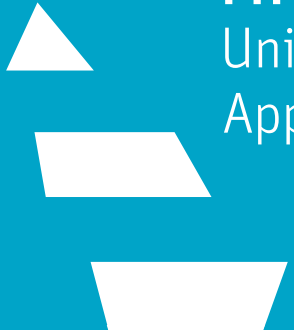
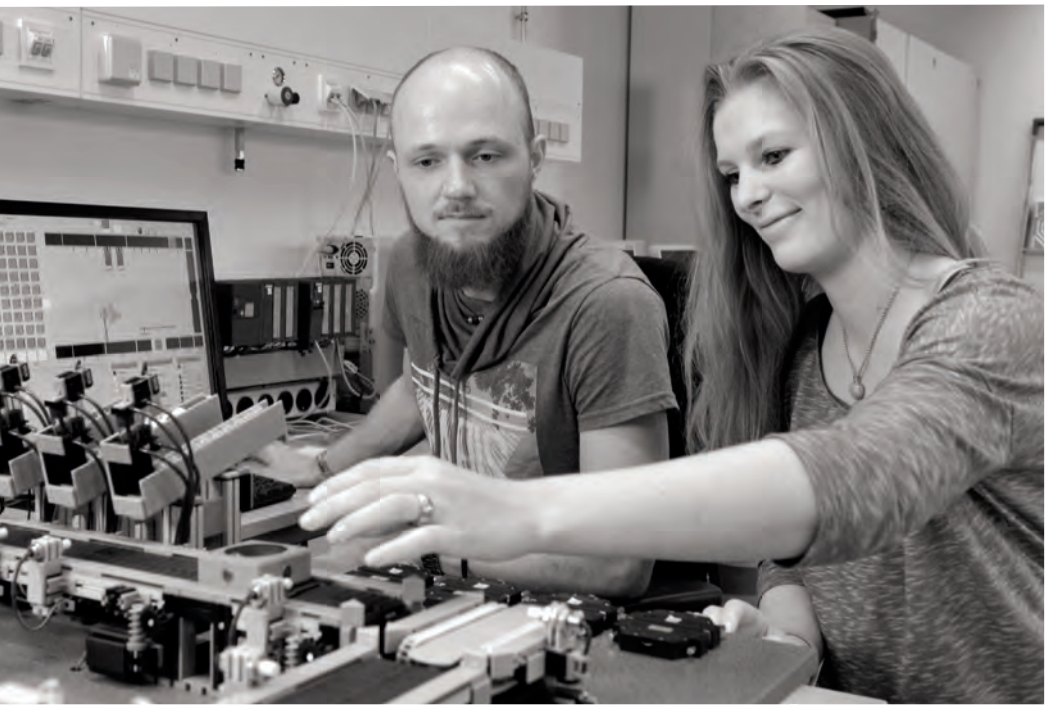
FACULTY OF
ENGINEERING AND MATHEMATICS

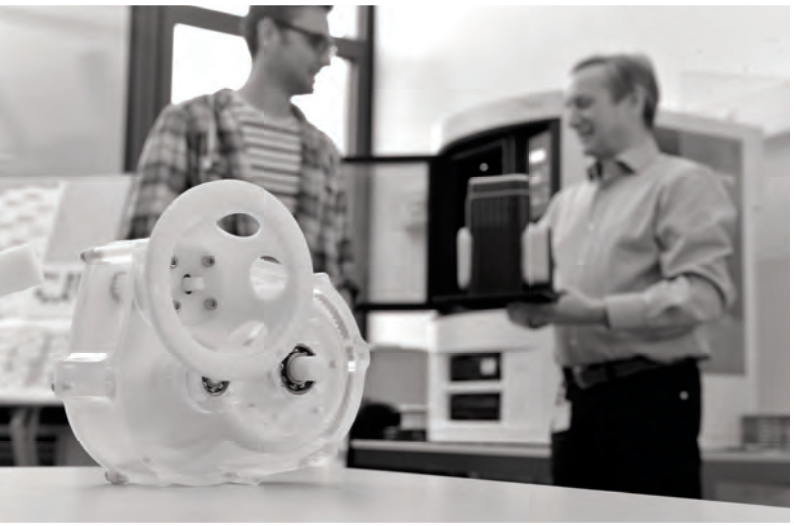
INTERNATIONAL REPORT

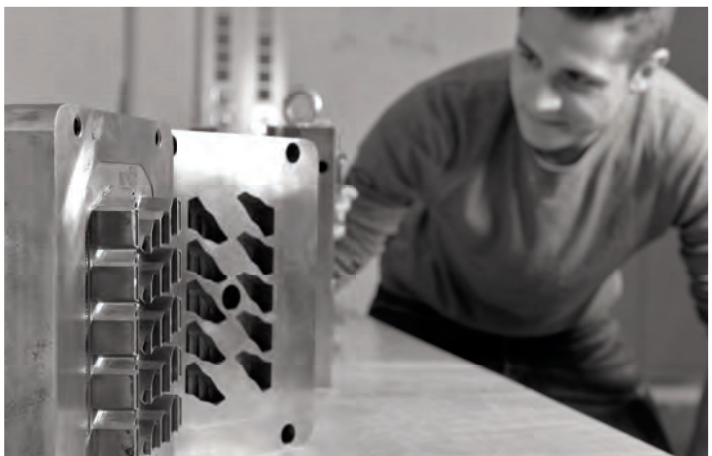


FH Bielefeld
University of
Applied Sciences





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ENGINEERING AND MATHEMATICS

INTERNATIONAL REPORT

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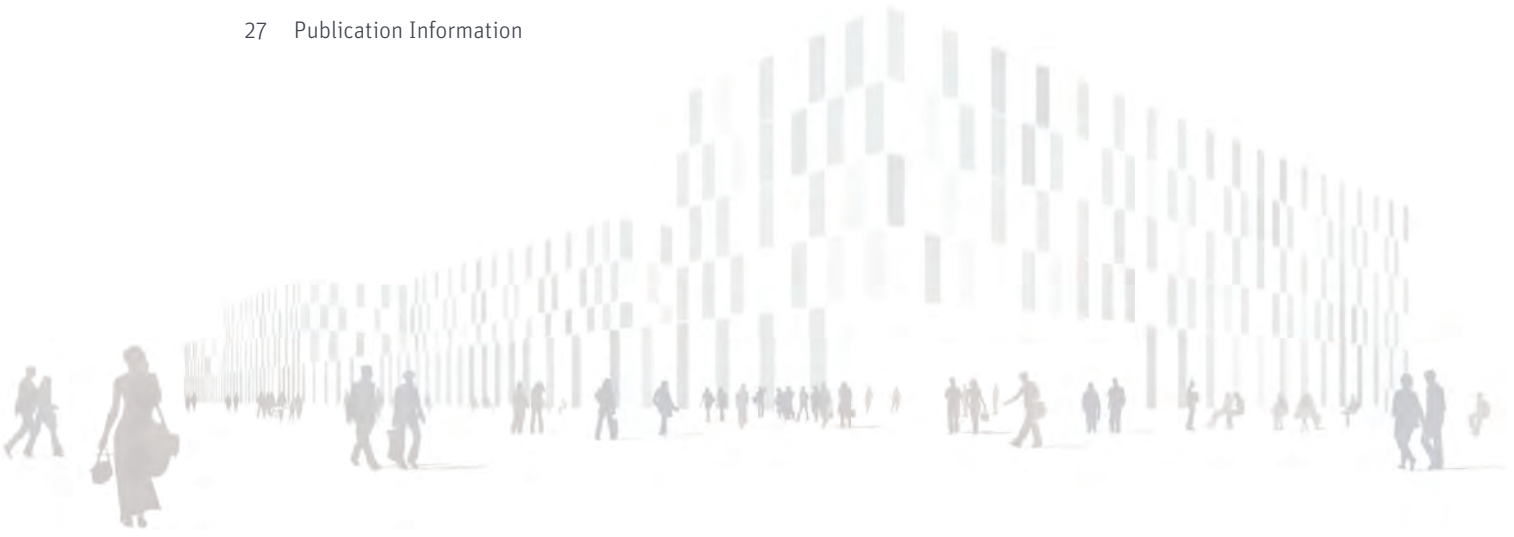
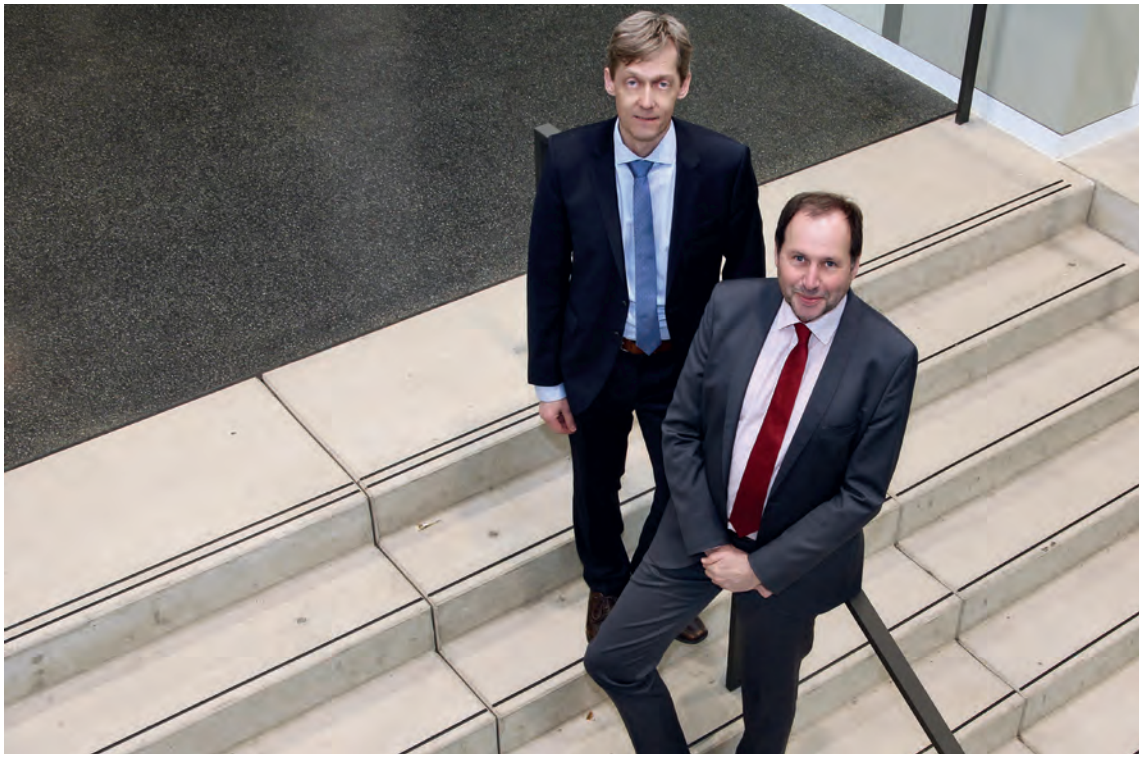


WELCOME TO THE FACULTY OF ENGINEERING AND MATHEMATICS



Prof. Rolf Naumann, Prof. Lothar Budde

Dear Reader,

With this brochure we would like to give you a short introduction to the Faculty of Engineering and Mathematics. The faculty is one of five belonging to the University of Applied Sciences in Bielefeld and it offers degree programs in the so-called STEM fields (science, technology, engineering and mathematics). Moreover, faculty members are involved in diverse applied research projects.

Bielefeld University of Applied Sciences is located in the region Ostwestfalen Lippe in the north-eastern corner of Germany's most populated state of North Rhine Westphalia. The region is characterized by its diversity of industry, and by its numerous successful medium-sized companies, as well as various global players such as Bertelsmann, Oetker, Miele, Schüco and Brax.

In the following pages we provide an overview of our degree programs, research areas and international activities.

We hope you will find this interesting.

Prof. Dr.-Ing. Prof. h.c. Lothar Budde
Dean, Faculty of Engineering and Mathematics

Prof. Dr.-Ing. Rolf Naumann
Vice Dean, Faculty of Engineering and Mathematics

BIELEFELD UNIVERSITY OF APPLIED SCIENCES

FACTS AND FIGURES

Faculties	Students
Campus Minden	1428
Design	558
Engineering and Mathematics	3186
Social Work	1330
Business and Health	3592
Courses of study (total number)	10095

(Status 10/2017)

Design Faculty, Lampingstraße 3, 33615 Bielefeld

The location of Biotechnology and Instrumentation Engineering:, Universitätsstraße 27, 33615 Bielefeld

In Gütersloh we can be found at: SGT, Schulstraße 10, 33330 Gütersloh

In Minden we can be found at: Artilleriestraße 9, 32427 Minden

The study programs of Biotechnology and Instrumentation Engineering are located in a technically well-equipped and modern building on the main campus in Bielefeld. The Bachelor study programs of Industrial Engineering and Mechatronics/Automation are offered in Gütersloh.

FH Bielefeld
University of
Applied Sciences

- founded in 1971
- 10095 students
- 244 professors and specialist teachers*
- 373 employees in research, teaching and administration*

*full-time equivalent
(Status: 10/2017)

THE FACULTY OF ENGINEERING AND MATHEMATICS

FACTS AND FIGURES – FACULTY OF ENGINEERING AND MATHEMATICS

- founded in 1958 (originally as a public school of engineering)
- 3186 students
- 75 professors and specialist teachers*
- 120 employees in research, teaching and administration*

*full-time equivalent (Status: 10/2017)

The Faculty of Engineering and Mathematics

The Faculty of Engineering and Mathematics is one of the largest at the University of Applied Sciences in Bielefeld, with more than 3,000 students and currently 18 undergraduate and master degree programs. The offer from the so-called STEM fields unites teaching fields such as electrical engineering, information technology, mechanical engineering, mechatronics, economic engineering, applied mathematics and biotechnology. As an alternative to the usual attendance studies, there are also job-related, cooperative and practice-integrated study models offered. In addition to the location in the main building of the University of Applied Sciences on the Bielefeld campus, Gütersloh is also part of the Faculty of Engineering and Mathematics. In two research institutes, two research focuses and 10 research groups, research and development is successfully carried out in various areas of engineering sciences.

NUMBER OF STUDENTS AT THE FACULTY OF ENGINEERING AND MATHEMATICS IN 2017

Study Program	Students	Degree
Applied Mathematics	211	Bachelor
Biotechnology and Instrumentation Engineering	121	Bachelor
Computer Engineering	174	Bachelor
Digital Logistics (integrated practice studies) new	9	Bachelor
Electrical Engineering	243	Bachelor
Electrical Engineering (part time) new	26	Bachelor
Information Technology (program closing)	3	Bachelor
Industrial Engineering	391	Bachelor
Industrial Engineering (integrated practice studies)	105	Bachelor
Mechanical Engineering	898	Bachelor
Mechanical Engineering (part time)	211	Bachelor
Mechatronics	173	Bachelor
Mechatronics/Automation (integrated practice studies)	127	Bachelor
Product Development Mechatronics (program closing)	4	Bachelor
Product Service Engineering new	3	Bachelor
Production and Plastics Engineering (program closing)	6	Bachelor
Renewable Energies	202	Bachelor
Applied Automation (part time) new	5	Master
BioMechatronics*	13	Master
Electrical Engineering	73	Master
Industrial Engineering (part time) new	16	Master
Mechanical Engineering	97	Master
Optimization and Simulation	82	Master
In total: 3186 students		Status: 10/2017

* enrollment in winter term at the University of Bielefeld and in summer term at the University of Applied Sciences Bielefeld

INFO

Planned after Winter Semester 2018/19 in Gütersloh:
Digital Technologies (Bachelor, integrated practice studies)

PROGRAMS OF STUDY – BACHELOR COURSES

BACHELOR COURSES **APPLIED MATHEMATICS** BACHELOR OF ENGINEERING

In Applied Mathematics, students acquire special skills in mathematics as well as basic knowledge in Business Administration, Engineering and Computer Science. Following the basic lectures, students choose additional coursework according to their interests. They can select from two different programs: the mathematical elective modules (catalogue A) and the mathematical applications (catalogue B). They learn how to use computer algebra systems and other applications and programs in the fields of engineering, computer science, and economics. Moreover, they are able to solve real-life problems using appropriate mathematical methods.

Career Options
After training at the Bielefeld University of Applied Sciences, mathematicians will find a variety of possible careers. The framework of our interdisciplinary and innovative environment of computer science, economics, R&D and technology in a company allows mathematicians to take on the role of "bridge builders" and mediators between these various disciplines. The key competences of graduates include their analytical skills and their ability to solve a company's problems by transferring these into suitable mathematical models and implementing them.

BACHELOR COURSES **BIOTECHNOLOGY AND INSTRUMENTATION ENGINEERING** BACHELOR OF ENGINEERING

In the course of this program students are exposed to very practical components. Learning content and scientific skills are applied in the modern biotechnology laboratories, and students gain important experience for their entry into professional life. The Department of Engineering and Mathematics offers a variety of different learning environments such as lectures, seminars, practice sessions, team work and presentations. Moreover, students participate in different projects and internships and can elect to spend a practical term in a company.

Career Options
Our graduates have expertise in both the fields of biotechnology and engineering, which means their application possibilities are as varied as the many sectors in which where this expertise is in demand:

- General: Diagnostics, development of new analytical equipment, establishment of innovative, diagnostic procedures, product management
- Pharmaceutical industry: Pharmaceutical development of therapeutic molecules, pharmaceutical production of active substances, quality assurance
- Medical industry: Development of technical devices, working in the field of "tissue engineering" or gene therapies
- Chemical industry: Production of bulk chemicals and solvents, synthesis of specialty fine chemicals
- Environmental technology: Production of alternative fuels or biogas, treatment of organic waste and sewage
- Food industry: Production of baker's yeast, cheese, yogurt, vinegar and soy sauce, brewery and winery products, production of aroma flavorings and dyes
- Agriculture: Breeding resistant plants, plant modification to improve nutritional content and manufacturing processes.

BACHELOR COURSES **COMPUTER ENGINEERING** BACHELOR OF ENGINEERING

The Computer Engineering program provides a solid basis for a successful career start in many industries. The University of Applied Sciences supports students acquiring important professional skills. The most important markets for Bachelor of Engineering are the information and communication technology sector, as well as the electrical engineering or automation industries.

System developers are not only necessary in the technical areas; hardware and software development are important aspects in many other industries as well.

Career Options
Computer engineers work in between the fields of informatics, electronics, software and hardware development. They develop electronic components and circuits, working as software architects and developers. »

They simulate and develop automatic controls and are involved in the organization of plants and systems, such as safe computer networks. Furthermore, graduates can work as a consultant to companies offering customized solutions.

BACHELOR COURSES **ELECTRICAL ENGINEERING** BACHELOR OF ENGINEERING

Students of Electrical Engineering focus on fundamental, practical aspects, however, the program includes options to specialize in certain subjects. The program helps satisfy the regional and national high demand for electrical engineers. Subsequently, the bachelor's degree also enables students to enroll in a master degree program.

Career Options
The living standard of modern society is essentially based on the achievements and on the evolution of the use of electricity. Therefore, the working areas for engineers and electrical engineers are diverse:

- Electrical Power: power production and distribution of electricity (grid expansion, wind turbines, photovoltaic systems, etc.)
- Electrical drive technology: development of electric motors (driving units in electric cars, trains and trams, servomotors, etc.).
- Electronics: development of analogous and digital components, circuits and systems for applications from small to large currents and from low to high frequencies.
- Automation technology: controlling, measuring, regulating, and communicating the automatic flow of processes in machines, equipment, and buildings.

BACHELOR COURSES **INDUSTRIAL ENGINEERING** BACHELOR OF SCIENCE

The bachelor's degree program of Industrial Engineering gives students integrative problem-solving skills needed by companies looking for managers who can act as an interface between the and technology. This interdisciplinary approach allows students to gain knowledge of technical and business disciplines. It uses a practical and project-oriented training approach to optimally prepare graduates. The final thesis students submit is realized in cooperation with an industrial company, where they apply their methodological skills and knowledge acquired in their studies to come to a result that can be implemented. Two specifications can be chosen within the course: "Production Management" and "Technical Sales". Moreover, individuals can set appropriate priorities in the fields of production/ logistics/ materials management or in the field of marketing/sales, giving all graduates a slightly different specification profile in addition to a general education.

Career Options
Following their training at the University of Applied Sciences, commercial engineers and industrial engineers have a broad, general study profile with a specialization either in "Production Management" or "Technical Sales". This profiling is not industry-related, but rather is functional-related, allowing graduates to work in all industries, such as in mechanical engineering, electrical engineering, or in the information technology industry. With regard to their functional tasks, graduates are particularly capable of working in the areas of Production, Material Management, Logistics, Quality Management or Sales/Marketing.

PRACTICE INTEGRATED BACHELOR STUDIES **INDUSTRAL ENGINEERING** BACHELOR OF ENGINEERING

According to the study program of Industrial Engineering, economic and technical aspects are a core part of the education. The practical integration trains industrial engineers in interdisciplinary activities to build an interface between technology and business management. Due to the balanced engineering and business education aspects of the program, they are capable of assessing, organizing and optimizing business processes.

Career Options
The universal character of studies offers various fields of work in many industries. Small and medium-sized companies also appreciate commercial engineers because of their multiple competences. Main working »

areas are purchasing, production planning, quality and project management, as well as technical distribution. Commercial engineers also often occupy positions in marketing, finance and controlling, because often it is in these domains where technical interdisciplinary and business skills are required.

BACHELOR COURSES **MECHANICAL ENGINEERING** BACHELOR OF ENGINEERING

Machines enable us to conquer space and to explore the earth. They secure food and energy and make us move. Engineers of mechanical engineering develop solutions for a variety of needs and requirements. From the first customer contact to development, manufacturing, commissioning, sales and maintenance, engineers are required to find creative solutions. In research projects they develop innovative strategies for new products. In a world with decreasing resources they develop environmentally friendly and competitive products, thereby contribute to sustainability in our society. Regardless of their chosen specialization, graduates of the Mechanical Engineering program know all components, assemblies, machines and equipment and they can develop processes that implement theory into practice. A focus is also on cost-effectiveness and efficiency in the use of energy and raw materials. There are four specializations possible:

1. Design and development
2. Energy technology, including the design and optimization of energy installations and equipment
3. Production and logistics, covering planning, implementation and operation of production and logistics systems
4. Plastic and material technology, taking technological, manufacturing, processing, quality and cost aspects into account.

BACHELOR COURSES **MECHANICAL ENGINEERING (COOPERATIVE ENGINEER TRAINING)** BACHELOR OF ENGINEERING

This program involves training the specialists of tomorrow. The Department of Engineering and Mathematics at the University of Applied Sciences has a cooperative engineering program for the study of Mechanical Engineering. The close links between theory and practice prepares graduates to enter easily into professional life after graduation. They gain insight into operational processes and build up a professional network. The cooperative engineering training provides the opportunity to graduate within four years and students have to pass two tests. The first is the skilled workers' examination administered by the Chamber of Commerce (IHK) or the final examination at the Chamber of Crafts (HWK) and the university degree (Bachelor of Engineering). Students' training is organized in close cooperation between a company, the university, and the Chamber of Commerce or the HWK.

Career Options

The increasing internationalization of companies, the rapid development of technology, and the use of media pose new challenges for engineers. They have to be versatile, educated professionals and managers. They address issues in an interdisciplinary environment and communicate with employees from all functional areas in order to work out solutions. Therefore, engineers have numerous working areas: development, design, manufacturing, sales, installation, service, recycling, quality management, planning, and testing.
Graduates of the cooperative engineering program have broad professional options: business engineering and plant engineering, construction and basic industry, the chemical and pharmaceutical industries, consulting companies, consumer goods industries, design offices, electrical companies, and transportation.

BACHELOR COURSES **MECHANICAL ENGINEERING (PART TIME)** BACHELOR OF ENGINEERING

This composite course allows students to work part time while studying mechanical engineering, offering a practical engineering education. The degree course has a focus on manufacturing technology and thus makes it possible to apply engineering methods, analyze technical applications, and work out practical solutions. Additional topics include particular aspects of cost reduction, the increase in production, and the increase in quality. Because the entire process of planning is in »

focus, the program promotes multidisciplinary thinking, so graduates are capable of goal-oriented cooperation with other functional areas of a company. In their 8th term students choose a special orientation: metal, plastic, construction or operational organization. The course at the University of Applied Sciences is offered in partnership with the University of South-Westphalia.

PRACTICE INTEGRATED BACHELOR COURSES **MECHANICAL ENGINEERING** BACHELOR OF ENGINEERING

The graduates of the Mechatronics / Automation program differ from others by linking elements of mechanical engineering, electrical engineering and computer science in the development and manufacturing of technical systems. The engineers take complex technical systems and secure their maintenance and work on their improvement. Finally, the training of the students has a focus on project management and successful teamwork.

Career Options

Because of their interdisciplinary training, graduates may work in many industries. Mechatronic graduates are needed, for example, in mechanical engineering, in the vehicle industry, in plants, in automation technology, in the aerospace engineering industry, in information and entertainment technology and even in the medical technology sector. A high demand for engineers of Mechatronics / Automation can be found in mechanical engineering companies and in the electrical industry. The main working areas are: R&D, design, manufacturing, quality management, service and sales.

BACHELOR COURSES **MECHATRONICS** BACHELOR OF SCIENCE

With a bachelor's degree in Mechatronics, the aim is to educate developers and product designers for the areas of machinery, vehicles, plant and training equipment manufacturing. The key skills of teamwork and communication are promoted through strong emphasis on project work. These projects are introduced by the teacher and implemented by including the students' ideas. Project work is carried out in small groups which work independently, but get support and advice from student tutors. In teams, students learn to solve specific problems of mechatronic development processes under practical conditions. Graduates with such qualifications are well prepared to work in vehicle, machinery, plant or equipment companies.

Career Options

Mechatronics engineers can be found in all classical engineering fields. They mainly work in R&D, production, services, sales or marketing, but they can also be professors or university teachers. However, mechatronics engineers are also often a part of company management. This is partly because they are technical experts and can help in developing strategies as well. Secondly, they are excellent project managers because they are structured, can observe analytically and do solution-oriented work. These skills may be the reason for the high demand for mechatronics engineers. An analysis of the professional life of former graduates in mechatronics shows that a significant percentage of students take part in the development, planning and controlling of projects. They accompany the development of products from conception to shipping. They coordinate company departments and use their project management skills acquired at the University of Applied Sciences.

PRACTICE INTEGRATED BACHELOR COURSES **MECHATRONICS/AUTOMATION** BACHELOR OF ENGINEERING

Graduates of the Mechatronics/ Automation degree programme improve their achievement potential by the development and production of technical systems involving elements of mechanical engineering, electrical engineering and computer science. The graduate engineers put complex technical systems into operation and secure their maintenance and improvement. During practical modules in industry, they apply their theoretical knowledge to current tasks in the company they are attached with. The training of the students is rounded off with a clear focus on project management and successful teamwork.

Career Options

Following this interdisciplinary training, graduates may work in many different industries. For example, mechatronic systems are used in mechanical »

engineering, vehicle manufacturing, plant engineering, in automation technology, aerospace technology, in information and entertainment technology and even in the medical technology sector. A particularly high demand for engineers of Mechatronics/ Automation can be found in mechanical engineering companies and in the electrical industry. Fields of activities range from research and development, technical design, manufacturing and quality management, but also in fields such as technical consultancy, sales and service

BACHELOR COURSES **RENEWABLE ENERGIES** BACHELOR OF ENGINEERING

In this course students acquire the knowledge and practical skills they will need to work as an engineer in the renewable energy industry. The main emphasis is on:

1. Production, distribution and effective use of electrical energy on the basis of renewable energy and
2. Production, distribution of bioenergy from renewable raw materials and biological waste.

Career Options

These two specifications, electric energy and bioenergy, provide the structure for the course of studies and are thus the two main branches graduates usually gravitate towards after graduation. It is possible to work in the field of the generation and distribution of energy, but also in the field of the efficient use of energy. Especially the efficient use is becoming a new challenge in a wide range of working sectors. However, there are also new working areas with innovative ideas to be developed, such as in data centers, communication technologies, industrial drives, production lines, municipalities, and private households. As far as bioenergy is concerned, it is primarily the relatively undiscovered fields of plant automation and plant control systems which offer new career options.

TEACHING POST "VOCATIONAL COLLEGE" **ADDITIONAL QUALIFICATION EDU-TEC** STUDY OPTION

For the Bachelor Courses of Mechanical Engineering and Electrical Engineering.

Course Objectives

The Bachelor Courses of Mechanical and Electrical Engineering offer students the possibility to gain an additional qualification to become a teacher at vocational colleges. For that purpose, students complete their regular bachelor degree in one of the mentioned courses, graduating with a Bachelor of Engineering. For their extra qualification as a teacher, they simultaneously take optional, replacement or additional modules in educational sciences and/or vocational training and didactics of technology.

A work placement to prove aptitude and a work placement to orientate, as well as an internship in the occupational field deliver insight into work at vocational colleges and give students of mechanical and electrical engineering the possibility to try out their teaching abilities in manageable units that are supervised.
The successful completion of professional studies and of the educational, technical and teaching post modules enable a smooth transition to the teacher training master degree program at the University of Paderborn. In conjunction with the internship in schools that follows, the program qualifies for a teaching post at vocational colleges.

Career Options

The study option Teaching Post “Vocational College” for the Bachelor Courses of Mechanical and Electrical Engineering creates diverse career options for students:

- Becoming a teacher at a vocational college that is made possible by a seamless transition to the teacher training course “Master of Education” at the University of Paderborn.
- Occupations that combine learning and technique, e.g. internal or further training and educational management.
- A regular occupation as engineer who works for industry.

Teachers at vocational colleges inspire young people for technology with their technical and teaching skills. The teachers organize lessons, cooperate with businesses and support students in their choice of career.

Graduates who gained the additional qualification as Teaching Post “Vocational College” may also work in out-of-school areas and develop and carry out employee or customer training or supervise apprentices and trainees.

PROGRAMS OF STUDY – MASTER COURSES

MASTER COURSES
BIOMECHATRONICS*
MASTER OF SCIENCE

* in cooperation with the University of Bielefeld

This course comprises four terms and 120 credit points and leads students to a Master of Science (M.Sc.) degree in Biomechatronics. Students can start the program in either the winter or the summer term. In the first two terms the studies contain an introduction into biomechatronics from the perspectives of biology and engineering (three compulsory courses), a basic course about system design (three compulsory courses), two Biomechatronics internships, a project and elective courses for an individual differentiation. The final course is reserved for the master thesis and a colloquium, which can be done in cooperation with a company.

Career Options
The master program imparts theoretical basics, scientific skills and methodological competence in the field of system engineering as well as general professional qualification such as the use of modern software and hardware. Moreover, the program also addresses secondary skills such as social, scientific and ethical subjects which result from applications and decision making. Students are trained to work independently according to the scientific principles of engineering as well as to work in teams for social and leadership skills.

The interdisciplinary study programs are of particular importance at the University of Applied Sciences. There is a high demand for well-trained engineers in industry, in services and in research in the field of mechatronic systems. Possible career fields can be e.g. in the R&D departments of the machine and plant construction, in production, in the automotive industry, in medical technology, in the development of autonomous systems (robots, intelligent assistance systems), as well as in scientific research.

MASTER COURSES
ELECTRICAL ENGINEERING
MASTER OF ENGINEERING

Specification:
Networked Electronic Systems
Electronic systems dominate all areas of our lives. In addition to an increase in the complexity of the individual systems, modern electronic systems are characterized by a high degree of cross linking and new technology. In this master program students gain the basis for understanding networks and linked electronic systems and they are able to use their acquired knowledge when solving specific problems.

Career Options
The widespread use of electronic systems has created a large demand for specialists in this area; including in the R&D departments of companies in the engineering, electrical engineering and automotive industries. By emphasizing a systematic approach and the provision of management skills, graduates can also work in development or as a product manager for electronic systems. This master program trains graduates to act independently and to guide others in projects in the field of electronics. Thus, graduates may work in many areas and also fulfill the conditions for obtaining management positions.

Specification:
Intelligent Energy Systems (IES)
Efficient and effective power generation, transport and energy use are the key to a sustainable future. In particular, the expansion and conversion of the infrastructure (smart grid), the integration of energy storage and the intelligent use of energy characterize the future challenges for engineers. Therefore, classical fields of power engineering are mixed with methods of process automation, communications technology and intelligent control and operating methods.

Career Options
Graduates of the specialization fields IES can work in all professional fields in which electrical energy plays a significant role, including a wide range of manufacturing companies of automation components, classic power

companies, automotive supply and automobile manufacturers as well as planning and consulting companies or municipalities in public administration. Furthermore, the master's degree enables students to enter a doctorate program.

MASTER COURSES
MECHANICAL ENGINEERING
MASTER OF ENGINEERING

Modern machine technology ranges from microsystems, miniature robots, washing machines and cars to the production of machine tools and plants. Development of new products requires the optimization of existing products with modern methods of "digital prototyping". Computer-aided design, analysis, simulation and visualization techniques offer enormous potential in the development and optimization of products in terms of quality, durability, reliability, energy efficiency and resource conservation.

The master course of Mechanical Engineering builds a consecutive program following the bachelor program in the department of Engineering and Mathematics. The aim of the master program is to educate graduates for activity in the field of computer-assisted development and design. They learn how to use scientific methods independently and are then qualified for further independent scientific work, such as a doctorate.

Career Options

Machine exporters in Germany need highly trained experts to continue steady innovation and to maintain global competition. The master's program qualifies its graduates to work in independent engineering activities in many fields of mechanical engineering, in particular in the field of computer-aided design and engineering. Positions in this area are excellent, as there is a high demand for experts and professionals. Mechanical engineers are required in a variety of industries, some examples are as follows:

- Plant engineering
- Automotive and Aerospace industry
- Chemical industry
- Electrical industry
- Consultants.

The scarcity of fossil fuels requires exploration and development of new technologies for the use of renewable energy. There are huge challenges for graduates, e.g. in the context of:

- Wind turbines
- Tidal power plants
- Fuel cells

MASTER COURSES
MOLECULAR BIOTECHNOLOGY*
MASTER OF SCIENCE

* in cooperation with the University of Bielefeld

The aim of the master program is to deepen skills acquired in the bachelor's degree in order to apply this knowledge to the practical environment while taking modern techniques and methods of biotechnology into account. In addition, students are increasingly trained to work independently and according to the common scientific principles of biotechnology.

Career Options

The profile of the program is structured in a way that broad training and a choice of all domains of biotechnology can be realized. This ensures that all graduates have a relatively uniform educational profile in biotechnology, but still have individual specialization profiles. This helps students in competition for jobs, as they can work in a wide range of fields.

The master program is characterized by a high level of practical work to ensure that graduates are able to apply current techniques and methods of biotechnology. This is also important for those graduates who will go on to obtain a doctorate. Students who have extensive training both in current molecular genetic / biochemical processes and thorough knowledge in material production, especially in conjunction with cell culture technology and processing methods, will be increasingly in demand by the industry in the future.

MASTER COURSES
OPTIMIZATION AND SIMULATION
MASTER OF SCIENCE

Mathematical models and methods, in particular from the field of optimization and simulation, have immense importance for numerous key areas of science and the economy. It is now standard, for example, in industries such as automotive, aircraft or aerospace industry, in the electrical industry or the chemical industry, to calculate processes and numerical computer simulations before actual production can start. Experiments using valuable raw materials are no longer acceptable due to the costs and environmental aspects. In the resource, sales and financial planning, computerized simulations are the basis for optimization approaches.

However, performing complex simulations in a professional way requires sound theoretical training. The new Master program Optimization and Simulation serves this requirement. Students are enabled to do scientific independent contributions in modeling, optimization and simulation. In addition to qualifying the students for many demanding activities in companies, it also enables them to work in the higher civil service.

Career Options

The demand for experts, professionals and executives in the field of computer optimization and simulation is large, so that there are many excellent career options for graduates of the master program. There are numerous specific positions in different industries where graduates can work. The following areas of work are some examples:

- Technical calculations: strength calculations, vibration analysis, image data analysis, weather calculations, default calculations, statistical analysis, news channels or encryptions
- Technical simulations: traffic simulations, network simulations, aerodynamic simulations or reactor simulations
- Technical system analysis, such as the modeling procedural processes for data processing or for computer product analysis
- Modeling and optimization of production processes, for example, solving machine scheduling problems or the organization of queues
- Sales and resource planning, for example, inventory optimization, improvement of delivery systems, material requirements planning, and determining optimal sales prices
- Financial and risk management, for example, reliability calculations, development of enterprise simulation based risk control systems, and optimization of the individual company finance structure.

ZDI (FUTURE THROUGH INNOVATION) SCHOOL LABORATORY

The ZDI program (“Zukunft durch Innovation”, or “shaping the future through innovation”) was initiated in 2004 by the Ministry of Science to promote the so-called STEM subjects (science, technology, engineering, and mathematics) and especially to encourage youngsters to develop an interest in these important fields. The State of North Rhine Westphalia supports more than 50 special School Laboratories, one of which is part of our University, to offer a wide range of workshops in STEM subjects for children aged 5 years up to young adult age.

Our ZDI School Laboratory belongs to the Faculty of Engineering and Mathematics and the workshops draw from the courses that are being taught. The school laboratory is part of the network “experiMINT” which emphasises the hands-on, learning-by-doing approach in multifunctional work laboratories. Throughout the year the school laboratory offers workshops on courses taught in the university like product development, automatisation, rapid prototyping, and renewable energies. The topics range widely from shapes and colours to projects in robotics and they are constantly being revised and extended. Workshops have been, and will be, created by professors who teach in the department, or who have been and will be, part of student projects.

Workshops are usually offered for the average class size, for pre-school up to grade thirteen. However, some workshops are restricted due to age, difficulty or necessary equipment. Most last for a couple of hours, but especially during the holidays, workshops that require a couple of days are also offered. Since finding a suitable career path is never easy, workshops are not only meant to impart knowledge about magnetism, electricity and such but also on how engineers work. Additional courses specifically for teachers are also available.

Responsible for the School Laboratory are the permanent staff members: Silja Stark, Manuel Mai, and Lisa Münstermann (filling in for Susanne Krüger who has maternity leave). The permanent staff members are always supported by five engineering students. Entrusted with the academic responsibility are: Prof. Dr.-Ing. Joachim Waßmuth and Prof. Dr. rer. nat. Lars Fromme.

Besides regular bookable workshops, the School Laboratory partakes in various projects such as “Open House”, the annual science fair "Geniale", and the International Summer Session. Classroom visits with mobile equipment are also an option.

LEONARDO DA VINCI MOVING INVENTIONS

Leonardo Exhibition at the FH Bielefeld: Prof. Dr. Horst Langer, Andreas Wollensak, Jana Mielke

SUCCESSFUL LEONARDO EXHIBITION TO BE SEEN AT THE FACHHOCHSCHULE

About 20 interactive models could be experienced and handled in the new FH school building at the start of the semester. The exhibition, which lasted for a week, gave an insight into the project work of students, started in 2004 and continued uninterrupted since then, to produce functioning technical models based on the sketches of Leonardo da Vinci.
The special challenge of this work lies, amongst others, in designing technically faultless and presentable models, resulting from incomplete sketched ideas. The collection of models may be viewed -by previous arrangement - at its location “Am Stadtholz” in Bielefeld.

COOPERATION OF THE NATURAL HISTORY MUSEUM WITH THE FACHHOCHSCHULE

What does the block grabber – invented by Leonardo da Vinci – have to do with the claws of a bird of prey? What holds a bridge together which is made only out of single timber posts? And what does bionic actually mean? These questions were answered by the leaders of the project “Bionic Workshop” of the Naturkundemuseum Bielefeld (natural history museum, affectionately known as “namu”), namely: Thomas Pupkulies and Ingo Hoepfner. They are responsible for a project of the museum which offers a lot of “technical experiences” to school children.

The high point for the little researchers of the class 4B of a Bielefeld school (Brackweder Suedschule), who were best in their subject, was the visit to the Leonard da Vinci Exhibition, called “Moving Inventions”, of the faculty of Engineering and Mathematics. “Leonardo da Vinci`s inventions form an excellent interface between nature and technology” explained Thomas Pupkulies. “We, and the children, are thrilled. Here it is very clear to see how the technology invented by Leonardo was inspired by nature. On the many models of the exhibition, the children can grasp the inventions in a playful manner because everywhere the technology may be moved, touched and tried.”
Bionics, that to say the observation of natural phenomena and its implementation into technology, can be experienced here in many places. There is, for example, the self-closing block grabber, which Leonardo da Vinci

intended to be used on building sites as an effective transport system for blocks of stone. The project was supported by the school laboratory "experiMINT" of the FH Bielefeld, which is for school children a part of a state project called "Future through Innovation" (Zukunft durch Innovation). An adventurous and educational journey of the Bionic Workshop, whose staff will be pleased to welcome more groups of technically enthusiastic school children. The project continues!

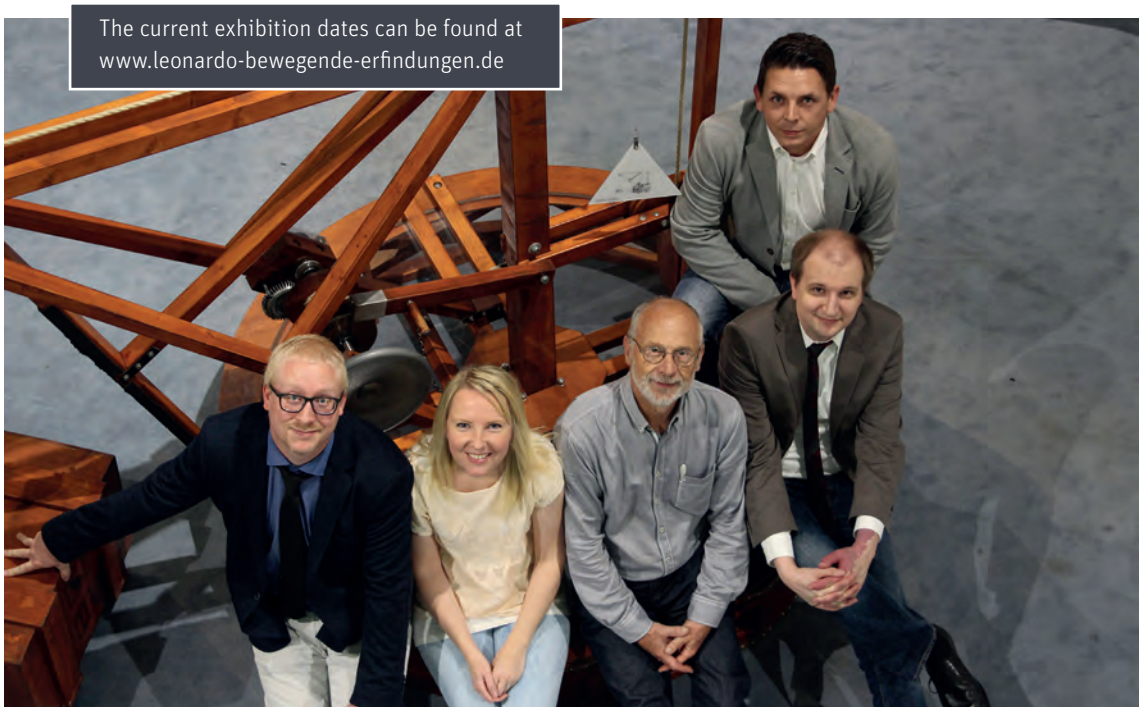
WIKIPEDIERS MEET AT LEONARDO DA VINCI

The locations for the Leonardo Exhibition this year were the Eulenburg Museum in Rinteln, the Carl Bosch Museum in Heidelberg, and the Deutsche Museum in Bonn, cooperating with the Wissenschaftzentrum (scientific centre). Especially in Bonn, lively interest was shown by 20,000 visitors to the special exhibition. "There was never before such a resonance" said the museum director, Andrea Niehaus, happily. Inspired by the special exhibition, "Leonardo da Vinci – Moving Inventions" 15 Wikipediers met together to a ´Writing Workshop´ named GLAM (galleries, libraries, archives and museums) and wrote new articles for the famous online encyclopaedia. In particular, the team showed interest in the origin story of the Leonardo models, explained to them in detail and enthusiastically, by Prof. Dr. Horst Langer and the three students, Arno Ortmann, Bjoern Beckmann and Dominik Steinhäusser. Particularly exciting for Dominik Steinhäusser regarding the creation of the functioning models, were: "the thought processes which occurred to Leonardo". The challenge for the students is the interpretation of the available sketches made by Leonardo. Often only a captured idea, they are sensibly and creatively extended, then historically put into practice. Link to the Wikipedia website about the Leonardo Exhibition: https://de.wikipedia.org/wiki/Leonardo_da_Vinci_(Ausstellung)

NEW PROJECT LEADERSHIP FOR 2017

With the beginning of 2017, Prof. Dr.-Ing. Thorsten Jungmann, head of the specialist department of Technical Didactics of the faculty Engineering and Mathematics, took over the leadership of the Leonardo Project. "The objective is to employ and extend the potential of this unique exhibition both inside and outside the Hochschule" explained Jungmann. The technical models are not only suitable as excellent objects of the students` project work, but offer also in their completeness an effective and attractive learning environment in which people of all ages can experience the enthusiasm for technology and science, and can share it with the Leonardo team.

The current exhibition dates can be found at www.leonardo-bewegende-erfindungen.de



On the photo: Arno Ortmann, Jana Mielke, Prof. Dr. Horst Langer, Dominik Steinhäusse and Björn Beckmann
Photo: DMB/Bonn

CfADS – CENTER FOR APPLIED DATA SCIENCE

THE DATA OF TODAY ARE THE BASIS OF INNOVATIVE PRODUCTS OF TOMORROW.

The **C**enter **f**or **A**pplied **D**ata **S**cience **G**ütersloh (**CfADS**) is a research centre of the Fachhochschule Bielefeld, located in Gütersloh, with the focus on the application-oriented and implementation-oriented realization of innovative research and development projects. Subject areas include data gathering, preparation and analytics with the objective of the digitalization and optimization of work and business processes.

The CfADS was founded in 2017 by Professor Wolfram Schenck, Professor Martin Kohlhase and Professor Pascal Reusch with financial support from the funding competition “Research Infrastructures" promoted by the state of NRW.

The centre supports one of the economically strongest regions of Germany on its way into digitalization by implementing new technologies from the fields of “Data Science", “Data Analytics" and “Cloud-based Optimization".

For this purpose, the CfADS has a freely configurable / freely programmable cloud platform of its own, comprising powerful hardware and software and general expertise in the field of data science. This is complemented by know-how and tools to apply special algorithms, workflows and prototypical solutions from the field of data analytics.

The developed technologies and competencies are used in cooperative projects e.g. for the digitalization and optimization of industrial processes in existing industrial plants as well as for the realization of predictive maintenance processes and the development of innovative business models.

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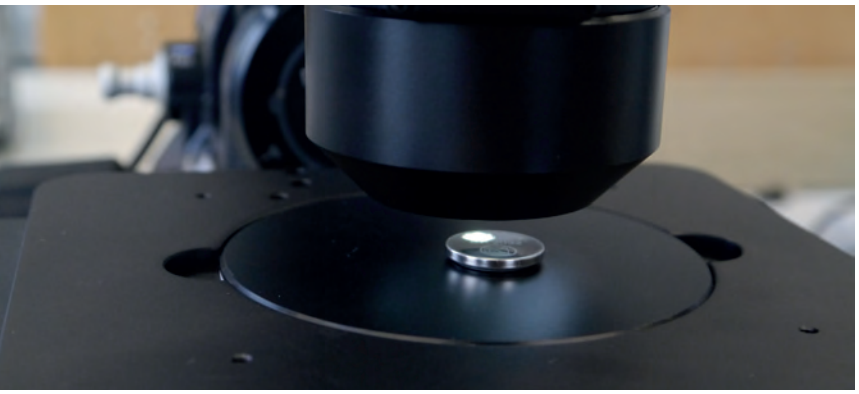
BIFAM – INSTITUTE FOR APPLIED MATERIAL SCIENCES



The Bielefeld Institute for Applied Material Sciences (BIfAM) was founded on 01 May 2013 as a research institute of the Bielefeld Fachhochschule and serves to strengthen the research profile of the university in the field of material research.

On the one hand the research activities of the BIfAM deal with basic investigations with regard to the physical properties of novel materials, and on the other hand with the intelligent linking, further development and/or industrialisation of fundamentally known methods and materials. It is ensured that interdisciplinary teams are formed by involving the cooperation of scientists from the fields of physics, computer sciences, machine building and electrical engineering so that innovative solutions are developed for those above mentioned tasks. The research activities are structured by three areas of competence:

1) The area “Application and Testing of New Materials in Electrical Engineering and Electronics” bundles up the activities of the institute in the field electrical engineering. Next to the pure electrical engineering topics, research topics which affect the fields of physics, chemistry and machine building are integrated here. The activities may be specified by the subject “micro- and nano layer systems” as well as by the use of materials for increasing energy efficiency. Extensive preliminary work was achieved in - among other things - flexible solar cells, functional layers in micro systems, and in the efficiency of inductive and thermal energy transfer.

2) Most important field of research of the competence area “the Characterisation, Application and Testing of New Building Materials” " is the efficient and appropriate use of different groups of materials, such as steel, nonferrous metals, plastics and composites as well as the characterisation of the behaviour of the material. Current areas of attention are molecular material, material behaviour under fatiguing demands, as well as the determination of design-relevant material parameters.

3) The competency “Model Design and Simulation” deals with the theoretical aspects of the material research. On the one hand it supplies the necessary theoretical knowledge for the other areas of competence, and on the other hand an independent methodology development - and also basic research is practiced. Topic emphases are fluid dynamics, tribology and rheology, nano- and micro structured magnetic systems, as well as magnetically-induced, coupled phenomena.

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Institute Deputy Management:
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Prof. Dr. rer. nat. Martin Petry
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Prof. Dr.-Ing. Dirk Zielke

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Dr. rer. nat. Katharina König

ISYM – INSTITUTE FOR SYSTEM DYNAMICS AND MECHATRONICS

The Institute for System Dynamics and Mechatronics (ISyM) is a scientific research department of the Fachhochschule (university of applied sciences) Bielefeld, and part of the Engineering and Mathematics Faculty. The institute was founded in 2013 by seven professors who fit optimally well together as a result of their wide spectrum of competence, and who carry out research in interdisciplinary fields. This is demonstrated by, amongst other things, the cooperative work of the members in teaching and in research subjects. Furthermore, there are countless collaborations with other specialist areas, research facilities and institutes which enable a solution oriented approach to practically relevant problems and challenges.

All members of the Institute are unified in the thought of a model-based design of the system development. Part of this principle is the application oriented use of methods and tools to form models and simulations, both for the analysis and also for the synthesis of heterogeneous (multi-domain) systems, with the objective of transferring these to, and further developing these in, the industry. The members of the Institute bring their system theoretical knowledge from the fields of control technology and signal processing together, with the target to make these methods useable in practice. As a result, nearly all fields necessary for mechatronic system design can be covered by the Institute. The Institute focusses thematically on the following two main points: Human Mechatronics and Model-based Automation

The term “Human Mechatronics”, which was coined by the ISyM, stands for human-centred technologies in which the mechatronic and the human aspects (Human Factors) are equally considered in the design of intelligent technical systems. Applications can be found in the fields of healthcare systems, but also the integration of intelligent technical systems in the working world demands the development of human-centred systems in order to achieve a place and a social acceptance of this system. For this purpose, the ISyM follows the bottom-up principle – that is to say, the modelling and development of applicable core technologies. In the field of “Model-based Automation”, the ISyM concentrates on the areas of modelling technical-physical systems; the designing of more modern, more powerful controlling and steering, and also the self-monitoring of technical systems. These subjects play a particularly important role in the development of intelligent technical systems, against the background of the advancement of the Fourth Industrial Revolution (known in Germany as “Industrie 4.0”).

Existing equipment and systems can also be optimised with regard to their productivity and efficient use of resources, based on these subjects.

ISyM Institut für Systemdynamik und Mechatronik

Further up-to-date information about the Institute is to be found on the internet site http://isym-bielefeld.de or send us an email to info@isym-bielefeld.de

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Prof. Dr.-Ing. Dirk Weidemann

AMMO – APPLIED MATHEMATICAL MODELLING AND OPTIMISATION

The research programme initiated in 2008 with the main focus on applied mathematical modelling and optimisation (FSP AMMO) has grown in the meantime to 12 members, bringing specific knowledge from different research directions of mathematics, and comprehensive knowledge from different practical environments. The AMMO programme bundles up these competences in the common interface area of mathematical modelling and optimisation in order to generate research and development projects together from this core region. Since the foundation of AMMO up until today, many different projects have been initiated and carried out.

The interdisciplinary nature of the research and development activities in the AMMO programme results not only from the different fields of application in the economy, but also from the variety of the methods for the modelling and optimisation of real systems and processes. The optimisation and the modelling are carried out by means of different mathematical strategies from discrete optimisation and differential systems of equations up to genetic algorithms. Current topics are, for example, model-based realisation of intelligent systems in nano- and bio-technology, parallel algorithmic differentiation in OpenModelica (specialist software) for energy-technical simulations and optimisation, Copula models, figure and topology optimisation, personnel planning in hospitals, risk modelling of insurance enterprises and the efficiency increase of power stations.

An idea was born, - for the 7th anniversary of the AMMO programme, - to characterize the facet-rich field of applied mathematical modelling and optimisation through typical problem fields and their corresponding solutions and to present them in the form of an anthology. It is the objective of the anthology therefore to understandably show the systematic approach to a problem in the practice, from the description of the problem, via the mathematical modelling and the development and/or selection of suitable solution procedures and their adaptation, up to the interpretation of the solution by means of some case studies. The presented examples come from the research fields of the involved AMMO members in collaboration with other scientists, but also supported by students of the bachelor courses of Applied Mathematics and of the master courses of Optimization and Simulation within the framework of their graduation or other qualification work. This anthology appears as Volume 4 in the series of research of the faculty of Engineering and Mathematics of the Fachhochschule Bielefeld (Publishers: Prof. Dr. H.-J. Kruse and Timo Lask, M.Sc.).

In addition, the FSP AMMO programme could convince external experts of its effective work and thus successfully passed its evaluation by them. Numerous research projects run under the auspices of the AMMO programme. Furthermore, the programme has its own publication series called “AMMO - Reports from Research and Technology Transfer” and to date, eight papers have already been published. Also the course of lectures entitled “Meeting Point AMMO”, to which scientists from other colleges as well as representatives from commerce and industry are invited, has established itself as a very successful regular event at the FH Bielefeld. During these meetings, progress and results of current research and development are presented and discussed as well as concrete every-day problems from the practice. Cooperation with other national and international scientific institutions was continued, for example with the Centre for Biotechnology (CeBiTec) and with the Technical Faculty of the University of Bielefeld, the Institute for Mathematics of the University of Paderborn, the Swedish universities of Linköping and Uppsala, the Centre of Excellence on Supercomputing Applications of the Bulgarian Academy of the Sciences, the Bergen University College (Norway) and the City University of Hong Kong.

Spokesperson:
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Deputy Speaker:
Dr. rer. nat. Sabrina Proß

Other members:
Prof. Dr. phil. Bernhard Bachmann
Prof. Dr. math. Friedrich Biegler-König
Prof. Dr. rer. nat. Claudia Cottin
Prof. Dr. rer. pol. Hermann-Josef Kruse
5x scientific assistants

ITES – RESEARCH FOCUS: INTELLIGENT TECHNICAL ENERGY SYSTEMS (FSP ITES)

New photovoltaic installation on the roof of the Bielefeld Fachhochschule

Based on the success already achieved, it was decided to develop the research focus of ITES even further. Essential components of this development include increasing staff in the existing research team. Basic parts of the research extension are the integration of light and/or energy "recovery" in textile materials, lightweight construction and fiber-reinforced plastics in electric mobility, the thematic extension of information, elucidation and training in the cross-cutting issue, smart interfaces and last but not least the implementation of a concept for cooperative doctorate programs with the University of Bielefeld.

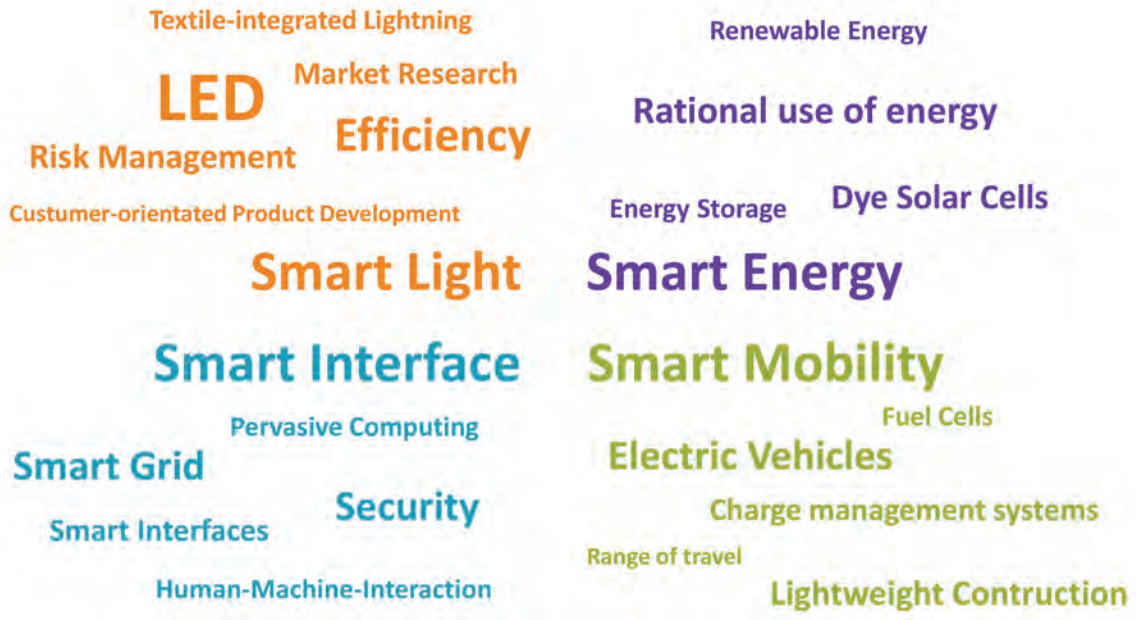
The infrastructure as a basis for further studies could be extended with a new photovoltaic installation on the roof of the Bielefeld technical college in December 2016. The unit consists of 6 systems, all directed southerly and each with a capacity of 2 kWp. The systems are distinguishable by their module type, e.g. mono- and polycrystalline modules as well as thin film modules, and the inclination (elevation) can be adjusted separately for each system.

The twin-axis tracking system (middle of picture) serves for all investigations as a reference system (optimal tracking to the sun) in the research and also in the teaching (practical training, project work, Bachelor and Master studies). In addition to the aspect of grid feeding, the PV systems are used for investigations into the increase of own energy consumption. Furthermore, students cooperate with the deeper examination of aspects of product safety (for example during hailstorms) and the improvement of energy efficiency.

The goal is to solve inter- and trans-disciplinary questions of systems engineering and to obtain an integration of economic, environmental optimization and social integration of decentralized energy systems – a safe, inexpensive, environmentally sound and efficient delivery/ use of energy. The proven organizational structure of ITES in different sub-topics is meant to be maintained as a basic structure.

The main topic Smart Light will set its focus in the future on LED, particularly on applications, on energy "production" and on textile materials through semiconductor materials. The integration of light, and/ or the production of energy in materials of the textile industry, is just one example. The product development of market and environmentally oriented LED street lights is important in order to satisfy customer requests. Furthermore, there is a need for LED lights in the field of health and safety, which comprises safety at large events as well as light in different contexts such as light & age and light & dementia. Other areas for specific applications of LED are the coexistence of human beings and animals, the combination of dairy cattle & human beings, pigs & human beings, as well as bats & human beings.

The main focus of Smart Mobility in the future will be on research, which will take place in the field of charging infrastructures and centralized charging systems of ››



vehicles, examining its effects on grids. It is necessary to find solutions for the integration of such systems into the overall electrical system. It is also planned that lightweight structures for electric vehicles will be manufactured. Their production should be cost and energy efficient, using an innovative mold system. With these structures, extremely lightweight structures can be produced in medium quantities at a relatively low cost. This could result in the development of an e-mobile platform for innovative lightweight materials with competitive prices.

In the frame of Smart Energy, R&D is dealing with the intelligent interconnection of future infrastructures for the energy distribution grid. Another research approach is the integration of the new DC technology in energy distribution. Furthermore, TSP Smart Energy deals with the interconnection of energy grids, in particular with district heating grids, which are used in metropolitan areas and consolidated within virtual power plants in order to construct a hybrid energy grid.

The focus of the cross-sectional theme Smart Interfaces is still on man–machine interaction, which comprises three main research fields. Information and education is important to show people how the interaction between human beings and technology can work. An example is Virtual Reality and Augmented Reality, which demonstrates how to utilize an on-shore wind energy plant in your own garden within a district and how this would play out.

Furthermore, the intelligent use of technology deals with the development of information systems and incentive systems for the development of intelligent devices that start depending on active feeding and grid loads. They are supposed to shift the network load and to give feedback in electric cars to counteract concerns of having an empty battery. In the area of guidance and training, interactive manual books, electronic trainings and web-based co-operations are in planning. The objective is to support different professionals from different fields of the energy technology sector and to amend technical innovations.

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Prof. Dr. rer. nat. Dr. phil. Andrea Ehrmann
Prof. Dr.-Ing. Herbert Funke

Ministerium für Innovation,
Wissenschaft und Forschung
des Landes Nordrhein-Westfalen

INTERNATIONAL AFFAIRS

Being in frequent contact with other countries is part of the work routine of most engineers. For example, many companies have their production facilities outside Germany, or they contract suppliers from other countries. Thus, communication with international staff, as well as with partners and customers from abroad, is an essential job element. Against this background, acquiring foreign language skills and intercultural competences is of utmost importance regarding the education of engineers. The VDI (Association of German Engineers) demands that 50% of future engineers should have a study-related experience abroad.

In order to increase the number of students from the Faculty of Engineering and Mathematics (IuM) who gain study-related international experience during their studies at the Bielefeld University of Applied Sciences, a strategy for internationalisation is going to be implemented in the faculty. The starting point for the development of this strategy is an analysis of the situation regarding internationalisation at the faculty IuM. The analysis was carried out within the scope of a project in the study program Industrial Engineering and Management under the supervision of Prof. Dr. Klaus Rüdiger, the international coordinator of the faculty.

The data of this study consist, amongst others, of a standardised survey with 653 students from the faculty IuM and interviews with staff from FH Bielefeld (the University of Applied Sciences in Bielefeld). According to this survey, 65% of the participants are interested in getting study-related experience in another country. However, the number of students who actually do go abroad in connection with their studies is quite low.
Many students who participated in the survey stated that they did not possess much knowledge about opportunities for stays abroad offered by FH Bielefeld. Therefore, an advertising campaign was started in autumn 2016 to inform about these possibilities, namely semester abroad, internship abroad and final thesis abroad. In this connection, presentations were held in the lectures from the third and fifth semesters of the Bachelor study programs of the faculty IuM. Additionally, an information session about studying in Australia, New Zealand and Asia was organized with speakers from the organisation GOstralia-GOzealand and the James Cook University in Australia.

Another measure to raise the international mobility of students of the faculty IuM comprises the preparation of portraits of partner universities with information on city, university and courses offered. Moreover, reports from former outgoing students about their experiences during studies abroad including contact details are made available. In this way, students can quickly access relevant data regarding potential study destinations and get first-hand information from their fellow students. Further measures contain, for instance, the creation of new university partnerships and the implementation of English-speaking lectures.

Besides the recent focus on the implementation of the strategy to increase outgoing student mobility, there have been many other international activities in the faculty IuM. Once a year, the international IHK (Chamber of Industry and Commerce) “Encounter Week” takes »

place in Ostwestphalia, focusing every year on another country or region. The event is organised by the IHK with the support of various partners such as local companies and universities. The faculty IuM has been one of these partners for the last couple of years. For instance, in 2017, Great Britain is presented from a variety of perspectives. Topics of presentations and discussion rounds include, among others, culture, politics, economy and finances. Additionally to the approximately 50 speakers who share their expertise about Great Britain, there are around 1,000 participants from industry, politics, etc., making the event a great possibility for networking with various stakeholders.

There are several lecturers at the faculty IuM who are highly involved in international academic cooperation. On the one hand, they have gone abroad for international conferences, guest lectures and guest professorships, e.g. to the Southwest Jiaotong University and the Shanghai Normal University (both in China). On the other hand, they have invited and hosted visiting professors and visiting students, e.g. from the University of Vigo (Spain) and from the PXL University College (Belgium). In 2017, the cities Bielefeld and Veliky Novgorod in Russia have their 30th anniversary of town twinning. In this connection, an academic cooperation between the Novgorod State University and the FH Bielefeld has been signed in a ceremony.

Are you interested in a cooperation with the faculty engineering and mathematics of the FH Bielefeld?
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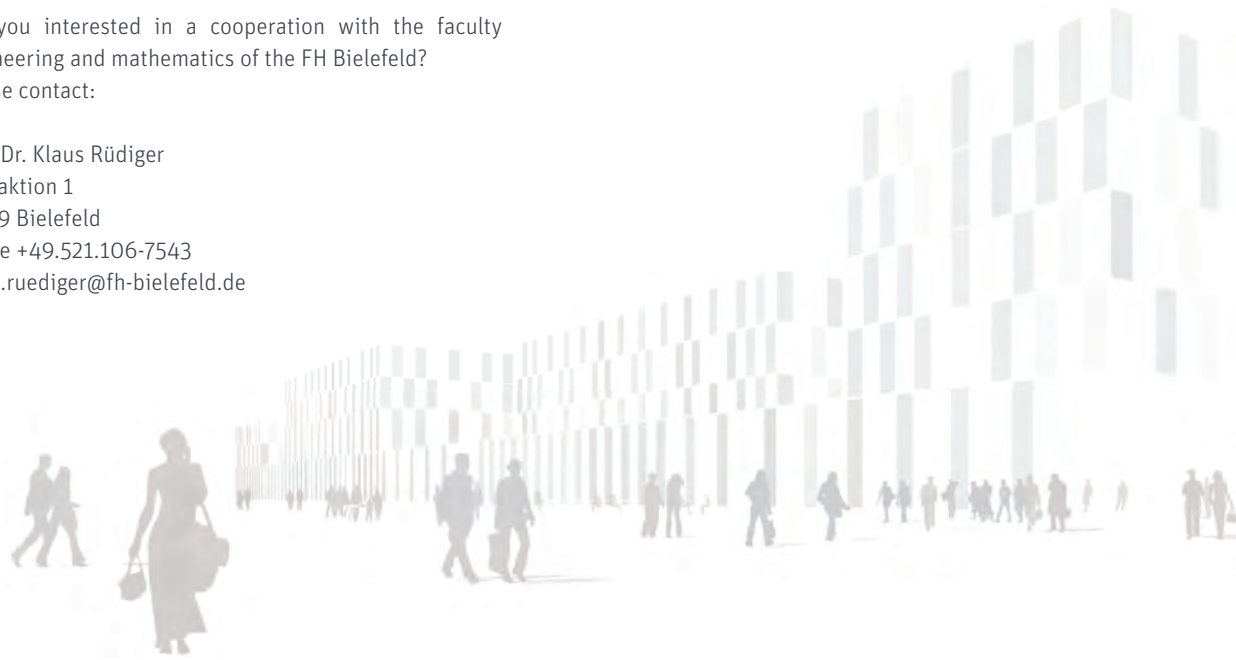

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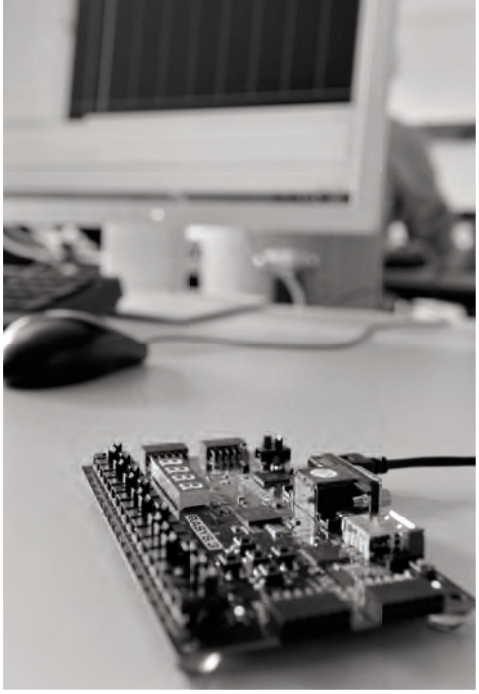


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