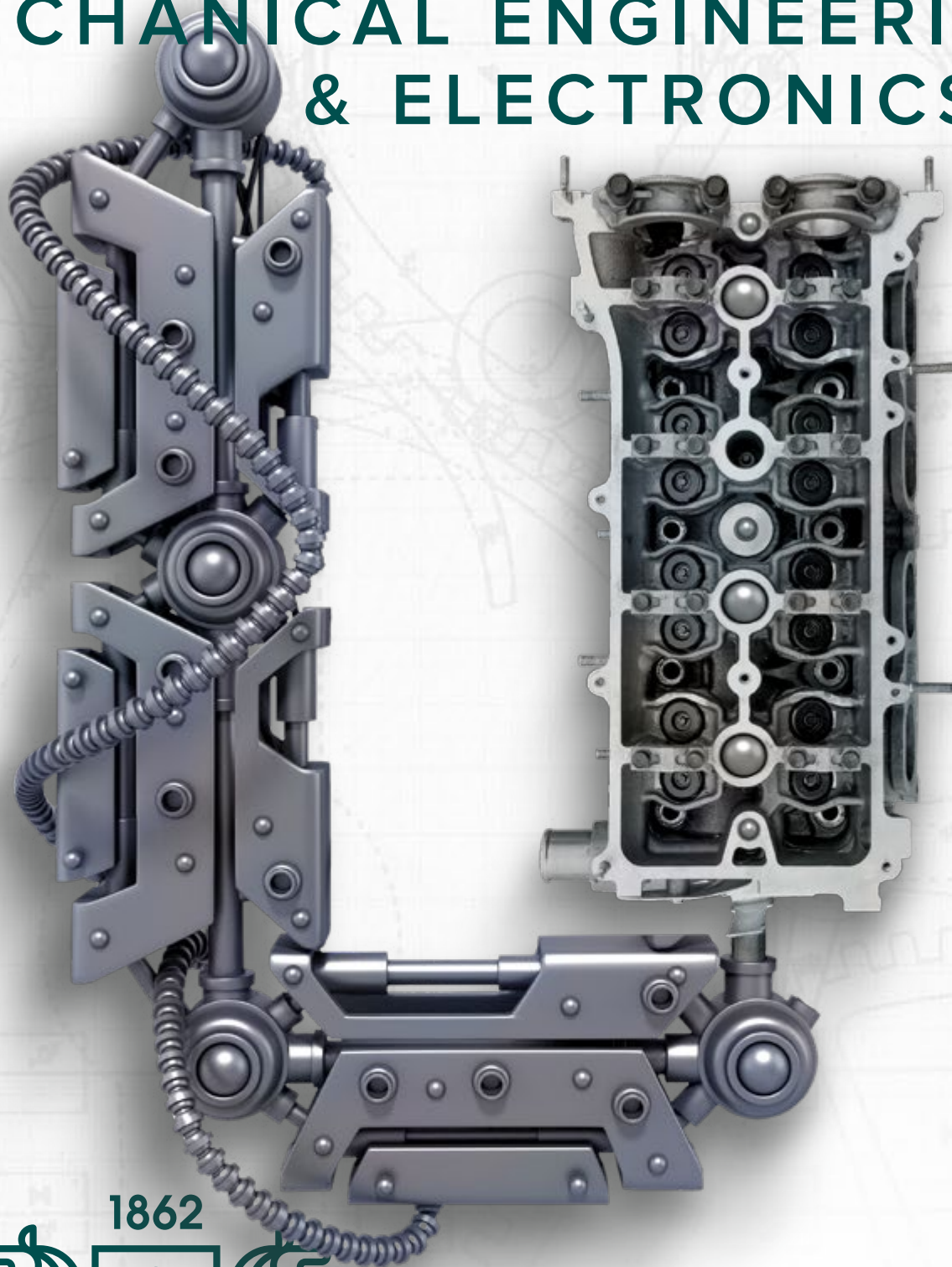


# METALWORKING, MECHANICAL ENGINEERING & ELECTRONICS



1862



**RĪGAS TEHNISKĀ  
UNIVERSITĀTE**



**MAGNETIC  
LATVIA**



# RIGA TECHNICAL UNIVERSITY

is the largest technological university in the Baltic States with rich history and clear future vision aimed at promoting excellence in student academic results, research, and global issues in cooperation with the industry and foreign partners.

# STUDIES:

Studies at RTU are implemented by 9 faculties, including 33 institutes.

RTU has 4 affiliations, it comprises Riga Business School, BALTECH — a consortium of seven engineering universities from the Baltic Sea Region, as well as Engineering High School.

# PROGRAMMES:

# 49:

RTU offers academic and professional study programmes in English at 3 levels:

# 3

# 13

undergraduate

# 24

post graduate

# 12

doctoral studies

INCLUDING

# 33

INSTITUTES

# FACULTIES

# RESEARCH ARCH

Research at RTU is organized on six research platforms:

- Energy and Environment;
- Cities and Urban Development;
- Information and Communication;
- Transport;
- Materials, Processes and Technologies;
- Safety and Security.

RESEARCH CAPACITY:

# 833 | 30

researchers | laboratories

Advanced infrastructure, innovation and technology transfer, cooperation with the industry.



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# 2017

RESEARCH PUBLICATIONS

in 2017:

# 1659

RTU publications/ in total indexed

# 900

indexed in SCOPUS data base

# 728

indexed in ISI Web of Knowledge data base

# FACULTIES

- Faculty of Architecture,
- Faculty of Civil Engineering,
- Faculty of Computer Science and IT,
- Faculty of E-Learning Technologies and Humanities,
- Faculty of Electronics and Telecommunications,
- Faculty of Power and Electrical Engineering,
- Faculty of Engineering Economics and Management,
- Faculty of Mechanical Engineering, Transport and Aeronautics,
- Faculty of Materials Science and Applied Chemistry.

MAIN FIGURES:

# 14 672

total number of students

# 2 353

international students

# 563

number of doctoral students

# 36

doctoral theses defended in 2017



RĪGAS TEHNISKĀ UNIVERSITĀTE





# 2018

## PATENT PORTOLIO

88

National (Latvian)  
patents in force

26

National (Latvian)  
patents filed

9

European patents  
in force

## PROJECT PORTFOLIO

From 2008 till 2017, RTU has been involved in the implementation of 34 EU 7th Framework Programme (FP7) projects and 17 Horizon 2020 Programme projects.

38

EU Structural  
Fund projects

34

International  
research projects

8

International  
cross-border  
research project

29

State funded  
research projects

# THINK GLOBAL, BE GLOBAL!

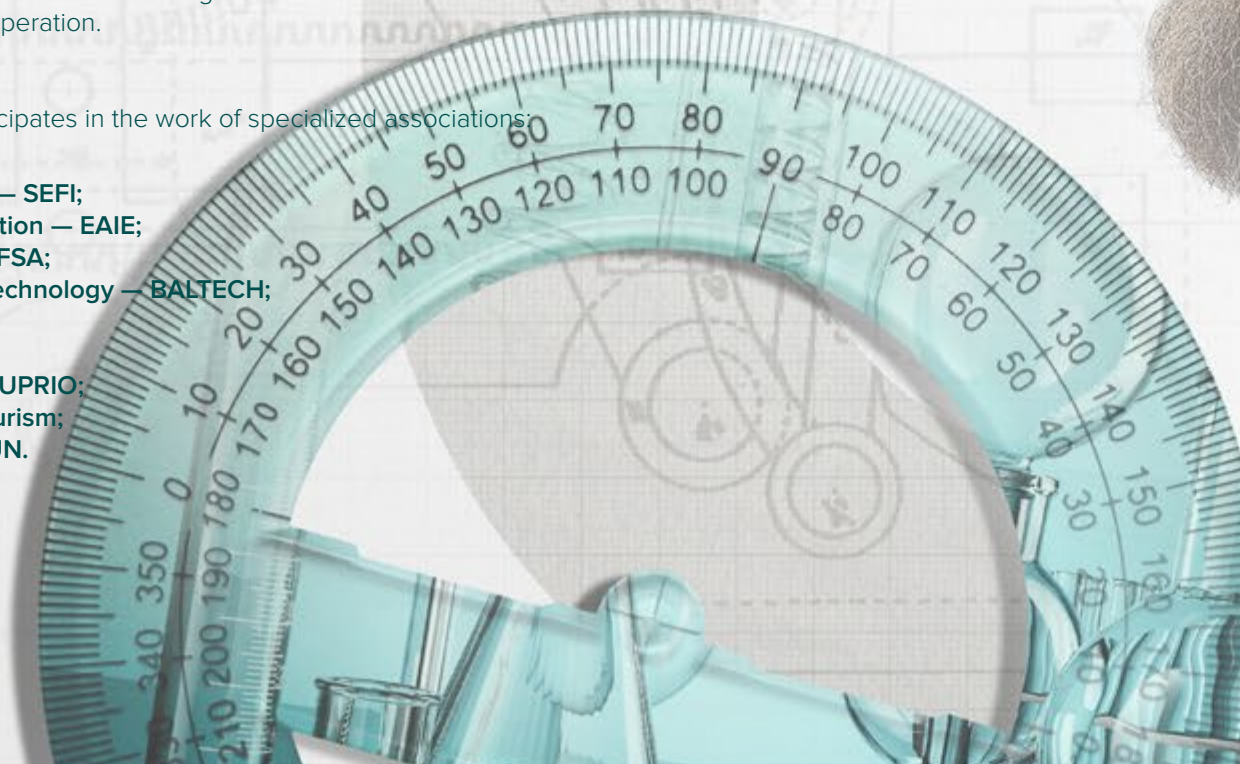
## INTERNATIONAL COOPERATION

RTU is highly active in international affairs. The University is open to cooperation with foreign partners, it hosts guest delegations to launch joint projects and organize exchange of good practices.

With a slogan "Think global, be global!" RTU positions itself in the global education market as a modern university open to international cooperation.

RTU is represented at the largest European and world education networks and actively participates in the work of specialized associations:

- European University Association – EUA;
- European Society for Engineering Education – SEFI;
- European Association for International Education – EAIE;
- Association for International Educators – NAFSA;
- The University Consortium for Science and Technology – BALTECH;
- Baltic University Programme – BUP;
- The Association «European Universities»;
- Public Relations and Information Officers – EUPRIO;
- Romualdo Del Bianco Fund – Life Beyond Tourism;
- Baltic Sea Region University Network – BSRUN.







RIGA TECHNICAL  
UNIVERSITY

# METALWORKING, MECHANICAL ENGINEERING & ELECTRONICS

## INSTITUTE OF AERONAUTICS

The Institute of Aeronautics is part of RTU Faculty of Mechanical Engineering, Transport and Aeronautics. It is active in the following areas:

- Aeronautics and air transport;
- Functional materials and nanotechnologies;
- Technical diagnostics and non-destructive methods of control.

### Major projects:

- Development of a prototype of an autonomous aerospace vehicle for comprehensive monitoring;
- A novel concept of an extremely short take-off and landing all-surface hybrid aircraft: from a light passenger aircraft to a very high payload cargo/passenger version;
- Development of an experimental long flight distance unmanned aerial vehicle prototype for multi-purpose environmental monitoring.

## POINTS OF EXCELLENCE

### REMOTELY PILOTED AIRCRAFTS AERTI 3

There is provided a remotely controllable airplane adapted for belly-landing, the airplane comprising a fuselage, a wing, a tail, a motor with a propeller, and an under-fuselage payload container adapted for carrying a surveillance equipment, wherein the payload container comprises a front module, an aft module, both coupled to the fuselage and spaced apart along the fuselage axis, and a central module, wherein the central module is rotatably attached to the front module and to the aft module.

Remotely piloted aircrafts find wide application for military and civilian purposes when manned flight operations are unacceptably costly and/or dangerous.

### ACOUSTIC EMISSION STRUCTURAL HEALTH MONITORING TECHNOLOGY FOR MACHINERY AND BUILDING STRUCTURES

Developed Acoustic Emission (AE) structural health monitoring (SHM) technology for machinery and building structures makes it possible to perform both the individual object elements and the whole object quality quantitative assessment in real structures in operation conditions.

This technology can be used to evaluate SHM of such objects as building structures, bridges, aircrafts, watercrafts, including in operation.

Developed AE method has a high sensitivity that is by far the most sensitive compared to other methods.

## INSTITUTE OF MATERIALS AND STRUCTURES

### Research directions:

- Finite element modelling and analysis of sandwich and laminated composites and structures;
- Optimal design of composite materials, structures and technological processes;
- Identification of material properties and damage in advanced composites;
- Damping analysis of composite materials and structures;
- Fracture analysis of laminated composites;
- Buckling and post-buckling modelling of stiffened composite structures;
- Smart control by PZT and MFC;
- Testing of material properties;
- Experimental analyses: static, dynamic, fatigue, impact;
- Experimental damage characterization in composite materials and structures.

### European Framework projects:

- Advanced low cost aircraft structures;
- Integration of technologies in support of a passenger and environmentally friendly helicopter;
- Modular ship concepts;
- Composites and adaptive structures: simulation, experimentation and modelling;
- Improved material exploitation at safe design of composite airframe structures by accurate simulation of collapse;
- Developing lightweight modules for transport systems featuring efficient production and lifecycle benefits at structural and functional integrity using risk based design;
- Flexible and near-net-shape generative manufacturing chains and repair techniques for complex shaped aero engine parts.

## POINTS OF EXCELLENCE

The researchers of the Institute of Materials and Structures of the Faculty of Civil Engineering in cooperation with company Airbus DS and the European Space Agency are developing a design and certification methodology, which can be used to determine the lowest robust load bearing capacity of thin-walled (radius/thickness ratio 400 to 1000) composite shells. The methodology will be used in manufacturing of the next generation of spacecrafts from composite materials.

The aim of the research is to develop an efficient design methodology for composite spacecraft constructions, assessing geometrical imperfections. Cylindrical thin-walled shells are most sensitive to product geometric tolerances, therefore the research focuses on the development and validation of design and certification methodology, which can be used to determine the lowest reliable design bearing capacity of thin-walled composite shells.

## INSTITUTE OF INDUSTRIAL ELECTRONICS AND ELECTRICAL ENGINEERING

### Research directions:

- Power electronic converters and their control algorithms in modern power supply systems, electric drive and renewable resource usage;
- Smart electric technologies in lighting systems;
- Manufacturing automation and energy efficiency improvement;
- Smart electric transport systems.

### Major projects:

- AREUS. DC micro-Grids for future robotic factories. FP7. Novel 600V DC power supply system for robotic factories to exchange, harvest, store and recover energy. Energy consumption reduction can reach up to 25% in a single robot production cell. Real 600V DC micro-grid architecture was implemented and compared with existing AC Grid technologies in DAIMLER AG factory in Sidelfingen, Germany. A simplified demo lab of a robotic factory production cell was set up in premises of RTU.
- A measurement system for monitoring electrical energy consumption has been developed within the National Research Programme "LATENERGI". The system is suitable for synchronous energy flow measurements in large number of points and can be applied either in industrial or household environment. The prototype of the system has been approved in two industrial test sites - "Daimler" (Germany), and "SIR" (Italy).



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## POINTS OF EXCELLENCE

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### **SPECIALISED SYSTEM FOR COMPUTERISED CONTROL OF EMBEDDED DEVICES**

Effective public utility sector facilities management and control tasks require the embedded systems for assistance in the automated water supply, power supply and heat supply control and management. Implementation of this system allows carrying out works in accordance with modern requirements and optimal cost. The system provides data collection from the objects, the analysis and control both in automatic mode and by request from the operator. It provides business planning in real-time and scope, and helps to minimize the risks.

Embedded system or subsystem can also be used on enterprise-wide basis.

City water supply, power supply, heat supply automated control system allows you to reduce the use of energy by 10 to 15 percent, reduce the losses associated with accidents, provide a rapid response to sudden changes in consumption, reduce maintenance and troubleshooting costs. Embedded systems provide more accurate and safer tasks planning, water, electricity and gas meter data automatic reading, remote security systems, time and energy minimization.

## INSTITUTE OF TELECOMMUNICATIONS

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### **Research directions:**

- Research on modulation formats (NRZ-OOK, RZ-OOK, Duobinary, PAM-4, etc.), modulation format conversion;
- Study of fiber Bragg grating based optical sensing technologies for structural health monitoring applications;
- Research on nonlinear optical effects in optical transmission systems, all-optical signal regeneration;
- Mathematical modelling and design of wired (including fiber optical) and wireless telecommunication networks and their components;
- Investigation of complex signal processing in transport navigation systems and its modelling, and on the performance assessment of wireless networks;
- Research of Internet of things (IoT) technologies and their related applications.
- Research of hybrid Wi-Fi – 4G/5G technologies to provide communication link between the participants of the road traffic at high speed with low delay;
- Research of WSN topology to provide data collection from sensors and determining the loss of energy resources of buildings;
- Research of Machine learning application for computer networks.

## POINTS OF EXCELLENCE

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### **ENERGY EFFICIENT FIBER OPTICAL COMMUNICATION SYSTEMS.**

Energy efficient communication system technology has been created, which will ensure energy efficient, fast and safe information transmission.

### **DEVELOPMENT OF HIGH SPEED PASSIVE OPTICAL NETWORKS**

The spectrum sliced dense wavelength division multiplexed passive optical network (SS-DWDM PON) technology has been developed, which is a cost effective and power efficient solution for a passive optical access.

### **DEVELOPMENT OF PASSIVE OPTICAL SENSOR NETWORKS AND TECHNOLOGIES**

In cooperation with industrial partners the research of innovative FBG sensor technologies and solutions for monitoring of material depletion - changes in mechanical parameters in microstrip road constructions, as well as deformation of embankments have been performed. The research include development and validation of the road infrastructure model, taking into account both the laboratory road pavement physical model and the in-service road pavement testing data.

### **DEVELOPMENT OF HYBRID 4G/WIFI NETWORK FOR MOBILE USERS**

Automotive radio communication network has been developed to be used to provide mobility, Wi-Fi based offloading for 4G in city environment. The research includes long-term activities targeting to experimentally improve the existing technologies, obtaining new knowledge, creating innovations and follows an intensive dissemination strategy for transfer of knowledge and technology.



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