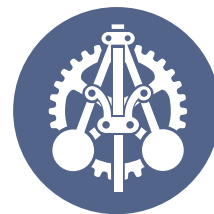


# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

## DEPARTMENT OF POLYMER ENGINEERING

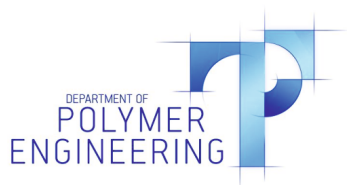


## INTRODUCTION

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
Department of Polymer Engineering

Head of Department  
**Dr. Tamás BÁRÁNY**

Address  
**Műegyetem rakpart 3.  
H-1111 Budapest  
Hungary**  
Telephone / Fax  
**+36 1 463 2003 / +36 1 463 1527**  
E-mail  
**pt@pt.bme.hu**  
Web  
**<http://www.pt.bme.hu>**



### General information

The Budapest University of Technology and Economics has a history of more than 220 years and is the largest and best known of Hungary's technical universities. The Department of Polymer Engineering has an impressive list of achievements and belongs to the Faculty of Mechanical Engineering, one of the most prestigious faculties of the university. The name of the department expresses our determination to promote the use of polymer structural materials as widely as possible.

Our laboratory has an area of over 1000 m<sup>2</sup> and is located in an imposing historic building of the university. Its recently renewed, modern laboratories, offices and auditorium makes it an ideal place for high quality teaching and R&D work. We strive to keep our polymer-processing machines and materials testing equipment up-to-date by continuously modernising and upgrading them.

The professors and researchers in our department are internationally recognised experts, who, together with our doctoral candidates, represent considerable research and development capacity.

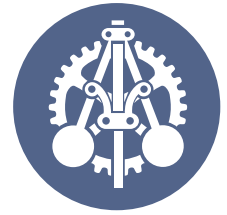
Since 2002 our department has been certified by TÜV Rheinland for the ISO 9001 quality management system.

Our test laboratory has been accredited by the Hungarian Accreditation Board since 2004, which guarantees the highest quality for our customers.

### Our cooperation with companies extends to the following areas:

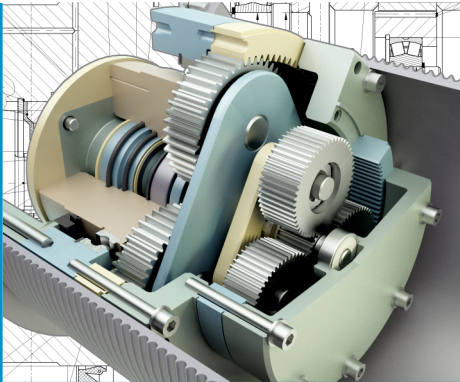
- Tests and test reports in our accredited system according to several standards for both plastic and rubber products.
- Quick and precise measurements and if necessary, supporting quality control activities of manufacturing companies.
- Part and process optimization of injection moulding with simulations.
- Rapid prototyping and tooling with different technologies (3DP, SLA, Polyjet, FDM).
- The support of the full creation process of composite products from the selection of materials through the planning of manufacturing technology to the final product.
- The development of novel and patentable materials and technologies.
- Expert advice and various kinds of training in plastic and rubber industry technologies.
- Our laboratory regularly takes part in joint projects with industrial partners.

# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

## DEPARTMENT OF MACHINE AND PRODUCT DESIGN



## RESEARCH PROFILE

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
**Department of  
Machine and Product Design**

Head of Department  
**Dr. Péter HORÁK**

Address  
**Műegyetem rakpart 3.  
H-1111 Budapest  
Hungary**  
Telephone / Fax  
**+36 1 463 2345 / +36 1 463 3510**  
E-mail  
**gt3@gt3.bme.hu**  
Web  
**<http://www.gt3.bme.hu>**



In the research profile of the Department of Machine and Product Design there can be found basic and applied research, just as experimental research and development. The fields of research are being shown organized around the three major educational competencies and responsibilities.

### Machine Design

- Design and development of machine elements, components and machine systems,
- Modern methods and tools of computer aided design,
- Determining the deformations, stress and thermal state of structural elements; structural optimization,
- Tribology behaviour of polymer / elastomer and steel sliding pairs,
- The behaviour and characteristics of condition of polymer structural elements,
- The failure analysis, the analyses of tribologic and dynamic conditions of spatial gears,
- Development of flat wheel harmonic gear drive.

### Industrial Design Engineering

- Genetic algorithms in design and in

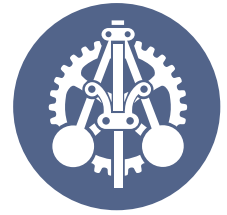
- The analysis and optimization of design processes in terms of time, cost, resources,
- The development and expansion of autogenetic design theory,
- Development of inventive problem solving methods in design,
- Designecology – the theory and practice of environmental design.

### Agricultural Machine Design

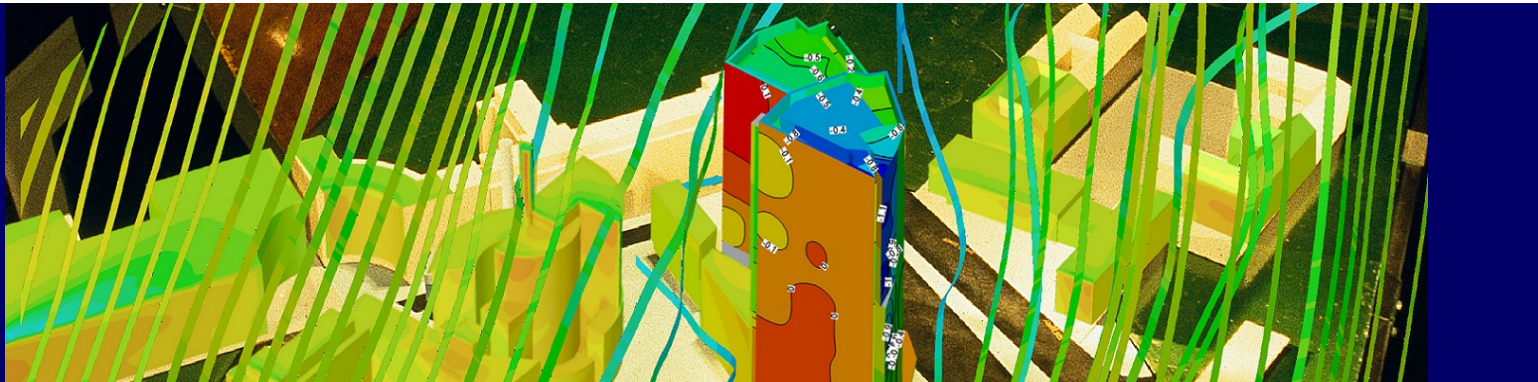
- The tasks, possibilities, and technical solutions of cultivation machines in the computer supported agriculture,
- The analysis of the interaction between rubber track wheels and soil in order to lower the harmful impact on soil structure,
- Design and examination of soil-protective and environment-friendly cultivating machines,
- Mechanization tasks of possible technologies for growing and utilizing bio-fuels,
- Development of tools to moderate the harmful effects of climate change,
- Real-time measuring and control of intelligent implements,
- Applications of modern designer's knowledge and software in agricultural machinery



# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING  
DEPARTMENT OF FLUID MECHANICS



## INTRODUCTION

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
**Department of Fluid Mechanics**

Head of Department  
**Prof. Dr. János VAD**

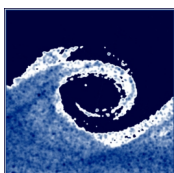
Address  
**Bertalan Lajos u. 4-6.  
H-1111 Budapest  
Hungary**  
Telephone / Fax  
**+36 1 463 4072 / +36 1 463 3464**  
E-mail  
**[vad@ara.bme.hu](mailto:vad@ara.bme.hu)**  
Web  
**<http://www.ara.bme.hu>**

The predecessor of the Department of Fluid Mechanics, the Institute of Aerodynamics, was established in 1934. In 1941 one of the largest wind tunnels in Central Europe was put into operation that still plays a major role in the work done at the department, not only in aircraft research, for which it was originally used, but also in aerodynamics, pollutant dispersion and urban climate investigations. The Kármán Tódor Wind Tunnel Laboratory was established to provide – with its capacities and instrumentation – unparalleled measurement facilities in Central Europe.

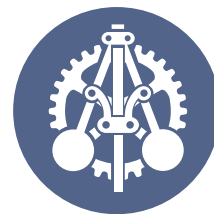
With the rise of information and computer technology, our department has made quick progress in computational fluid dynamics and computational acoustics. 20 researchers and engineers work on public or industry funded projects using experimental or computational fluid dynamics (CFD) tools. Our CFD team has expertise in the use of Fluent and OpenFOAM CFD codes, as well as in writing custom codes. The Department operate an own PC cluster and have access to the BME university supercomputer.

The department also operates an acoustic laboratory with an anechoic and a reverberation chamber, and apply phased array microphone techniques, as well as computational aeroacoustics simulations in the investigation of airfoil and fan noise. Acoustic simulations are well supported by the Békésy György Acoustic Laboratory's background in measurement technology. The measurement capabilities are being further expanded with the addition of a new phased array microphone system.

As an international forum of the research results, the Conference on Modelling Fluid Flow (CMFF) is organized by the department every third year in Budapest with the participation of fluid technology researchers from more than 30 countries. Due to the high-quality of this event, the prestigious International Journal of Heat and Fluid Flow publishes a special issue on CMFF, which presents the most outstanding contributions.



# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

## DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING



## INTRODUCTION

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
**Department of  
Materials Science and Engineering**

Head of Department  
Prof. Dr. Péter J. SZABÓ

Address  
Bertalan Lajos u. 7.  
H-1111 Budapest  
Hungary  
Telephone / Fax  
+36 1 463 1234 / +36 1 463 1366  
E-mail  
matsci@eik.bme.hu  
Web  
<http://www.att.bme.hu>

Since its founding in 1889, the Department deals with materials science and technology. Because of the fast development of materials and technologies, by now, our activity has specialized for metallic and ceramic materials. By the integration of well-established disciplines, namely applied materials science, applied mechanics, thermodynamics and materials informatics our staff members are successful on their special and classical research fields, such as research of materials properties, forming, welding and heat treating technologies, modelling of technologies, development of special materials like composites and biomedical materials.

### Education

Being an integrated part of the Faculty of Mechanical Engineering, our department teaches materials engineering, testing of materials, welding, forming and their biomedical aspects. The objective of our philosophy of education is to give to our students an up-to-date and firm knowledge, based on the most recent theories and results that enable their effective integration as useful members on every level of a company structure from the design through the production planning, production and quality management to the leadership. Our

scientifically well-established PhD education programme offers creative, research-development-innovation (R+D+I) centralized professionals for our most important industrial partners.

Our Department focuses special emphasis on welding, which is one of our most important fields of interest. Since 1993, the international welding engineer course is continuously available for our partners.

### Materials testing, research and development

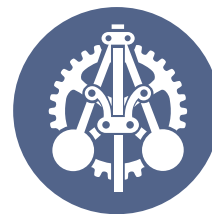
The investigation of materials structures, microstructures and properties should be distinguished from our competence fields. Besides the non-destructive and conventional mechanical testing, we have experts in optical microscopy, scanning electron microscopy, energy dispersive X-ray spectrometry and electron back scattered diffraction.

Beside materials testing our well-experienced engineers and laboratory infrastructure are continuously involved in various research projects, including, but not limited to:

- Forming technologies
- Welding and heat-treating technologies
- Development of special and composite

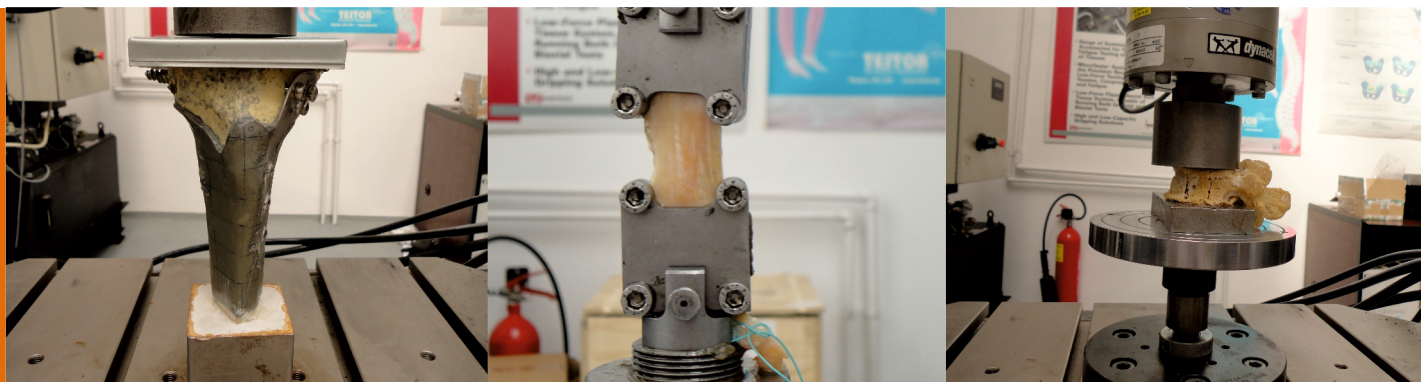


# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

## BIOMECHANICAL COOPERATION RESEARCH CENTRE



## INTRODUCTION

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
Biomechanical Cooperation Research  
Centre

Chair of Centre / Director of Centre  
Dr. Lajos BORBÁS / Dr. Rita M. KISS

Address  
Műegyetem rakpart 3.  
H-1111 Budapest  
Hungary  
Telephone  
+36 1 463 1476  
E-mail  
rikiss@mail.bme.hu  
Web  
<http://www.biomech.bme.hu>



### General information

The Biomechanical Cooperation Research Centre of the Budapest University of Technology and Economics was founded in 2002 in order to coordinate biomechanical research work at the University. The Research Centre is an independent association of three departments of the Faculty of Civil Engineering, seven departments of the Faculty of Mechanical Engineering, one department of the Faculty of Chemical Technology and Biotechnology, and two departments of the Faculty of Transportation Engineering and Vehicle Engineering. The fundamental duty is to concentrate and coordinate and increase the efficiency of the work of the departments, professors and researchers taking part in the cooperation, as well as to develop and renew the pool of assets, to promote successful participation in domestic and international tenders, to keep organized contacts with medical universities, clinics and hospitals in Hungary, and to coordinate joint research projects. The Research Centre plays an active role in the foundation of the Society of Biomechanics, its current operation, and in organizing Conferences of Biomechanics.

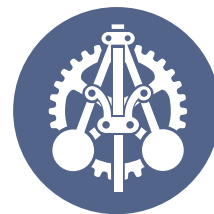
Our laboratory has an area of over 90 m<sup>2</sup> and is located in a historic building of the University. Our testing laboratory has been accredited by the Hungarian Accreditation Board since 2009, which guarantees the highest quality for our researchers and for our customers. Our material testing equipment (INSTRON 8870) is capable for static and dynamic testing of different materials (steel, plastics, living tissues) until 25 000 [N].

### Our activities

- Numerical analysis of different human living signs as example artery blood flow and circulation.
- Test and test reports in our accredited system for human and animal tissues such as bones, ligaments.
- Development of novel methodology for orthopedical and oro-maxillofacial implants.
- Tests and test reports in our accredited system according to several standards for steel and plastic products.
- Develop and introduce new investigation methods in field of biomechanics.
- Taking part in international and national R&D projects with universities and industrial companies.



# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING  
DEPARTMENT OF ENERGY ENGINEERING



## RESEARCH PROFILE

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
Department of Energy Engineering

Head of Department  
Dr. Gyula GRÓF

Address  
Bertalan Lajos u. 4-6.  
H-1111 Budapest  
Hungary  
Telephone / Fax  
+36 1 463 2613 / +36 1 463 1762  
E-mail  
tanai@energia.bme.hu  
Web  
<http://www.energia.bme.hu/english/>

Researches are related to the systems and equipment of transformation and efficient utilization of energy as well to the economic, social and natural processes, which are classified into the following three groups:

### Machines and equipment of energy systems

- Modeling, design, development installation, operation and maintenance:
  - combustion systems, steam generators, boilers,
  - steam- and gas- turbines, IC engines (gasoline, diesel, alcohol, vegetable oil, multi fuel),
  - heat pumps and refrigerators.
- R&D for increasing the energy efficiency, decreasing the emission of pollutants and increasing the share of renewable energy:
  - solar heat and power generation,
  - combustion of biomass and waste, gasification, biogas generation,
  - biomass based liquid and gaseous fuels in IC engines and turbines.
- Modern instrumentation and knowledge to examine and qualify the operation of machines and equipments of energy systems as well as special thermal processes.
- Investigation of malfunction of boilers, heat engines, combustion equipment etc.

### Heat and power generation - environmental aspects of energy engineering

- R&D for novel solutions and the improvement of already existing systems and equipment.

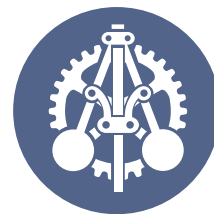
- Research focusing on operation of customized combustion systems, finding improved solutions for cogeneration, and economical operation of district heating systems.
- Power generation R&D experience stretches from the questions of national strategy to the improvement of power plant efficiency (economical and environmentally friendly operation, cogeneration, keeping district heating economical and competitive).
- Besides the technological improvements life cycle analysis, CO<sub>2</sub> intensities and ecological footprints are also matter of our activity (GHG audit).
- Complex renewable energy laboratory to investigate the utilization of solar (heat and power) and wind energy, as well as biofuels. Research works are focused for the integration of traditional and renewable energy technologies.

### Modeling of energy systems

- In research projects we use commercially available engineering software and our own codes, which apply analytical or numerical computational methods.
- Control of processes in energy systems.
- Numerical simulation of energy systems (thermodynamic cycles).
- Finite element thermal analysis, computational fluid dynamics problems of heat engines and combustion systems.
- Inverse heat conduction problems.
- Optimization applying soft computing methods.
- Investigating thermophysical properties, as well as theoretical



# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

## DEPARTMENT OF BUILDING SERVICE AND PROCESS ENGINEERING



## RESEARCH PROFILE

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
**Department of Building Service and  
Process Engineering**

Head of Department  
**Dr. László KAJTÁR**

Address  
**Műegyetem rkp. 3.  
H-1111 Budapest  
Hungary**  
Telephone / Fax  
**+36 1 463 2503 / +36 1 463 1708**  
E-mail  
**kajtar@epget.bme.hu**  
Web  
**<http://www.epget.bme.hu/en/>**

The department has two main research fields: heating, ventilation and air conditioning (HVAC) and unit operations.

In the field of HVAC, the accent is on comfort research, heat supply and heating systems, ventilation systems as well as gas and water supply, district heating and sewer systems. The definition of requirements and technical parameters on the basis of probability theory and risk analysis is a priority research field. Research topics of the above HVAC systems are connected to system elements and issues of complex systems.

In the second main research field any industry related to unit operations where material flows are transformed such as chemical industry, food, pharmaceutical and oil industries, environmental protection and biotechnology offer topics to research. Typical devices include separation columns, heat exchangers, mixers, tanks, pressure vessels and pipeline systems. Operations and equipment of heat and mass transfer, their construction and modelling, experimental testing, control and instruments belong to the fundamental topics.

### Typical, recent R&D projects

- Efficiency improvement of air conditioning systems
- Study of air conditioning, indoor air

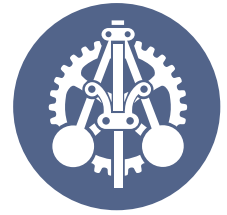
quality and thermal comfort of office buildings and hotels

- Study of economical development of chilled water systems
- Optimization of district heating systems, mathematical modelling of heat storage
- Building physical revision of a standard building, determination of dimensioning parameters of HVAC systems
- Investigation of radiation asymmetry and impact of floor temperature causing thermal discomfort involving human subjects
- Modelling of pressure distribution caused by wind around a building or building group
- Improvement, optimisation of rectifying and absorption-desorption systems
- Improvement of special new batch distillation processes and configurations
- Technology and equipment development for decreasing SO<sub>2</sub> and CO<sub>2</sub> emissions
- Capacity increase of a coke oven gas purification system
- Investigation of heat and mass transfer processes during convection drying
- Pilot plant spray drying experiments
- Research and development of new biological sewage purification equipment and technologies
- Design of a plastic rain water container



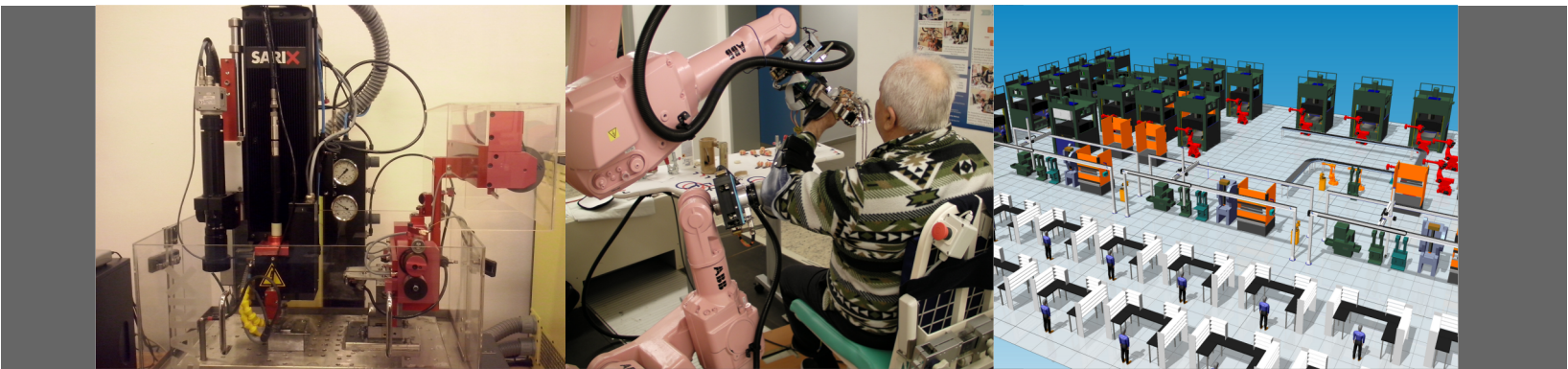


# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

**DEPARTMENT OF MANUFACTURING SCIENCE AND ENGINEERING**



## RESEARCH PROFILE

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
**Department of Manufacturing Science  
and Engineering**

Head of Department  
**Dr. Tibor SZALAY**

Address  
Műegyetem rkp. 3.  
H-1111 Budapest  
Hungary  
Telephone / Fax  
+36 1 463 2515 / +36 1 463 3176  
E-mail  
info@manuf.bme.hu  
Web  
<http://www.manuf.bme.hu>

Advanced knowledge based production engineering methods have become one of the most important factors that contribute to industrial leadership. Since its establishment in 1951 the Department has been active in the forefront of education and research of manufacturing engineering and production engineering at the Budapest University of Technology and Economics.

Research is based on four pillars and sponsored by various public and private bodies: basic research, applied research, collaborative research with national, European, and international partners, contract research based on industrial orders, among others from ALCOA, Audi, Direct-Line, Excel Csepel, General Electric, Gravitass 2000, Grundfos, Knorr Bremse, Mitutoyo Hungária, NCT, SemiLab, SIEMENS, Varinex, Zeiss, etc.

Our prominent research topics served by 30 staff members and high tech laboratory equipment are focused in four main directions:

1. Design of machine tools and manufacturing systems (synthesis, configuration, simulation, analysis and optimisation methods)
2. Experimental and theoretical investigation of mechanical micro and hard machining (machinability of new materials, optimization of technology for new processes, micro EDM milling)
3. Development of robotized processes (automated manufacturing, service robotics, robot assisted motion therapy, new concepts of mechanisms such as indoor climbing and swinging robots)
4. Smart factories (knowledge-based production planning, scheduling and controlling, logistics, supply chain management, cyber-physical systems)

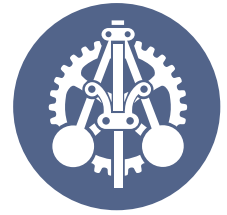
Additionally, the department is active in several traditional fields of manufacturing and production engineering.

The department eminently complements the competences of the existing Fraunhofer Project Centre for Production Management and Informatics at SZTAKI, and the best partner to guide and help the





# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING

## DEPARTMENT OF HYDRODYNAMIC SYSTEMS



Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
Department of Hydrodynamic Systems

Head of Department  
Dr. György PAÁL

Address  
Bertalan Lajos u. 4-6.  
H-1111 Budapest  
Hungary  
Telephone / Fax  
+36 1 463 1680 / +36 1 463 3091  
E-mail  
info@hds.bme.hu  
Web  
http://www.hds.bme.hu

Founded in 1899 by Donát Bánki, the inventor of the carburettor, the Department has a long and rich history. Our tradition is to combine mathematically well-founded theoretical work with careful experiments. We have experts in various aspects of applied fluid mechanics.

The Department has a healthy balance of teaching, scientific research and industrial consultancy. We teach large basic subjects in the lower semesters, as well as highly specialized fluid mechanics subjects in the higher semesters. Former students specializing in fluid mechanics find highly attractive jobs in the industry. There is a vivid interaction between industrial consultancy and scientific work, resulting in a mutual inspiration in both directions. Experiences from both often flow into teaching.

The Department has experts together with lively industrial contacts in the following fields:

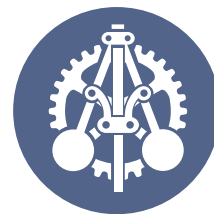
- Simulation of steady and transient flows in large pipe networks, also with partially free surface flow. Partnership with several municipal water works.
- Stability behaviour of pressure relief

valves using the tools of nonlinear dynamics. Partnership with a large American valve producer.

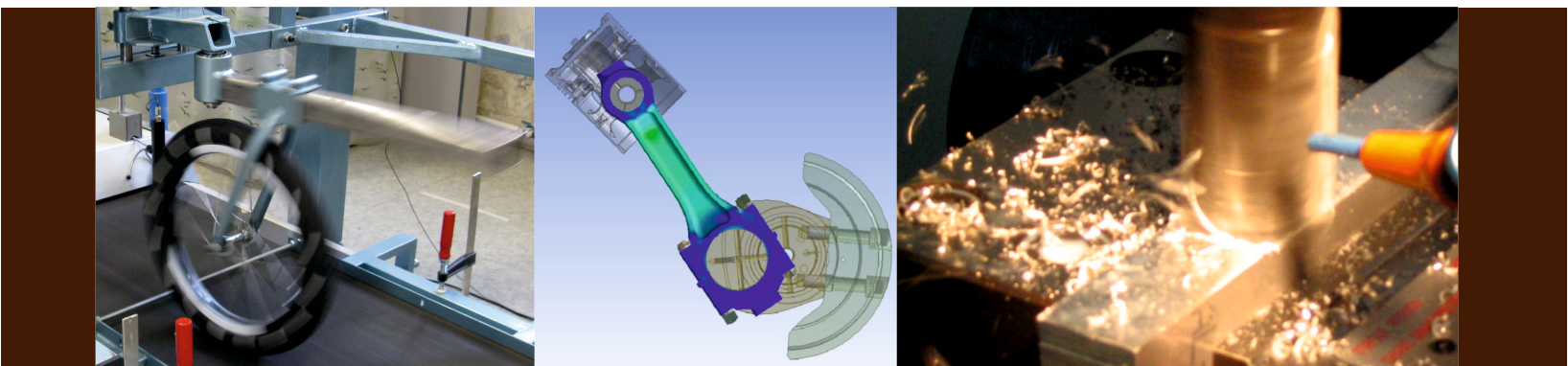
- Optimization of pump schedules. Partnership with Hungarian and Finnish waterworks and universities.
- Other optimization problems with various industrial partners.
- Application of CFD in a variety of challenging industrial problems. Partnership with a range of domestic and foreign companies.
- Design and commissioning of pneumatic transport systems.
- Experimental and computational investigation of cavitating flows around bluff bodies.
- Nonlinear dynamical analysis of acoustically excited gas/vapour bubbles. Partnership with German universities.
- 1D simulation of arterial and venous networks as well as 3D simulation of intracranial and abdominal aneurysms. Partnership with the best medical institutes of Hungary.
- Lattice-Boltzmann simulations using



# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
FACULTY OF MECHANICAL ENGINEERING  
DEPARTMENT OF APPLIED MECHANICS



## RESEARCH PROFILE

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
Department of Applied Mechanics

Head of Department  
Prof. Dr. Gábor STÉPÁN

Address  
Műegyetem rkp. 3.  
H-1111 Budapest  
Hungary  
Telephone / Fax  
+36 1 463 1369 / +36 1 463 3471  
E-mail  
mechanics@mm.bme.hu  
Web  
<http://www.mm.bme.hu>



The major research topics include transient chaotic motions, stability and nonlinear vibrations of delayed dynamic systems, suspensions, wheel dynamics, parametrically excited vibrations, digitally controlled systems, robotics, robot controls, mechanisms, machine tool vibrations, finite elastic-plastic deformations, theoretical and numerical analysis of constitutive equations containing geometrical and material nonlinearity, finite element methods, fatigue analysis, micro-continuum deformations, strength analysis of micro-electromechanical systems, fracture mechanics and dynamical analysis of composites.

Experimental research work related to dynamical problems is carried out in the vibration lab of the department. The lab possesses two Brüel&Kjaer Pulse multichannel dynamic measurement systems with integrated function generators, different types of acceleration sensors and electromagnetic shakers. Motorized test stands for tension and compression testing applications are also available, which can perform a wide range of tests, including break testing, cycling, limit testing to a load or distance, load

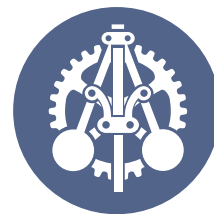
holding, elongation testing, tensile testing, compression testing. In addition to research works, these equipment are also used in industrial projects.

Researchers of the department have been involved in several international research projects including bilateral projects with Slovenian, Spanish, French, German, Chinese, Singaporean and English partners. In various EU projects, we act as coordinators or principal investigators. Lecturers of the department coordinate 6 research projects financed by the Hungarian National Science Foundation (OTKA) and further 5 international research programs: Reharob (EU-FP5), Acroboter (EU-FP6), Cosmosys (EU-FP7), Dynxperts (EU-FP7), SIREN (ERC-AdG).

The corresponding topics are:

- machine tool vibrations
- robotics
- wheel dynamics and rolling contacts
- human and robotic balancing
- non-smooth dynamics
- constitutive laws of foams
- isogeometric FEA
- delaminated composites

# BME FACULTY OF MECHANICAL ENGINEERING



BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS

FACULTY OF MECHANICAL ENGINEERING

## DEPARTMENT OF MECHATRONICS, OPTICS AND MECHANICAL ENGINEERING INFORMATICS



## MECHATRONICS, ROBOTICS, OPTICS AND BIOMECHATRONICS

Budapest University of  
Technology and Economics  
Faculty of Mechanical Engineering  
**Department of Mechatronics, Optics  
and Mechanical Engineering  
Informatics**

Head of Department  
**Prof. Dr. Péter KORONDI**

Address  
Műgyetem rkp. 3.  
H-1111 Budapest  
Hungary  
Telephone / Fax  
**+36 1 463 2602 / +36 1 463 3787**  
E-mail  
**info@mogi.bme.hu**  
Web



### Mechatronics and Robotics

Mechatronics, has an integrative character therefore it joins closely to the competence of other departments and faculties, and for this reason our department plays an important role as a coordinator.

The main research field is Etho-robotics, which place the relation of human and robots on a new, ethologically inspired base. A family of mobile robots was developed, which is capable of social interaction and expressing feelings related to attachment using ethology based patterns. The result is an artificial device that shows attachment to its human user.

Other important competences are:  
Mechatronic sensors and actuators;  
Research of intelligent materials in order to make sensors and actuators; Silicon based sensors and actuators; Axial micromotors; servopneumatics; Robotic systems; Robot control (optimal trajectory planning); Telepresence (cognitive telemanipulation and 3D augmented reality); Human-Robot Interaction.

### Optics and Opto-mechatronics

Since the foundation of our department, optics – that covers both applied and technological optics – is a traditional research area.

Our main competences are: Diagnosis and correction of human colour vision deficiency; Engineering of optical systems (lens and mirror systems, image compose and light technological optical systems); Optical transfer functions (the most important characteristic of optical systems); 3D image compose technologies, 3D visualization in intelligent space and in robotics; Moiré measurement technology; Photometry, radiometry and spectroradiometry (development and measurement of the optical characteristics of light sources).

### Biomechatronics

The science of biologically inspired intelligent machines. Main fields of practice: New engineering structures based on biological principles; Development of medical measuring instruments and methods; Support of ethology studies.