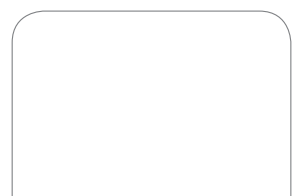
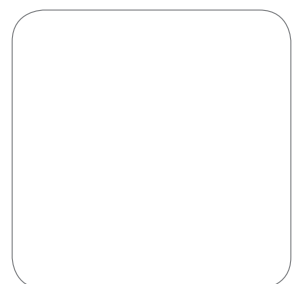
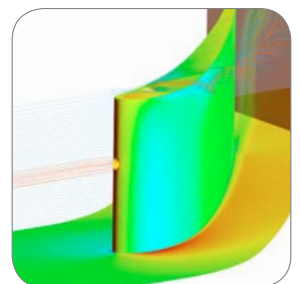
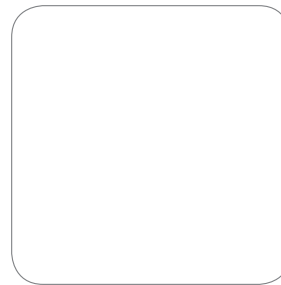
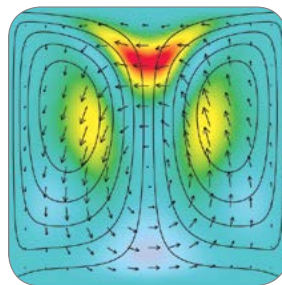
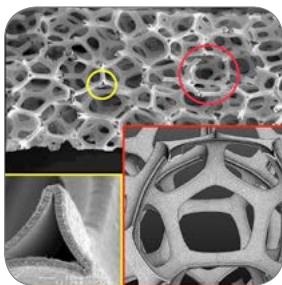


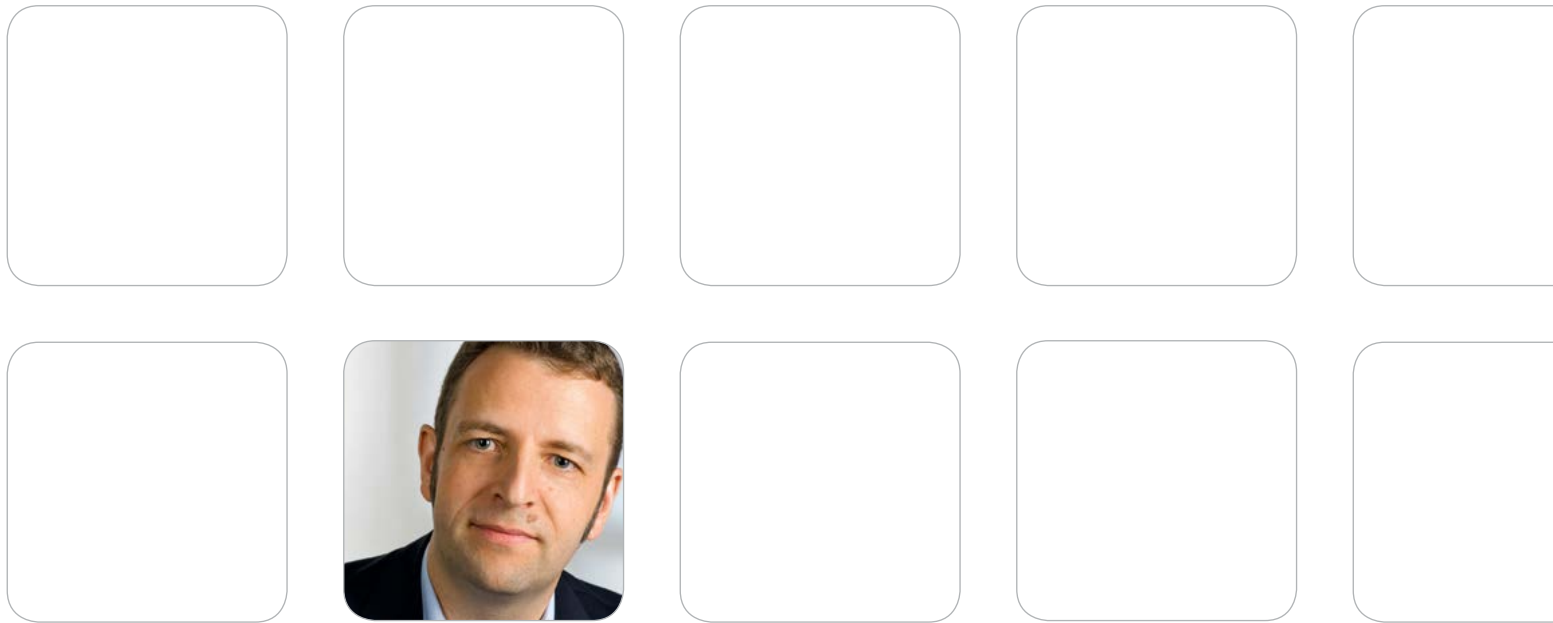
The Faculty of Mechanical and Industrial Engineering





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Dean's Foreword

Dear Reader,

In 2015 the Vienna University of Technology is going to look back on a tradition of 200 years. In 1815 its predecessor, the k.k (imperial-royal) Polytechnic Institute was established which, in the first half of the 19th century, represented by far the largest institution of its kind within the Habsburg Empire. In line with its purpose, this institution traditionally has had close ties with industry and commerce and from the beginning it has especially addressed subject matters that nowadays one would associate with mechanical engineering. In 1872 the k.k. Polytechnic Institute was transformed into a Technical College. Since 1901 it has been authorised to award doctoral degrees, and since 1975 it holds the name "Vienna University of Technology".

In addition to the traditional areas of mechanical engineering, the teaching and research fields of the roughly 20 Chairs of the faculty also include industrial management sciences. The faculty offers the two curricula of mechanical engineering and industrial engineering, both consecutively structured as bachelor and master programmes each. In addition, our faculty is substantially involved in the curricula of plant/chemical engineering, in the master curricula of materials science and biomedical engineering, as well as in various postgraduate programmes.

The faculty's research activities cover a wide spectrum and are thoroughly integrated in the research areas of the Vienna University of Technology in terms of strategic profiling. Five primary research areas were defined with a special focus on:

- Energy and environment;
- Mobility and transportation;
- Material and manufacturing technologies;
- Production systems and industrial management;
- Numerical engineering methods and IT-based engineering.

This brochure provides a broad insight into the wide competence range of the faculty with regard to academic teaching, our strategic directions of research, and the profiles of the individual institutes.

Let me thank you for your interest in our faculty. I hope you will find this brochure interesting and I would like to encourage you to address me or the mentioned contact persons of the institutes with any relevant questions or problems you may have.

Univ.-Prof. Dipl.-Ing. Dr.-Ing. Detlef Gerhard
Dean of the Faculty of Mechanical and Industrial Engineering



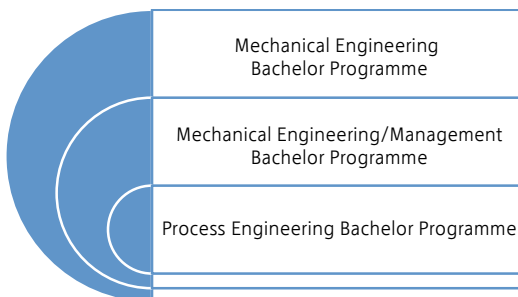
The Faculty of Mechanical and Industrial Engineering

Extensive Know-how Through Research-led Teaching

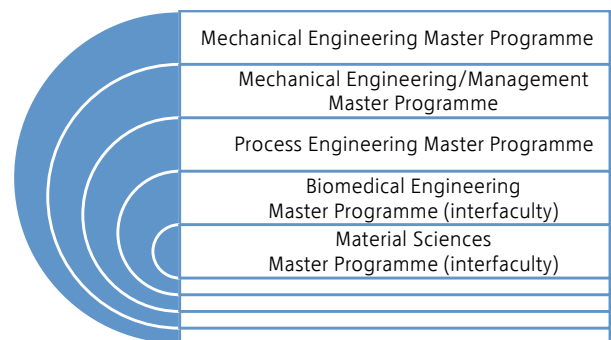
Current research trends indicate the necessary focus points in teaching with the aim of subsequent individual and current technical specialisation

The Faculty of Mechanical and Industrial Engineering offers three bachelor and five master programmes (two of them together with other faculties).

BACHELOR PROGRAMMES



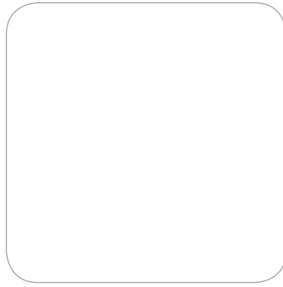
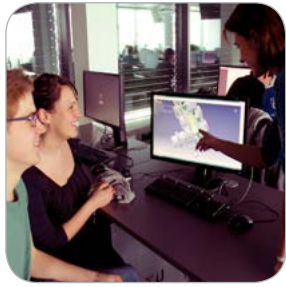
To qualify for a bachelor programme, applicants need to have a general university entrance qualification or they need to have passed a university entrance exam. The bachelor programme is completed after six semesters and concludes with a "Bachelor of Science" (BSc) degree. It offers broad-based know-how providing graduates with professional qualifications that will enable them to start either a professional career or a further master programme based on the scientific competencies gained.



MASTER PROGRAMMES

To qualify for a master programme, applicants need to have a relevant bachelor degree or college undergraduate degree, or they need to have completed an equivalent programme at a recognised Austrian or foreign post-secondary educational institution.

The master programme usually lasts four semesters. At the end of the programme, students will be awarded a "Dipl.-Ing." academic degree. As part of the master studies, all the skills required to apply scientific methods independently in research, profession or practice are taught. Similarly, graduates can continue and further develop their academic education and training by joining a doctoral programme. Currently, the number of jobs available in this area clearly exceeds the number of graduates.



BACHELOR PROGRAMME QUALIFICATIONS PROFILE

The bachelor programmes offered provide extensive basic training of high scientific and methodological quality, focused on sustainable knowledge, which prepares graduates both for further training in a master programme as well as for employment in various fields. When graduating, students are internationally competitive.

TECHNICAL AND METHODOLOGICAL SKILLS

In today's industrial and information society, requirements made to graduates change constantly. To keep pace with these changes, the main goals of a bachelor programme are teaching the basic engineering sciences, natural sciences, mathematics and information technology methods and knowledge, which are required for future professional activity. Such wide and thorough basic training as well as method-oriented professional training open up a variety of application fields and career opportunities to graduates. In addition to mathematical and engineering knowledge, students can acquire specific skills depending on their study field, with the aim of being competitive in the environments of mechanical, industrial, and process engineering.

MASTER STUDIES QUALIFICATIONS PROFILE

Based on the fundamental skills acquired during the bachelor programme, the master programme courses increasingly deal with latest research results. The Vienna University of Technology's research activities influence students' academic life more and more as their studies progress. Due to this type of research-led teaching, students in the master programme participate in laboratory projects and theses related to current research already during their master studies. The master studies provide education of a high sci-

entific and methodical quality that aims to convey sustainable knowledge, which qualifies graduates for further education, especially in the context of a doctoral programme, as well as for employment in the business environment, and makes them internationally competitive. In a master programme, students deepen their technical, methodological as well as cognitive and practical skills in the chosen fields of technology. Master studies offer a range of major fields of study that students can combine individually. This gives each and every student the opportunity to adapt the master programme to their own interests.

DOCTORAL STUDIES

The faculty of Mechanical and Industrial Engineering offers graduates the possibility of earning a PhD degree. Beside the research to be conducted and the dissertation to be prepared, they can complete additional courses. Graduates of the doctoral programme of technical sciences will be awarded a "Dr. techn." degree.

Summary of typical activities following a bachelor or master degree at the Faculty of Mechanical and Industrial Engineering:

- Research and development;
- Process engineering;
- Environmental engineering;
- Automotive engineering;
- Power engineering;
- Production and logistics management;
- Quality, process and project management;
- Controlling;
- Safety engineering/accident prevention, environmental protection and waste management;
- Service and maintenance of process engineering production units.



Dipl.- Ing.ⁱⁿ Nicole Paces, 28, Trainee Field Engineer, OMV E&P GmbH

"I studied process engineering at the Vienna University of Technology and graduated in 2009. After that, I worked as a project assistant at the Institute of Mechanics and Mechatronics. I'm going to do my PhD degree in the field of model-predictive regulation of biomass. Since July 2011, I have participated in a project & engineering trainee programme at OMV Exploration & Production. The solid basic training in scientific and technical disciplines as well as numerous project-related scientific activities provide the best basis for a successful and quick entry into industry and research. Of utmost importance are also the social skills which I gathered during my involvement in the faculty's student council and my work in the study commission."

COGNITIVE AND PRACTICAL SKILLS

All courses of study focus on the acquisition of cognitive and practical skills in the chosen technical field. Graduates will be able to describe tasks and to develop appropriate solutions using all relevant engineering and operational research methods. These include, in particular, abstraction and modelling capabilities. Graduates will be able to procure the information they need in order to work in a new field and to quickly work their way into new areas of knowledge. They have learned how to formulate problems and to take over the tasks arising in organised teams, to work independently, gather the results of others and to communicate their results. Accordingly, they are familiar with the required technical terminology, relevant laws and regulations.

SOCIAL SKILLS AND INNOVATIVE COMPETENCE

In addition to technical skills, students can acquire technical skills in other fields and soft skills which prepare them for the non-technical requirements of their professional activity. Student mobility is promoted through international exchange programmes offering students the opportunity to develop additional language skills and to gain valuable experience abroad.

Summary of possible focus areas in the master programme:

- Industrial engineering;
- Organisation & strategic management;
- Financial and risk management;
- Power engineering;
- Biomechanics and rehabilitation engineering;
- Manufacturing automation;
- Environmental engineering;
- Machinery and plant manufacturing;
- and many more.

Planned curricula including detailed information are available at:
<http://mwb.tuwien.ac.at>

LEARNING AND RESEARCHING ACROSS THE FACULTY

In the faculty's learning and research factory students can view the product development process from the initial product idea through design and manufacturing to installation. The real picture of the relevant business units allows them to do practical training in many study fields. Students can use CAD working facilities, a modern machinery park and flexible assembly locations as part of a project to put in practice the contents they have learned in product development, production and industrial engineering.

Dipl.-Ing. Michael Tauscher, 38, Head of Aerospace Engineering, TEST-FUCHS GmbH

"I studied general mechanical engineering at the Vienna University of Technology and completed the diploma programme in 2001. As Head of Aerospace Engineering I am now responsible for the development of components and systems for TEST-FUCHS GmbH helicopters, airplanes, satellites and launch vehicles. The first class basic training at Vienna University of Technology, together with a few specialisations, is an absolute prerequisite to developing and launching new and innovative products in this field of leading-edge technology. During my studies I worked in the student council and was elected students' representative. These experiences, and especially working together with all students far beyond the university context, have been lasting memories for me."





Dipl.-Ing.ⁱⁿ Elvira Thonhofer, 27, Head of Engineering, Acico Yachts

"I studied mechanical engineering at the Vienna University of Technology and in 2011 I completed the diploma programme. As part of an ERASMUS year I also studied naval architecture. As Head of Engineering at Dutch yacht constructors Acico Yachts I am now responsible for the design and dimensioning of metal and composite structures. That includes everything that is not covered by usual regulations (for shipbuilding). This means that the thorough basis in the fields of mechanics, FEM and CFD is absolutely necessary for me to do my job. The mechanical engineering programme teaches exactly these basics very well. In combination with specific knowledge that can be acquired from other fields of study, each and every graduate has a lot of opportunities, which you might not be aware of while you're a freshman."

STUDENT COUNCIL

The student council is responsible for statutory activities to be performed by students' representatives. Furthermore, it supports students by giving advice, representing the voice of students on various committees (study committee as well as faculty, habilitation and appointment committees) and thus making an important contribution to quality assurance in teaching.

SELF-ASSESSMENT TOOL FOR PROSPECTIVE STUDENTS

If you are interested in studying at the Vienna University of Technology in general, or specifically at the Faculty of Mechanical and Industrial Engineering, you can complete a free and anonymous online test at <http://studienwahl.tuwien.ac.at/>. This will help you to make a well informed decision and provide a self-assessment tool.



Dipl.-Ing. Alexander Raab, 36, Head of Quality Engineering, DIAMOND AIRCRAFT INDUSTRIES GmbH

"I studied industrial engineering at the Vienna University of Technology. Through the tutorial given by the student council it was easy to quickly get to know the entry procedures and I was able to establish valuable contacts with colleagues who were all sharing my passion for aviation, which is no more a focus of the university. Also, while I was active as a students' representative in the student council, I acquired social skills in addition to the interdisciplinary skills that are taught in the context of studies. In my current position, these have helped me to handle complex projects from development to production."

Whom to contact on teaching matters

Dean of studies:
Ao.Univ.-Prof. Dr.
Kurt MATYAS



Dean's office of the Faculty of Mechanical and Industrial Engineering

Dekanatszentrum Karlsplatz 2, E 402
A-1040 Vienna, Karlsplatz 13

mwb.tuwien.ac.at

Phone: +43 1 58801 30011

Fax: +43 1 58801 30099

Opening hours of the dean's office

Mon - Thu 10:00-12:00 a.m.

Student council



Getreidemarkt 9
A-1060 Vienna

Phone: +43 1 58801 49561

www.fsmb.at



Faculty of Mechanical and Industrial Engineering

Research Aimed at Innovative Ways to Create Products and Processes

MISSION STATEMENT

Research and teaching aimed at innovative ways to create products and processes. Technology – Economy – Ecology – Human factors

The major goals of the research and teaching activities of the Faculty of Mechanical and Industrial Engineering are the generation and transfer of scientifically substantiated methodical knowledge to create innovative products and production systems, and also the design and optimisation of processes in manufacturing companies. In achieving these objectives, technological, economic and ecological requirements as well as human factors are extensively taken into account.

RESEARCH METHODS

In the field of fundamental research, the MIE Faculty predominantly focuses on method-oriented rather than product-oriented work in order to avoid narrowing to only a few sectors of mechanical and industrial engineering. This research strategy ensures that, based on a solid foundation of methodical knowledge, the diverse requirements of the economy and society in the development of innovative products and processes can be met in an appropriate way within applied research projects. The research fields of the Faculty of Mechanical and Industrial Engineering can be divided into four categories:

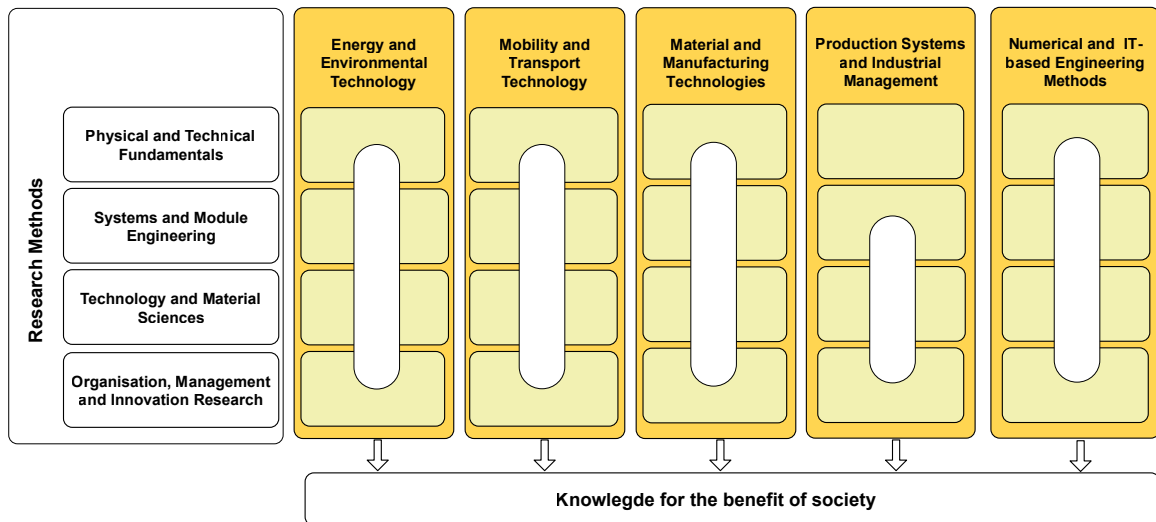
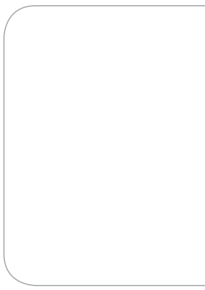
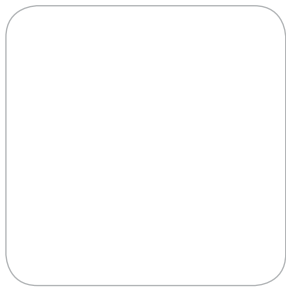
- » Physical and technical fundamentals;
- » Systems and module engineering;
- » Technology and material sciences;
- » Organisation, management and innovation research.

KEY RESEARCH FIELDS

Based on the research methodologies described above, the Faculty of Mechanical and Industrial Engineering has defined five primary research fields, taking actual and predictable needs of our society as well as national and international developments in the areas of mechanical and industrial engineering into account. These five research fields form the pillars of the research matrix shown below.

RESEARCH MATRIX AND RESEARCH PROFILE

The method-oriented approach of the Faculty of Mechanical and Industrial Engineering towards future research topics is reflected within the research matrix. The resulting research profile of the Faculty is shown in the white vertical bars of the illustration. The comprehensive coverage shows that research is being conducted in all five primary research areas based on broad methodical expertise. The interplay between basic research and applied research enables the Faculty of Mechanical and Industrial Engineering to expand and apply expertise in different research activities.



RESEARCH ACTIVITIES AND COOPERATIONS

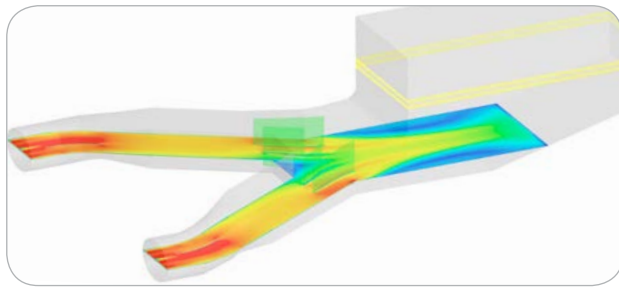
The guiding principle of research-led teaching at the Vienna University of Technology is filled with life whenever the very professors and lecturers conduct research and include current research results in their teaching. Therefore, it is imperative that any substantial research conducted is financed from own funds rather than being mandated from outside. Additionally, fundamental research of the faculty is financed through projects which are funded by the Austrian Science Fund (FWF).

Professors and post-doc researchers generally conduct their research in collaboration with doctoral students or pre-doc research assistants and their supervisors. The faculty is leading or participating in several TU in-house doctoral colleges. These internal cooperation projects or FWF projects often generate follow-up projects that are funded by the Austrian Research Promotion Agency (FFG) and rather touch on concrete industrial application. These also contribute to achieving the goal of encouraging inventions and to their exploitation, for example, through start-ups. Institutes of the faculty participate in cooperative inter-university research projects within COMET competence centres and competence projects (funded by FFG). Additional engagements of the MIE Faculty in EU research projects not only lead to substantial third-party funds through

which thesis projects may be financed, but also result in a strengthened international focus of research activities and in increased mobility of researchers and students. One particularly interesting form of cooperation between institutions of the faculty and industrial companies is represented by CD laboratories (funded by the Christian Doppler Research Association), where application-oriented basic research providing particular benefits for industrial partners is conducted.

In addition to the abovementioned forms of research activities, a majority of externally funded research at the faculty is conducted through direct, usually bi-laterally agreed contract research. Companies with specific research questions directly get in contact with MIE Institutes having the required competence and these will deal with the topic based on a contractual agreement, provided that the nature of the research to be conducted is sufficiently scientific.

In all these research activities students get involved side by side with academic staff of the faculty. In this way, the faculty not only meets its mission of serving society and the economy through valuable research contributions, but it even fulfils the more fundamental mission of forming young people academically. Thus, the MIE Faculty makes a contribution in keeping with the Vienna University of Technology's motto: "Technology for People".



Institute of Energy Systems and Thermodynamics

Thermodynamics, Thermal Engineering, Fluid-Flow Machinery

INSTITUTE PROFILE

Within the Faculty of Mechanical and Industrial Engineering, the Institute for Energy Systems and Thermodynamics (IET) is the centre of excellence for the mechanical and process engineering aspects of energy technology. IET aims at offering high-quality education both in fundamentals and application aspects of energy technology. The content and methods used are guided by research and innovation. In its research activities, IET concentrates on selected topics which have a high relevance in the field of energy technology while also being of specific importance for the industrial and energy sectors in Austria. IET is interested in close collaboration with industry and in this context it develops specific competences and know-how in the fields of analysis, simulation and testing methods (CFD, thermal simulation, circulation calculations, shock pressure calculations, etc.).

IET is organised in two research fields: the combined research field of Thermodynamics and Thermal Engineering, and the research field of Fluid-Flow Machinery. Each research area has a major laboratory for research and research-led teaching at its disposal.

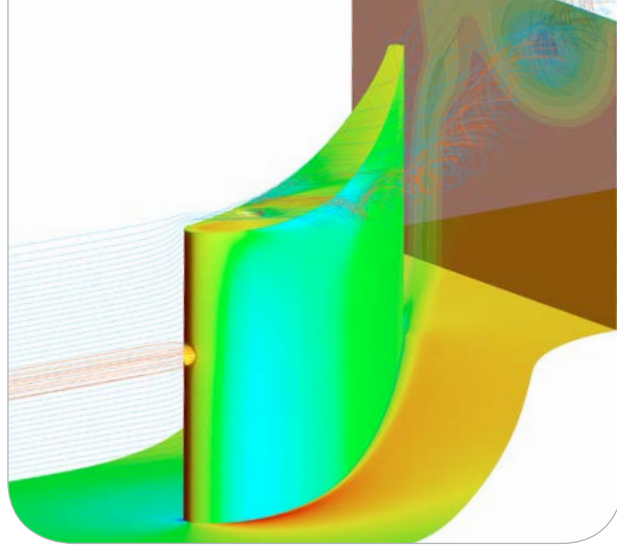
RESEARCH AT IET

Currently, energy technology is among the most thoroughly investigated and discussed topics in engineering and in society as a whole. The velocity

and complexity of research for new solutions and their implementation are higher than ever. In line with these challenges, possibilities to do fundamental and application-oriented research are increasing in the same way. The institute would like to meet these future challenges and promote intra- and interfaculty collaboration regarding the matters in question, for example, energy storage and integration into electric grids, and energy efficiency both in industry and in residential as well as municipal areas.

TEACHING AT IET

IET is responsible for teaching fundamental thermodynamics as well as all aspects of engineering energy technology. Beside learning about thermodynamics, students are encouraged to acquire solid fundamental knowledge in the areas of fluid dynamics, solid mechanics and machine dynamics. In the context of research-led teaching, upcoming engineers are trained comprehensively in the field of energy technology. Students have the opportunity to broaden their knowledge of computational and experimental methods without sacrificing their analytical view on the problems. We particularly promote an independent way of working in order to prepare students for the constantly growing requirements in industry, academia and government bodies. Our aim is to encourage students to think in an interdisciplinary way rather than to passively acquire specialist knowledge.



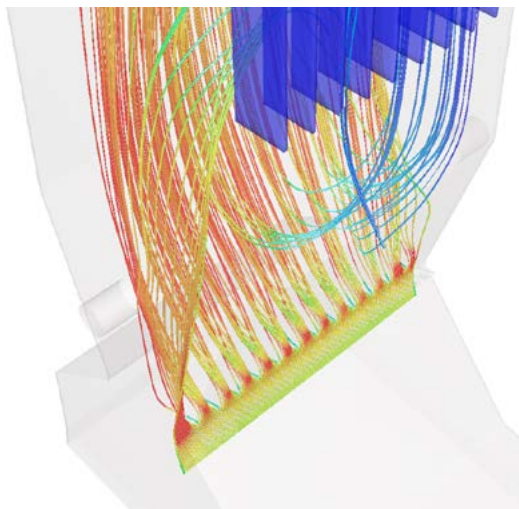
Passive air injection into a turbine blade



DEPARTMENT OF THERMODYNAMICS AND THERMAL ENGINEERING

The department organises its teaching and research activities around the core competences and methods of thermodynamics and thermal engineering, and around four main areas of research. The “Modelling of Reactive Multiphase Flow” area covers theoretical and applied aspects of phenomena such as combustion, gasification, melting, freezing, evaporation, condensation, and the fluid dynamics of gas-solids and gas-liquid flow. The “Thermodynamics and Thermal Engineering of Renewable and Fossil Energy Systems” area bundles the competences in analysis, modelling and design of power plant systems independently from the primary energy source. The third area is “Numerical Simulation of Stationary and Transient Multi-phase Flow in Complex Piping Networks”. In the area of “Energy Storage”, research activities are centred around sensible thermal, latent thermal and thermo-chemical energy storage.

Besides basic and applied research in the four core areas, the department is very active in direct development projects for industry, in particular in the field of thermal engineering.



Fluid flow in a waste incineration plant

DEPARTMENT OF FLUID FLOW MACHINERY

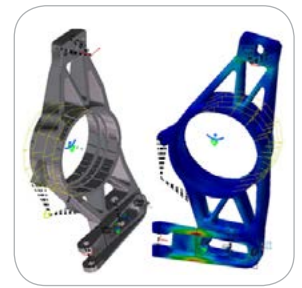
The department deals with current research topics related to thermal and hydraulic turbo machines. In the field of hydropower, one area of research is the performance increase of runner and casing design for Pelton turbines. Another important topic is the numerical and experimental investigation of flow phenomena at off-design points for pump turbines. In addition to these activities we develop a multi stage, modular pump turbine for decentralised energy storage.

In the field of thermal turbo machinery, theoretical, numerical and experimental investigations are performed to improve the performance of various components. One important task is the reduction of tip-leakage losses in axial flow turbines by means of an innovative passive flow control concept. Furthermore, research on traditional labyrinth seals as well as advanced turbo machinery seals (brush seals, leaf seals) is conducted. The objective is to improve the understanding of the flow in these seals and thus to enhance their performance level. Finally, based on fundamental laws of energy transfer, another objective is to bring in a fresh perspective on the established similarity laws of turbo machinery stages.

IET – CENTRE OF EXCELLENCE FOR ENERGY TECHNOLOGY

Being a competent point of contact for all mechanical and process engineering aspects of energy technology, the Institute for Energy Systems and Thermodynamics continues to make every effort to push research and development forward in this area. A lot of these efforts have resulted in a COMET project called “Green Storage Grid” with one key task of this project being the research into different storage technologies.

Contact: www.iet.tuwien.ac.at



Institute of Engineering Design
and Logistics Engineering

Methods for the Design and Development of Innovative Machines and Systems

INSTITUTE PROFILE

Based on the fundamental knowledge of machine elements, systematic design and engineering informatics the research groups at the institute work on the application of this knowledge in several fields and in close connection with its lecturers. Traditional and new research areas are being combined and support one another.

ENGINEERING DESIGN AND MATERIAL TRANSPORT HANDLING AND CONVEYING SYSTEMS

Univ. Prof. Dr. Georg Kartnig

The group deals with design principles in mechanical engineering and with technical as well as logistical tasks of material handling.

Experimental research is done both in our laboratory and in the field. Theoretical research, simulation and interpretation of measuring data can be conducted with the help of comprehensive computer equipment.

Further key research activities of the group that involve cooperation with industry are related to rail vehicles, ropeways and supporting structures.

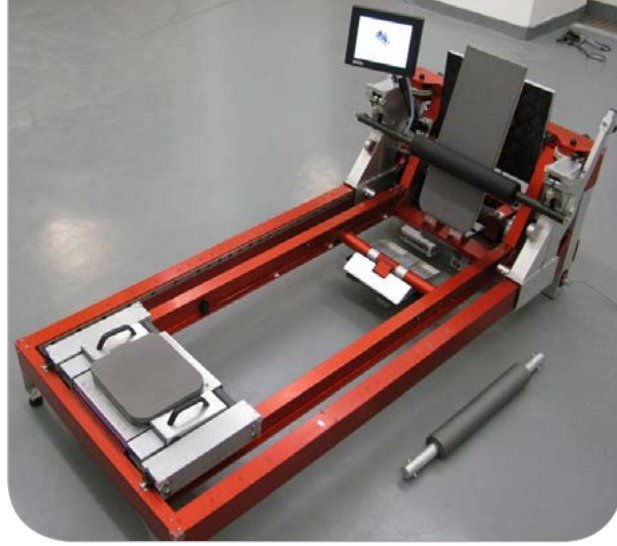
ECODESIGN

Ao. Univ.-Prof. Dr. Wolfgang Wimmer

ECODESIGN is a source of innovative and eco-intelligent products. It works on the reduction of the consumption of resources and, consequently, of the ecological impact of products during their life cycle. A broad range of products is covered, e.g. dictating machines as well as subway trains. The group's core competence is in the development of new methods, tools and strategies for sustainable product development as well as the implementation of new, innovative and sustainable product ideas in close collaboration with industry.



Test bed for assessing the operating performance of process belts



Multifunctional training tool for use in a state of weightlessness

MACHINE ELEMENTS

Univ.-Prof. Dr. Michael Weigand

The Machine Design division teaches and works scientifically on the basics of mechanical engineering, thus dealing with the design and calculation of basic machine elements. One main field of research includes power transmissions and drive trains for various fields of application, with a special focus on transmissions for aviation. Acoustics is a further field of research.

REHABILITATION ENGINEERING

Ao. Univ.-Prof. Dr. Margit Gföhler

Ao. Univ.-Prof. Dr. Thomas Angeli

Rehabilitation engineering is an interdisciplinary research field applying engineering and physical methods to medical, human and biomedical problems with projects ranging from simulation of motion to the design of mechanical support means.

MECHANICAL ENGINEERING INFORMATICS AND VIRTUAL PRODUCT DEVELOPMENT

Univ.-Prof. Dr. Detlef Gerhard

The focus of the MIVP research group is on the application of information technologies and computational methods in the development of machinery, vehicles, and equipment. Virtual product development is essentially about describing and illustrating real products with their characteristics as completely as possible using computer models, and about managing the generated data and processes. The aim is the validation and verification of functions by means of simulation and digital prototypes, but also the complete documentation of a product and its development process. Applied research projects are conducted with partners from manufacturing industry as well as software and consulting companies. Process and organisational aspects are considered holistically in addition to modelling and software implementation aspects.

PRESSURE VESSEL AND PLANT TECHNOLOGY

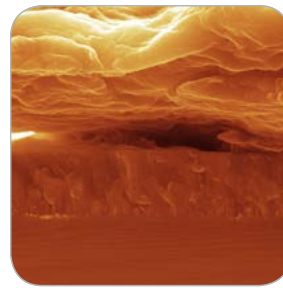
Ao. Univ.-Prof. Dr. Franz Rauscher

The research group for Pressure Vessel and Plant Technology is active in teaching and research in the field of pressure equipment. Most activities concentrate on pressure vessels, pipelines, pressure accessories and safety accessories as used in chemical plants. One of the group's focus areas is design, more specifically the enhancement of methods for design by analysis. Fatigue and creep damage are of special interest. In the field of inspection and testing of pressure equipment, the group conducts research into acoustic emission examination.

Contact: www.ikl.tuwien.ac.at



Several research groups of our faculty and of the faculty of Technical Chemistry together with TU's testing facility TVFA have combined their capabilities and interests in drivetrain technology and built a competence center for gears and transmissions in Austria. Covering all aspects like design, calculation, materials, dynamics, testing, manufacturing and lubrication the main goal is to collaborate in education and research with national and international universities and leading research organisations like the FVA (Forschungsvereinigung Antriebstechnik). Furthermore, Vienna Gear²ing wants to serve the industry's needs for qualified engineers and technological support. The Machine Elements research group (Prof. Weigand) is the point of contact and coordination of Vienna Gear²ing.



Institute of Materials Science and Technology

Materials Driving Innovation

THE INSTITUTE

The Institute of Materials Science and Technology comprises the three research groups for Materials Science, Non-Metallic Materials, Materials Science and Materials Technology. In 2004 it evolved from the former 'Institute for Materials Science and Materials Testing', which itself evolved from the 'Institute of Mechanical Technology I and Construction Materials' in 1980.

MATERIALS SCIENCE

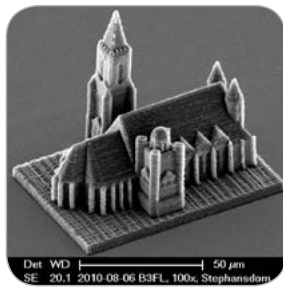
The focus of the research group for Materials Science (P. Mayrhofer) is directed towards developing the science underlying the relationships between the synthesis, chemistry, structure, properties and performance in structural, nanoscale and functional materials. To address these relationships, we integrate experimental and computational studies with all the aspects of materials science ranging from developing a fundamental understanding to the design, synthesis and testing of new materials. Specifically, our research focuses on a detailed atomic-level understanding of microstructure-properties relations, kinetic processes, mass transport mechanisms, chemical reaction paths, material thermodynamics and phase transitions. We use a wide variety of in-situ as well as ex-situ characterisation tools such as scanning electron microscopy (SEM) equipped with analytical techniques, differential scanning calorimetry (DSC), X-ray diffraction (XRD), submicron synchrotron X-ray tomographic microscopy (SXRTM), and high resolution trans-

mission electron microscopy (HRTEM). Computational studies involve density functional theory (DFT), molecular dynamics (MD) and TEM image simulations.

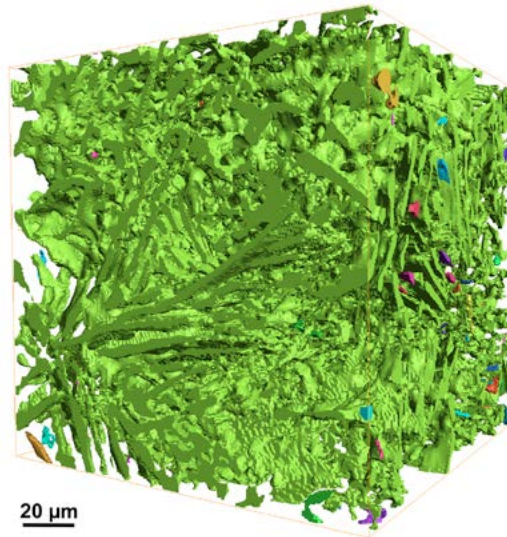
We also continue traditional research in the area of crystal growth, physical properties of metastable ceramic and metallic alloys and multilayers, and their thermal stability. The "Structural Metallic Materials and Composites" working group (G. Requena) investigates the relationships between thermo-mechanical behaviour and the microstructure of structural materials. 2D microstructural characterisation methods are combined with 3D techniques such as laboratory and synchrotron tomography. Thermo-mechanical characterisation encompasses the study of internal stresses, deformation mechanisms and phase transformations applying ex-situ and in-situ bulk diffraction methods, e.g. neutron and synchrotron diffraction.



Bending tester with microscope
to study crack propagation in PE-UHMW



Micromodel of Vienna's Saint Stephen's Cathedral: Two-photon lithography (scanning electron microscope image on a scale of 1:1 000 000)



NON-METALLIC MATERIALS

The Non-Metallic Materials research group extensively deals with problems related to polymers and ceramics in engineering applications.

The research activities of the "Structural Polymers" working group (V.-M. Archodoulaki) mainly focus on structure-property relations, fracture mechanics, ageing and fatigue as well as modification and reactive extrusion of polymer materials. The traditional methods of polymer characterisation and testing for analysis of thermal and mechanical properties are complemented by spectroscopic and microscopic techniques. The wide spectrum of thermoplastics, elastomers and thermosets with widely varying materials properties shows great potential and a need for further research and development.

The focus of the "Functional Non-Metals" working group (J. Stampfl) is on additive manufacturing of non-metallic materials. In addition to materials development (high-performance ceramics, bio-ceramics, bio-photopolymers), proprietary lithography-based systems are developed, which are based on the principles of two-photon lithography or dynamic masks for structuring complex components in 3D. These techniques are mainly applied in the field of biomedical engineering.

MATERIALS TECHNOLOGY: APPLICATION IS SCIENCE

The research group for Materials Technology (E. Kozeschnik) is concerned with problems of microstructure evolution during processing of structural metallic materials. In addition to focused research on steel and Ni-base alloys, a special focus is also directed towards aluminium. Assisting the experimental characterisation and interpretation of microstructure evolution, computer simulation of phase transformations plays an essential role. A corresponding software package is being developed in-house (<http://matcalc.at>). With the aid of mechanism-based theoretical modelling, the simulations attempt a quantitative prediction of

processes occurring inside the material on microscopic and nanoscopic length scales.

LABORATORY FOR MATERIALS CHARACTERISATION AND PHYSICAL SIMULATION

The equipment available at the Institute is used in mechanical and thermo-physical materials testing and analysis for various fields of application. We offer standard and special testing procedures for metallic and non-metallic materials as well as consulting and expertise in failure analysis.

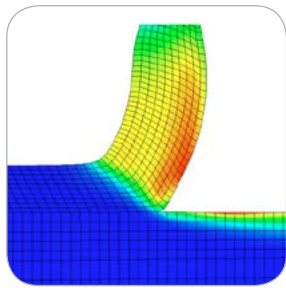
Contact: www.tuwien.ac.at

Christian Doppler Laboratories at the Institute:

"Application-Oriented Coating Development" CDL
The combination of applied and fundamental research in the area of protective coatings for machining tools and components used in the automobile and aviation industries is addressed by Paul Mayrhofer within this Christian Doppler Laboratory.
<http://hardcoatings.tuwien.ac.at>

"Photopolymers in Digital and Restorative Dentistry"
In this laboratory, the team around Jürgen Stampfl develops and characterises materials as well as manufacturing systems for 3D printing of ceramic restorations (crowns, bridges, etc.).

"Early Stages of Precipitation" CDL
At the Vienna University of Technology's branch of the "Early Stages of Precipitation" Christian Doppler Laboratory, Ernst Kozeschnik investigates the potential of computer simulation in precipitation engineering in metallic materials.
<http://www.cdlesop.at>



Institute of Production Engineering
and Laser Technology

Innovations in Manufacturing Technology - From Theory to Applications

The Institute for Production Engineering and Laser Technology (IFT) covers a broad range of manufacturing technologies and machine tool engineering subjects. When it comes to designing new and innovative machine tools and manufacturing processes, IFT is the leading Austrian research facility. At IFT, technology transfer through project partnerships is considered a key factor to securing the competitiveness of Austrian enterprises. Research at IFT focuses on the following fields:

- Technology;
- Machine tools and production systems;
- Manufacturing automation;
- Measurement and test engineering;
- Laser-based manufacturing.

TECHNOLOGY

Research into technology covers all machining processes with the relevant upstream and downstream process steps, as well as metal forming and mating processes. Main objectives include the development of innovative technologies and the optimisation of established manufacturing processes along the entire manufacturing value chain. Key issues are increasing of process rates, optimising process capability, or resource and environmentally friendly production. In addition to research in the field of tool engineering, IFT currently focuses on difficult to machine, or lightweight materials, the shortening of process chains by means of hard machining, or the use of hybrid technologies. Other

research interests refer to electrochemical processes and the production and processing of fibre-reinforced composites. Work at IFT also focuses on the implementation of feasibility studies, the experimental study of machining strategies, specifically for large-scale production, and the production of prototypes and small series.



MACHINE TOOLS AND PRODUCTION SYSTEMS

Increasing demands on manufacturing accuracy, productivity, flexibility and energy efficiency are just one field that needs to be considered in the development of machine tools today. Key priorities include the design and experimental investigation of technical requirements for higher accelerations and velocities of feed axes, increasing the spindle speed, self-optimising precision control, and adaptability of production systems. Additional research conducted focuses on developing new machine structures.



MANUFACTURING AUTOMATION

Based on mechatronics, production systems can be developed to be flexible and efficient at the same time. Sensors are being integrated into production lines to determine the current state of processes and machines while their data are processed by the controller. As a result, actuators provide optimal operating conditions. Related research topics range from process control, digital factory or control systems to adaptronics with the integration of active components for machinery and tooling. Automation solutions based on plug-and-produce-enabled manufacturing systems and virtual commissioning are among the focal points.

PRODUCTION ANALYSIS AND QUALITY

The industrialisation of production technologies is accompanied by the development of quality assurance competencies. Related research focuses on business processes in production technology, on the collection of relevant data and feedback for use in operational control loops. In addition to production metrology, emphasis is placed on quality management, statistical process control, nano metrology and geometrical product specification.

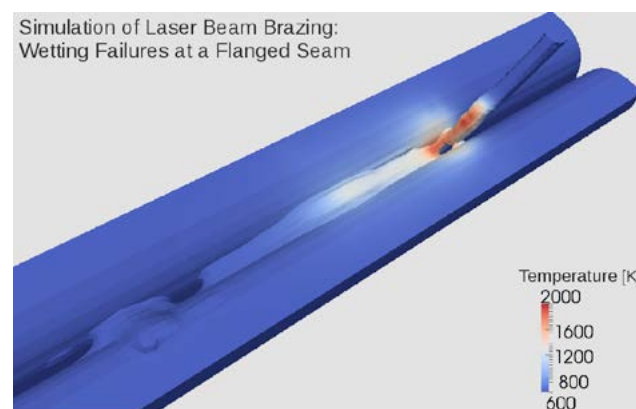
LASER-ASSISTED PRODUCTION

Today the use of lasers as innovative and flexible tools represents a key technology in production industry. Applications extend from laser measuring technology to laser material processing and they open up new possibilities for increasing productivity, flexibility and quality.

The research conducted at IFT covers optics and beam source development, laser technology and laser material processing. In the field of material processing laser joining and separation, as well as laser-assisted metal forming are priorities of research.

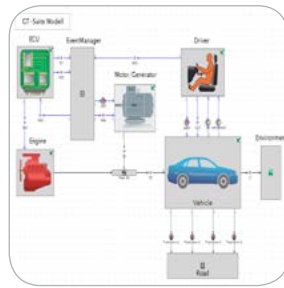
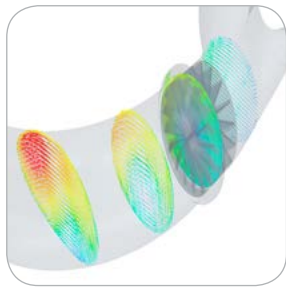
In the upcoming future, further new technologies like micro- and nano-machining will be developed. Interdisciplinary issues concern the simulation and diagnostics of the mentioned production methods. The aim is to analyse and understand the highly dynamic and complex processes that occur in the optimisation of laser material processing and to develop entirely new processes and tools on that basis.

Contact: www.ift.at



Resource and Energy Efficient Manufacturing

Production engineering is often being associated with the generation of waste material, the use of additives, and high energy consumption. Eco2-cut aims at the development of resource-efficient value chains and uses a metrological and model-based analysis of processes and machines. www.eco2cut.com



Institute of Powertrains and Automotive Technology

Mobility in Transition

OVERVIEW

The Institute for Powertrains and Automotive Technology (IFA) was originally founded as Institute for Airships and Automobiles back in 1909. In the following years it was headed by renowned scientists like Prof. Knoller, Prof. Richter and Prof. Eberan-Eberhorst. In 1974 Prof. Hans-Peter Lenz assumed leadership of the institute and it became an internationally active research and teaching centre. More than 30 years ago the International Vienna Engine Symposium was established and the institute became world famous in the automotive area. Since then the institute has been a centre of expertise for the Austrian automotive industry. In 2002 Prof. Bernhard Geringer assumed leadership of the institute and since then it has developed international visibility especially in the field of alternative drives and fuels. Currently about 30 scientific employees and an almost equivalent number of specialists are working at IFA.

The modern facilities of the institute enable research and research-led teaching at the highest level. In terms of infrastructure the institute offers 15 engine test benches with air conditioning, a 4-wheel chassis dynamometer with air conditioning, a Hardware-in-the-Loop (HiL) test bench, a component and prototype manufacture as well as a separate Linux cluster.

Research and development at IFA focuses on the entire vehicle with a specialisation on drivetrains. The institute's close contacts with vehicle manufacturers and suppliers as well as an excellent network with partner universities, ministries and research associations allow for both basic research-led education of the highest standard and industrial research

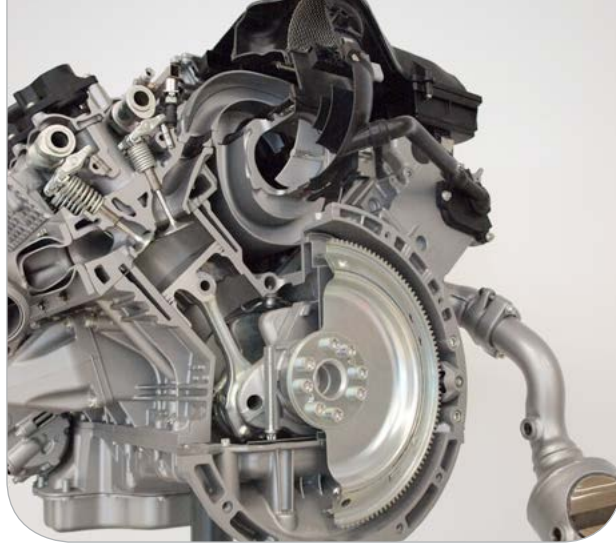
at the same time. In lectures and exercises students have access to state of the art knowledge which they can apply directly in the lab. This is additionally supported by numerous lecturers from industry.

EXHAUST GAS AFTERTREATMENT

Exhaust gas aftertreatment systems constantly need to be developed further in order to meet the ever tighter legal emission limits. While the three-way catalyst for gasoline engines and the oxidation catalyst for diesel engines already show a high level of development, there are still major challenges to be tackled in reducing particulate and nitrogen oxide emissions. Therefore, one focus of IFA is in the area of research and development of soot particle filters, and in systems for the reduction of nitrogen oxides (NOx storage catalytic converter or SCR system). Such systems are not only relevant for diesel engines but can also be used in alternative combustion processes for gasoline engines of the future.



"CULT": CNG Powertrain with innovative hybrid concept
and 49g CO₂ emissions per km



COMBUSTION PROCESS DEVELOPMENT

Nowadays experts agree that the internal combustion engine will remain the dominant element in drive train systems, at least in the near future. At IFA we therefore work intensively on the development of combustion processes for gasoline and diesel engines. The focus is placed on their adaptation to alternative fuels as well as on valve timing and fuel injection strategies. Relevant components which are being analysed and developed also include heated injectors, new spark and heat management systems as well as heat storage systems. Measurement instruments include dynamic exhaust gas instrumentation (high speed FID, FTIR), particle number and size distribution measurement as well as optical measurement (high speed camera). In addition, also numerical simulation is being used.

NUMERICAL SIMULATION

At IFA we have all numerical tools available that are necessary to address relevant questions in the areas of engine combustion and exhaust or energy management. Mixture formation, turbulent combustion as well as all kinetically controlled processes (compression-ignition, emissions, catalytic reduction of pollutants) can be simulated using suitable numerical models.

Operating strategies for hybrid powertrains are defined through the determination of energy fluxes and usage of powerful numerical optimisers. Depending on the problem to be solved, zero-, one- or three-dimensional modelling approaches are applied. The model depth ranges from engine map approaches to longitudinal dynamics and from real-time to three-dimensional simulations of turbulent flow fields to detailed reaction kinetics.

ALTERNATIVE FUELS AND PROPULSION SYSTEMS

The limited availability of fossil fuels as well as the demand for sustainable mobility have led to an extensive search for alternative fuels and propulsion systems. For decades IFA has been conducting research

in the areas of CNG biogas, biogenic fuels such as ethanol and various other alcohols, BTL, NeXBTL, FAME, and others to be used in internal combustion engines. Research activities cover the adjustment of the combustion process of changed substance properties as well as measures to improve engine start behaviour and exhaust gas aftertreatment.

Intensive work is also being carried out in the area of electrification and especially in the development of hybrid vehicles. The emphasis is on the measurement and analysis of the overall vehicle, development and optimisation of operating strategies, sizing of electrical components, technology assessment and trend analysis. A major focus is placed on the total energy management of the vehicle and in particular on thermal management which represents a special challenge in alternative drive systems.

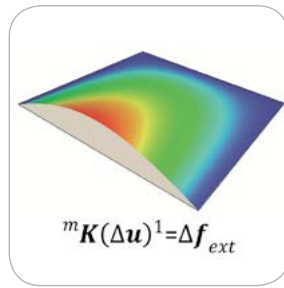
Contact: www.ifa.tuwien.ac.at

Research competencies of IFA

- Numerical simulation;
- Combustion process development;
- Alternative fuels;
- Component development;
- Alternative propulsion concepts;
- Exhaust gas aftertreatment;
- Heat storage;
- Potential and technology assessments;
- Trend analysis.



© DLR

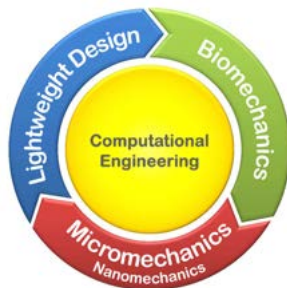


Institute of Lightweight Design and Structural Biomechanics (ILSB)

Simulation and Experiments in Lightweight Structures and Biomechanics

THE ILSB'S INTERRELATED RESEARCH FIELDS

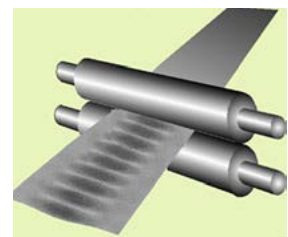
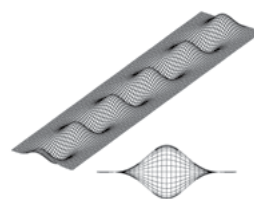
The ILSB's research fields, i.e. lightweight structures, micro- and nanomechanics of materials, and biomechanics are closely interconnected, the link between them being computational engineering.



LIGHTWEIGHT STRUCTURES

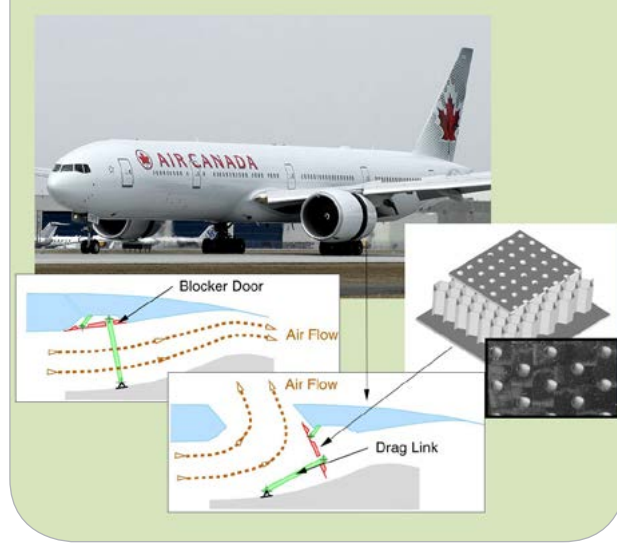
Lightweight design plays an important role in nearly all fields of up-to-date mechanical engineering. Its importance is based, inter alia, on the need for conserving natural resources in the production and usage of products, on ecological demands and economic requirements. In order to make lightweight design really effective it is necessary to achieve appropriate results in basic and application-oriented research, which then must be introduced into engineering practice. The ILSB's research into lightweight structures encompasses investigating and developing efficient computational and optimisation methods for the application of lightweight materials and material combinations, for meeting the requirements of lightweight design and product safety, and for manufacturing concepts required

for the successful application of lightweight design. Typically, lightweight structures are thin-walled, which makes them vulnerable to a loss of load-carrying capacity due to a loss of stability (buckling, etc.). The ILSB does intensive research on stability analysis at all length scales, with theoretical investigation being linked to experimental work. Instabilities may appear not only during the operation of lightweight structures, but they may also interfere with production processes or reduce product quality. An example for the latter type of issue is waviness detected during rolling of thin strips or thin-walled profiles.



Instabilities during rolling of thin sheets

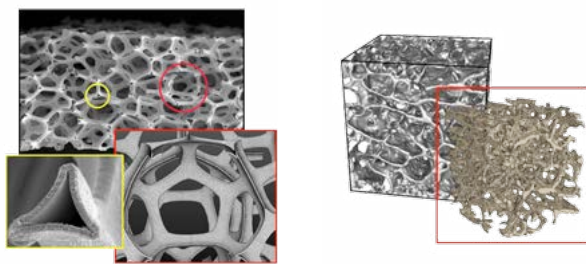
The research activities concerning composite materials and compounds are not only important in "classic" mechanical engineering, but they also impact fields such as the design of electronic components. It is in the area of composite materials that the connection between micro- and nanomechanics as well as biomechanics becomes especially evident.



Aircraft © Creative Commons

MICRO- AND NANOMECHANICS

In its research activities in the fields of micromechanics and nanomechanics the ILSB applies analytical and numerical methods of continuum mechanics to describe the thermomechanical behaviour of materials and structures on small to extremely small length scales. Typical applications would be studies of materials that consist of clearly distinguishable constituents at length scales ranging from a few to some hundred micrometers (e.g., composite materials, polycrystals, foams) or extremely small structures with sizes in the nanometer range (e.g., thin films, micropillars, carbon onions consisting of many fullerene-like carbon shells or carbon nanotubes). This research work is aimed at achieving an improved understanding of the behaviour of such structures and materials in order to support the interpretation of experimental results and the development of new materials. These results can provide important input for models in the fields of lightweight design and biomechanics.

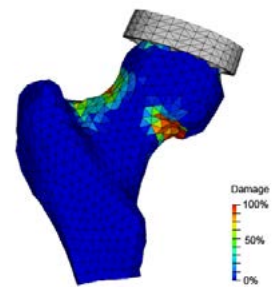
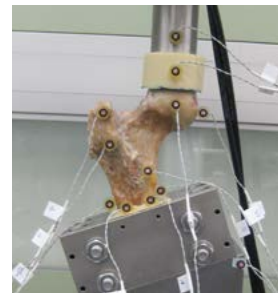


Microstructure of open-cell metal foam (left) and of a cancellous bone (right) © Vale Canada

BIOMECHANICS

Structural biomechanics applies methods of mechanics to biological systems, such as bones and other tissues. Due to the inherent hierarchical scale of biological tissues, this involves mechanical testing, as well as structural and chemical assessment from the macro- to the nanoscale, to identify mechanisms required for appropriate mechanical performance. These efforts are carried out in the interfaculty laboratory for micro- and nanomechanics, and they allow for

the development of relevant models of such systems, studied by means of computational engineering. Essential insights can be obtained from such simulations without recourse to experiments on humans or animals. This line of work specifically concentrates on studying the mechanical behaviour of bone. Not only are questions of materials science investigated but also clinically relevant research projects are pursued in collaboration with international hospitals and pharmaceutical companies.

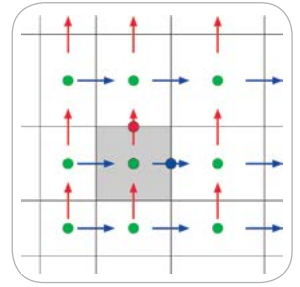


Mechanical testing of a femur; experiment (left) and numerical simulation (right)

The interfaculty laboratory for micro- and nanomechanics consists of experimental facilities and a preparation room where biological tissues can be stored and prepared for experiments. Preparation equipment includes several saws, a polishing machine, a high-temperature oven, a micro milling machine, and other machinery. Experimental facilities currently include a micro-computed tomography device, nanoindentation devices, an atomic force microscope, a motion capture system, a confocal laser microscope and a biaxial, servo-hydraulic mechanical testing machine. For further information please visit:

www.ilsb.tuwien.ac.at/biom/labcontact.shtml

Contact: www.ilsb.tuwien.ac.at



Institute of Fluid Mechanics
and Heat Transfer

Big Splashes about Turbulence

OVERVIEW

Fluid flows are ubiquitous both in nature and technology. They transport species, momentum, and heat. Owing to its paramount importance, fluid mechanics is a fundamental discipline in engineering.

Fluid mechanics is based on three mutually complementary approaches: theoretical modelling, experimental methods, and numerical simulation. In these areas the institute carries out application-oriented basic research and research-led teaching. It is the institute's primary objective to make substantial contributions toward the solution of current problems in the field of fluid mechanics. An important aspect is the achievement of a deeper physical understanding of fluid-mechanical transport processes. The institute is an attractive partner for students as well as for industries that are strongly interested in a unified approach based on physics-based mathematical modelling and computational analysis.

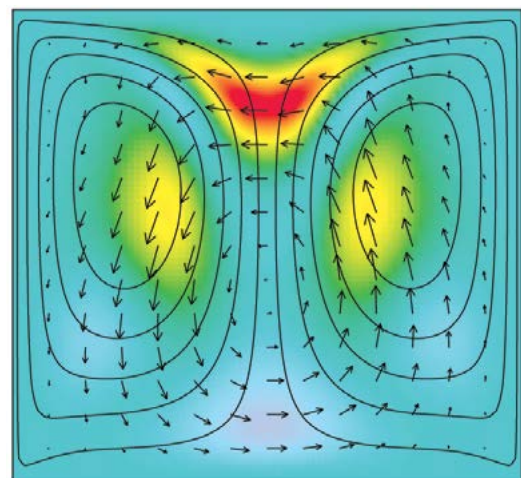
We offer solutions to engineering problems related to scientific and applied fluid mechanics, to heat and mass transfer, as well as to fluid-structure interaction.

COMPUTATIONAL FLUID MECHANICS

Flows characterised by moderate characteristic non-dimensional numbers, e.g. the Reynolds number, are amenable to numerical simulations, since the constitutive equations (Navier-Stokes equations) are well-known to high precision. Nevertheless, numeri-

cal treatment can be difficult at times, because there is no general-purpose concept of solution, the number of unknowns can be large, and variables are coupled nonlinearly.

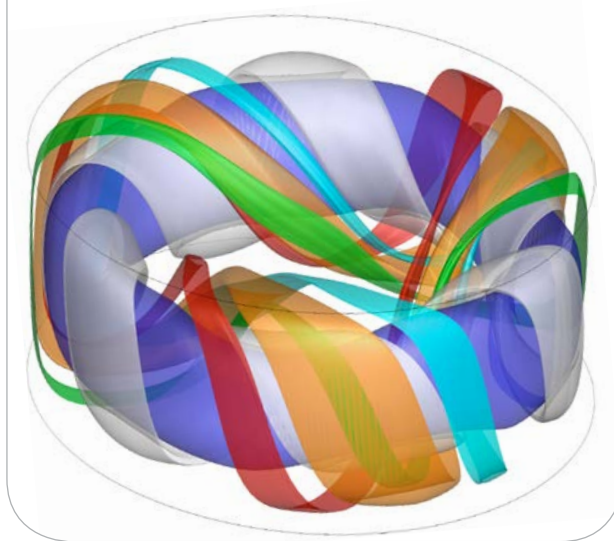
One focal point of the institute's research is the transition to turbulence. This is an important field, since the onset of turbulence is usually marked by a dramatic increase of drag force and heat transfer. Moreover, phenomena and flow patterns are particularly rich with parameters for which transition occurs. Additional focal points are interfacial flows, particle transport in fluids, dynamics of vortices and fluid mechanics under weightlessness.



Breaking of the mirror symmetry of two vortices
with opposite sense of rotation



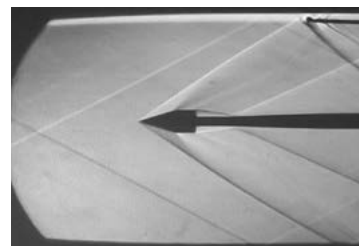
Taylor-Görtler vortices
in a cavity



Invariant tori in
a thermocapillary
flow

EXPERIMENTAL FLUID MECHANICS

All theoretical and numerical results must be verified by comparison with corresponding experiments. One current focal point of our fluids laboratory is the transition to turbulence in different generic geometries. Among these are generic channel and pipe flows, convection and vortex flows in closed cavities, as well as flow-induced oscillations. To measure these phenomena we employ Laser-Doppler velocimetry (LDV), Particle Imaging Velocimetry (PIV), differential interferometry, and hot-wire anemometry, among others. The institute operates a subsonic wind tunnel for atmospheric boundary layers that is equipped with a six-component balance and a 2m-long test section with a cross section of 1 x 1.25 sqm. A shallow-water channel as well as the planned reconstruction of our supersonic wind tunnel complete the range of experimental facilities.

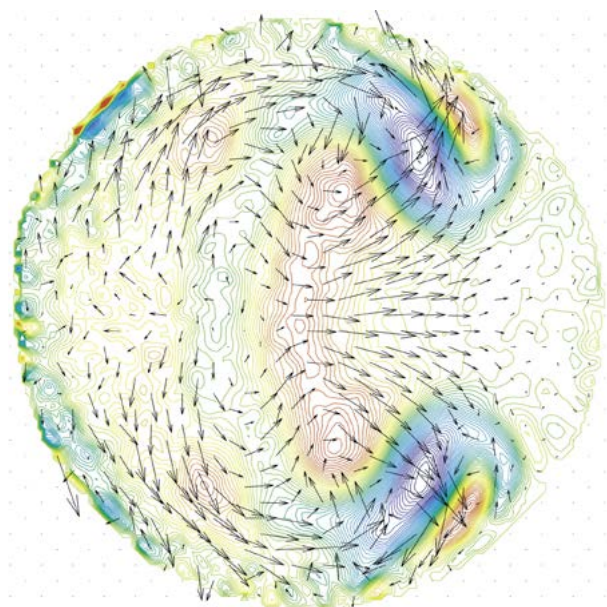


Supersonic flow over a conical body

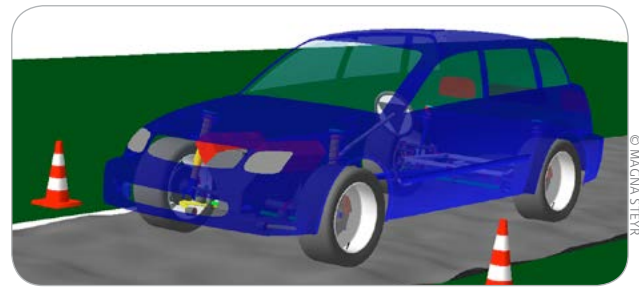
THEORETICAL FLUID MECHANICS AND THEORY OF HEAT TRANSFER

Despite the great performance of modern supercomputers not all fluid-mechanical problems can be solved numerically. For instance, a minimum of 10^{16} grid points is required to resolve all relevant scales in a direct numerical simulation of the turbulent flow around the wing of a passenger airplane. For that reason, modelling and analytical methods are very important. The institute has a long tradition in the application of modern methods of perturbation theory, for which it has earned wide international recognition. These concepts enable the identification of characteristic similarity parameters and allow a systematic reduction of the problem to its irreducible core. This approach enables a deep and comprehensive understanding of all relevant physical processes, and corresponding optimisation problems can be solved efficiently. Active research subjects are aerodynamic problems such as laminar or turbulent separation of the boundary layers on slender or blunt bodies as well as turbulence transition and control. Thermodynamic problems encompass convection, phase transition in flows through porous media, and explosive crystallisation of semiconductors.

Contact: www.fluid.tuwien.ac.at



PIV record of a coherent structure in the flow inside of a torus



Institute of Mechanics and Mechatronics

Analysis, Synthesis and Optimisation of Mechanical and Mechatronic Systems

MECHATRONICS: A YOUNG DISCIPLINE

Present-day technical devices, vehicles and facilities increasingly require mechanical and electronic components to interact synergetically. This has led to the emergence of mechatronics as a discipline. In the mechanics field of mechatronics, the focus is on modelling and analysing structures, mechanisms, and dynamic processes using highly advanced analytical and numerical methods. Many problems arising in the area of industrial applications can nevertheless be solved only by means of a synthesis with elements of electronics and informatics. For example, concepts of control engineering are essential in optimising a process, while both modern measurement engineering and actrics are indispensable in applying and validating it.

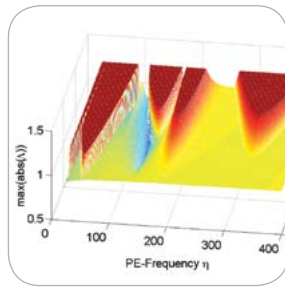
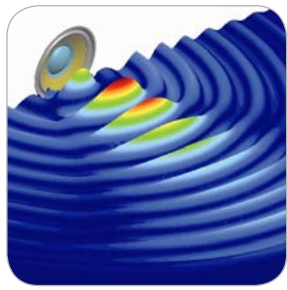
MECHANICS OF SOLID BODIES

This research group is concerned primarily with the modelling and analysis of static structures and dynamical systems. Due to a variation of relevant parameters like, for example, a static load or operating speed, a specific state of a system may become unstable; nevertheless, based on nonlinear stability theory one can predict the behaviour of the system in the critical range. Applying a dimension reduction process allows to reduce systems of equations with many unknowns to significantly smaller systems without any loss of essential information. Possible fields of application are, e.g., tethered sat-

ellites, vibrations caused by friction, the stability of space elevators and buckling and bulging of beams, plates and shells under static loads.

TECHNICAL DYNAMICS AND VEHICLE SYSTEM DYNAMICS

The research group of Technical Dynamics and Vehicle System Dynamics studies machines, sets of equipment, and facilities as well as the system dynamics of ground vehicles; moreover, specific topics of bio-mechanics are within the scope of investigation. Based on the traditional methods of technical dynamics in the analysis of mechanical systems in general, the research group is in particular concerned with the incorporation of mechatronic components into these systems. As a consequence thereof, novel possibilities for influencing their dynamic properties have emerged. For example, mechatronic components can be used for the stabilisation of unstable systems, or the desired performance of a system may be improved by their application. In the field of Vehicle System Dynamics, the research group particularly develops solutions for problems that are specific of the automotive and railway industries; for this purpose, advanced multi-body simulations are used. Among the topics of research are the simulation, optimisation, and control of vehicle behaviour based on mathematical-physical modelling, and the analysis of factors related to the driver and to



Dynamic pantograph testbed with
realtime catenary simulation



vehicle components (tires, shock absorbers, hydro-mounts, track/wheel-contact, chassis, etc.). Moreover, also the interactions of technical and biological systems as they occur, e.g., in bicycles or intelligent prostheses, are a subject of extensive investigation. Based on the research group's expertise in the above fields, numerous cooperations with international companies (e.g., manufacturers of passenger cars and trucks, railway vehicles, motorcycles, bicycles, airplanes) and with institutions in the field of biomedical engineering develop.

MEASUREMENT ENGINEERING AND ACTORICS

The focus of this research group is on the development of mechatronic sensors and actors (electromagnetic and piezoelectric position actors, efficient fly wheels mounted on magnetic bearings, etc.), highly advanced measurement devices (for vibrations and structural analysis, magnetic fields, acoustics, etc.), and both sound design and noise reduction (vibro-acoustics and aeroacoustics). To this end, laboratories for the characterisation of sensors and actuators, for the determination of material properties, for optical vibration analysis and acoustic measurements are available, as is a laboratory for electronics in general. Moreover, there is a well-equipped workshop for the design and manufacturing of both prototypes and measurement devices.

In the field of computer-aided analysis of complex systems in engineering and medicine, the CFS++ (Coupled Field Simulation) research code is available. It can solve coupled partial differential equations with high efficiency and accuracy by using the Finite Element Method (FEM).

Furthermore, based on the SIMP (Solid Isotropic Material with Penalisation) method, CFS++ also enables the computer-aided optimisation of shape and topology. Further developments of CFS++ focus primarily on flexible discretisations (non-conformal grids), sophisticated material models (nonlinearities, hyste-

reses), and inverse methods for the identification of material parameters.

CONTROL AND PROCESS AUTOMATION

The Control and Process Automation research group works on general theory as well as on applied solutions for modelling, control and optimisation of mechatronic systems and processes in the fields of mechanical and chemical engineering. Control theory and process automation are disciplines that are relevant in almost all fields of engineering. Important applications are, for example, autopilots in aerospace engineering, the electronic stability programme (ESP) in vehicle dynamics, or the optimal control of power plants. The research group provides expertise and integrated solutions for challenging problems regarding optimisation and control in the following fields: modelling, in particular non-linear system identification, as well as optimal design of experiments; model reduction and analysis of systems, taking the requirements for highly specific applications into account; selection and development of controller architectures that may be implemented efficiently; optimisation of integrated systems with respect to the parameterisation of the controller parameters, and also cost-benefit analyses for the design of complex technical systems.

Contact: www.mec.tuwien.ac.at

CDL for Model Based Calibration Methodologies:

The research team of the Christian Doppler Laboratory develops new and integrated methodologies for model-based calibration and optimisation of automotive systems (combustion engines, powertrain systems, hybrid components). It combines the three essential aspects of experiment design, nonlinear system identification and nonlinear controller stability analysis and design.

<http://mbc.tuwien.ac.at>



Institute of
Management Science

Management of Industrial Organisations at the Enterprise, Business, and Process Levels

MISSION STATEMENT

Development of comprehensively aligned competences in business administration, management and leadership to establish sustainable and competitive industrial enterprises.

RESEARCH

The Institute of Management Science's research activities relate to the design and management of industrial enterprises. Research fields cover the optimisation of intra- and interorganisational processes and structures, innovations research, and the development of risk-based enterprise management methods and techniques to establish sustainable and competitive industrial enterprises.

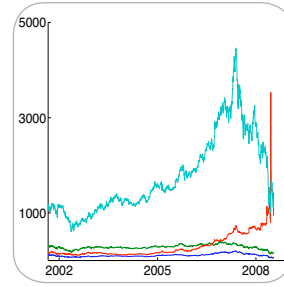
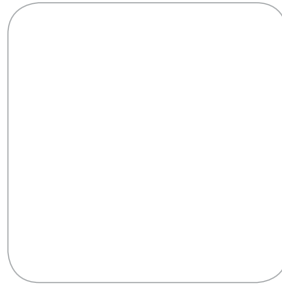
Research activities are based upon a multi-perspective management approach where the objective of sustainable competitiveness is addressed by means of innovative research methodologies for the different levels of a company. At the process level, industrial engineering and labour-related aspects are predominant. At the business and enterprise levels, additional economic and financial aspects are prevailing. At the enterprise level, a corporate governance framework has to be designed and implemented in order to integrate the different business activities within a competitive enterprise system.

	Industrial Engineering	Business Economics	Environmental Sustainability	Social Responsibility
Enterprise Management				
Business Management				
Process Management				

Multi-perspective management approach

TEACHING

The Institute of Management Science's teaching activities cover the business engineering, financial, managerial and organisational skills conveyed in the training of industrial engineering students and business informatics students at the bachelor, master and doctoral levels. These contents are offered as individual courses also to other students of the Vienna University of Technology in order to provide them with optimal support for their professional careers. To promote research-driven education, specialisation tracks are aligned with the research fields of the institute's four departments. The institute plays a leading role in the MBA programmes offered by the Continuing Education Center of the Vienna University of Technology.



LABOUR SCIENCE AND ORGANISATION RESEARCH FIELD

Optimal design of production and service operations based on a division of labour

Today's value chains are organised in virtual enterprises and networks spreading across borders of organisations and countries. The aim of the labour science and organisation research field is an optimal configuration of production and service operations. Innovation-enabling organisational designs and incentive systems need to address the challenges of coordination and motivation resulting from a global division of labour. For this purpose, it is essential to develop strategies and models that facilitate the management of conflicts and diversity in organisations while at the same time ensuring the physiological and psychological health of the members of an organisation in a performance-driven work environment.

INDUSTRIAL AND SYSTEMS ENGINEERING RESEARCH FIELD

Optimisation of value adding activities in production networks

The research field covers innovative and future-oriented issues in logistics systems as well as research and application-oriented projects within the field of production management.

- Logistics: lean and flexible logistics structures and processes as well as optimisation of order processing and production planning & control in production companies;
- Production optimisation: application and development of lean methods, integrated production and logistics planning as well as work system design and MTM;
- Production structures: factory and production design that is best suited for the relevant production site, as well as evaluation of the impact of technological changes on production structures.

FINANCIAL ENTERPRISE MANAGEMENT RESEARCH FIELD

Risk-based performance management in decentralised enterprises

Economic sustainability is at risk if an enterprise loses its liquidity or equity capital. In times of increasing volatilities in the various business fields, a risk-based financial management system is necessary to identify opportunities and risks in the markets, align them with production facilities and support them based on adequately financed business strategies. In the Financial Enterprise Management group, optimal performance and risk management systems based on control theory are developed, simulated and tested especially to cater to the needs of decentralised enterprises. By means of precise specification of the management information that is flowing between the different managerial activities it is possible to translate these activities into one risk-based management information system.

FACILITY / REAL ESTATE MANAGEMENT RESEARCH FIELD

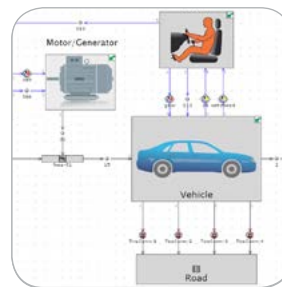
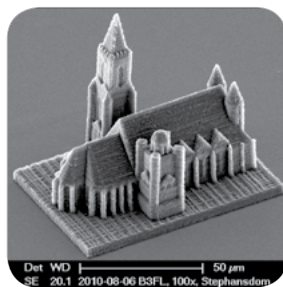
The research area focuses on how efficient and effective real estate and facility management (FM) can optimise secondary processes and therefore support the core business in an optimal way. Current research projects focus on:

- Status and trends within FM based on international studies;
- Value added by FM;
- Best practice processes and reference models within facility and real estate management;
- Integrated Facility Services, i.e. optimisation of building operations;
- Risk management and compliance within FM;
- New ways of working and innovative offices.

Facility management acts as a link between research and practice.

Contact: www.imw.tuwien.ac.at

Scanning electron microscope
image of a micromodel of
Vienna's
Saint Stephen's Cathedral



Hardware in the loop
simulation

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