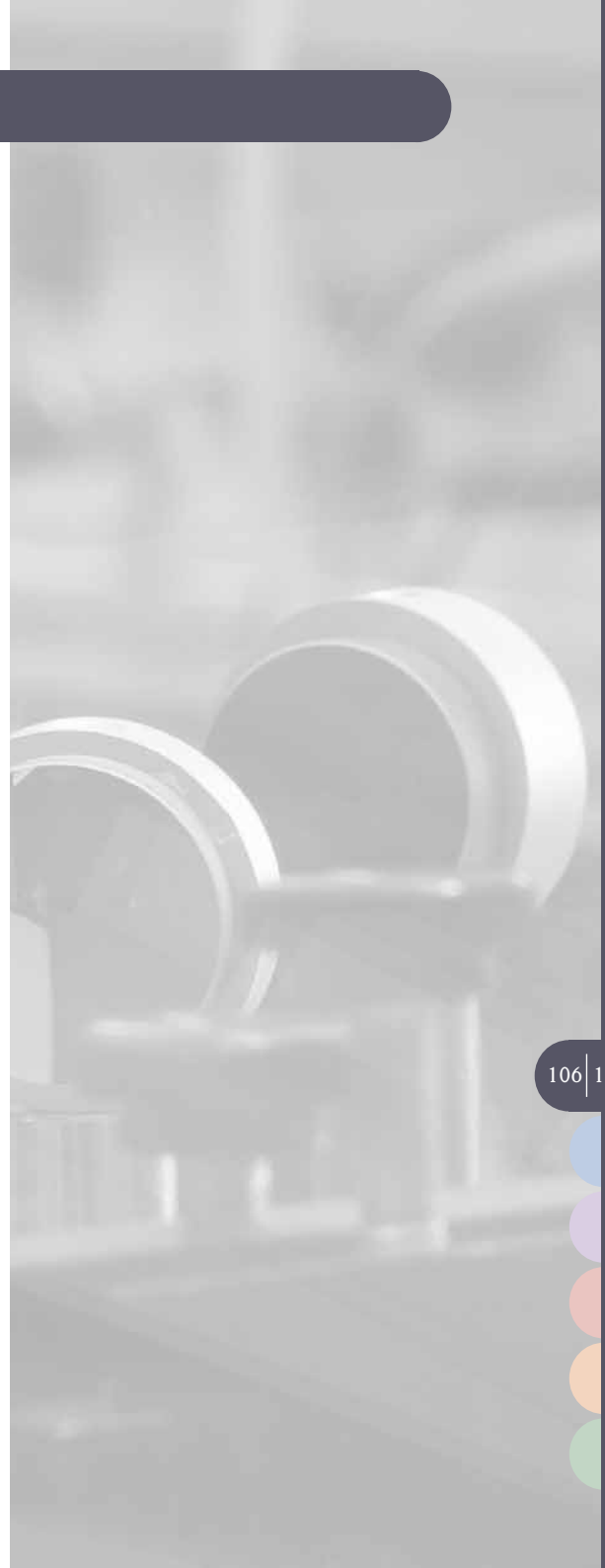

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