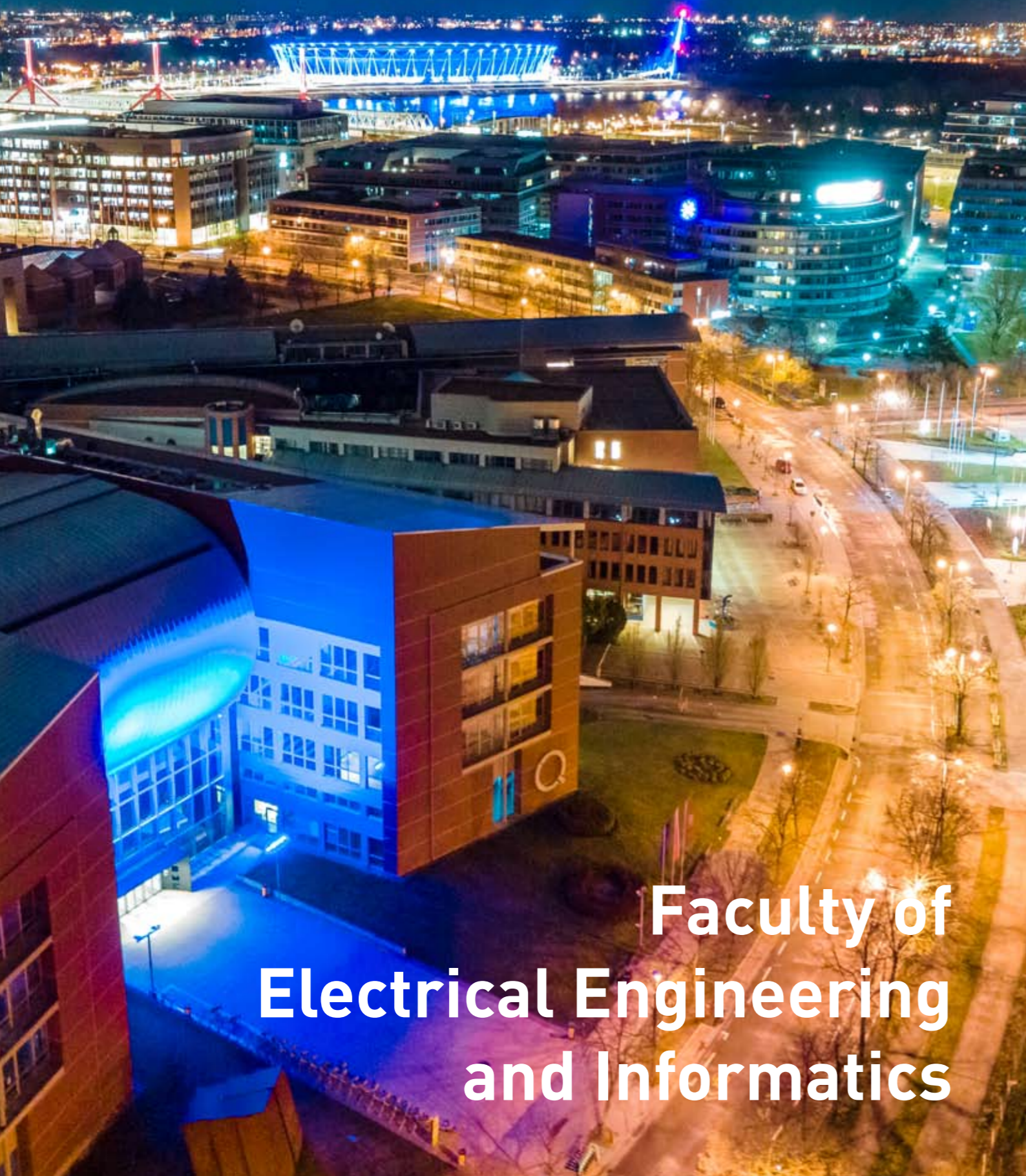




BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS



Budapest University of Technology and Economics



Faculty of Electrical Engineering and Informatics

Facts and figures

History

The Budapest University of Technology and Economics (BME) is Hungary's leading higher education institution in engineering. The direct predecessor of the Budapest University of Technology and Economics (BME) is the Institutum Geometrico-Hydrrotechnicum, founded in 1782, which was the first institute in Europe to train engineers in university structure. The university's fundamental task is to train professionals in the disciplines of technology, information technology, natural sciences, economics, business and management.

Mission

BME's mission, inseparable from training and education, is to conduct scientific research which encompasses the three activities required to make up the innovation chain: fundamental and applied research, technological product and service development, and the application of research findings. The BME campus is located in the heart of Budapest, an area that was ranked as the 7th „coolest place” worldwide by Time Out Magazine in 2022 due to its exciting intellectual life and vibrant city culture.

8 faculties

- Faculty of Civil Engineering
- Faculty of Mechanical Engineering
- Faculty of Architecture
- Faculty of Chemical Engineering
- Faculty of Electrical Engineering and Informatics
- Faculty of Transportation Engineering
- Faculty of Natural Sciences
- Faculty of Economics and Social Sciences

Figures

- Full English degree programs
- 70 Departments
- 22 000 Students, 2700 international students
- Academic Staff: 1300, with scientific qualification: 800
- Research University

EELISA Alliance Partner

The BME is member of the European Engineering Learning Innovation and Science Alliance



Studying in the elite

With its regular high ranking position (between 200 and 800) BME is among the top universities (2-6%) globally by QS.

BME in the QS 2024 rankings

Field of science:

- 201-240 Architecture & Built Environment
- 151-200 Civil and Structural Engineering
- 151-200 Mechanical, Aeronautical & Manufacturing Engineering
- 201-250 Electrical and Electronic Engineering
- 251-300 Computer Science and Information Systems
- 301-350 Chemical Engineering
- 351-400 Materials Science
- 251-300 Mathematics
- 351-400 Chemistry
- 301-350 Physics & Astronomy
- 551-600 Business & Management Studies

Education programs in general

- BSc, MSc and PhD curricula in English
- Since 1994 European Credit Transfer Scheme
- Continuing Engineering Education, postgraduate courses, MBA, etc.

Programs

All fields of Engineering, Nat. Sciences, and Economic

Available degrees	Number of programs	Duration (semesters)	Credits
BSc	19	7	210-240
MSc	25	4	90-120
PhD	12	8	2+2 years

Sustainable university

In the QS Sustainability Rankings, released for the first time, BME is ranked 198th worldwide and rated as the best Hungarian institution in the Environmental Impact category.



Facts and figures

Facts

- Largest faculty of the university
- 5800 Hungarian and 650 international students
- 4000 Hungarian and 500 international BSc students
- 1800 Hungarian and 150 international MSc students
- 350 academic staff, 270 with PhD
- Degree programs are taught in: HU, EN, DE

10 departments

- Department of Artificial Intelligence and Systems Engineering
- Department of Automation and Applied Informatics
- Department of Broadband Infocommunications and Electromagnetic Theory
- Department of Computer Science and Information Theory
- Department of Control Engineering and Information Technology
- Department of Electron Devices
- Department of Electronics Technology
- Department of Electric Power Engineering
- Department of Networked Systems and Services
- Department of Telecommunications and Artificial Intelligence

Programs

BProf	Computer Operational Engineering	6 semesters
BSc	Electrical Engineering	7 semesters
	Computer Engineering	7 semesters
MSc	Electrical Engineering	4 semesters
	Computer Engineering	4 semesters
	Business Information Systems	4 semesters
	Biomedical Engineering	4 semesters
	Space Engineering	4 semesters
PhD	Artificial Intelligence	4 semesters
	Doctoral School of Electrical Engineering	8 semesters
	Doctoral School of Informatics	8 semesters

Electrical Engineering Fields

Microelectronics

Thermal analysis and reliability

Sensors and microfluidics

Biosensors, nanocomposites • Microreactors, flow chemistry

Power electronics

Converters, inverters • HIL and PHIL models

Solid-state lighting

Constant flux control • Multi-domain modeling

Electronic technology

Materials for soldering • Biodegradable circuits

Electric Power Engineering

Power systems • High voltage • High current

Communication Fields

SMOG-P

First 5x5x5 sized satellite

Quantum communication channel

Attacks can not remain hidden
Working prototype, own development

5G campus network

Private network for research

Autonomous, communicating

vehicles and real demos in Budapest

Navigable networks

Adapting human navigation strategies to computer networks

Computer Engineering Fields

Immersive driving

VR-based • Demo available

Virtual Rubik's cube

Tech demo at CES

Critical system's design

Model checking based on formal models

Artificial Intelligence

Numerous application at almost all fields

Blockchain

Reliability analysis of blockchain systems

Security

Discovery and analysis of Duqu, a new class of malwares • Designing security protocols • Malware analysis

Academic Cooperation

Student Exchange

- Based on bilateral agreements
- Usually one semester long study periods
- Students take the courses in English at BME
- Students receive the same services as EU students (in the framework of the Erasmus+ exchange programs)

Academic Partnerships

- Sabbatical stay at BME, research stay of PhD students in BME labs
- Participation of BME staff at partner institutions in visiting scholar programs
- Workshops jointly organized in selected topics and to prepare joint proposals

International Programs

- BSc, MSc & PhD degree programs are available in English
- Erasmus program
- Stipendium Hungaricum scholarship program

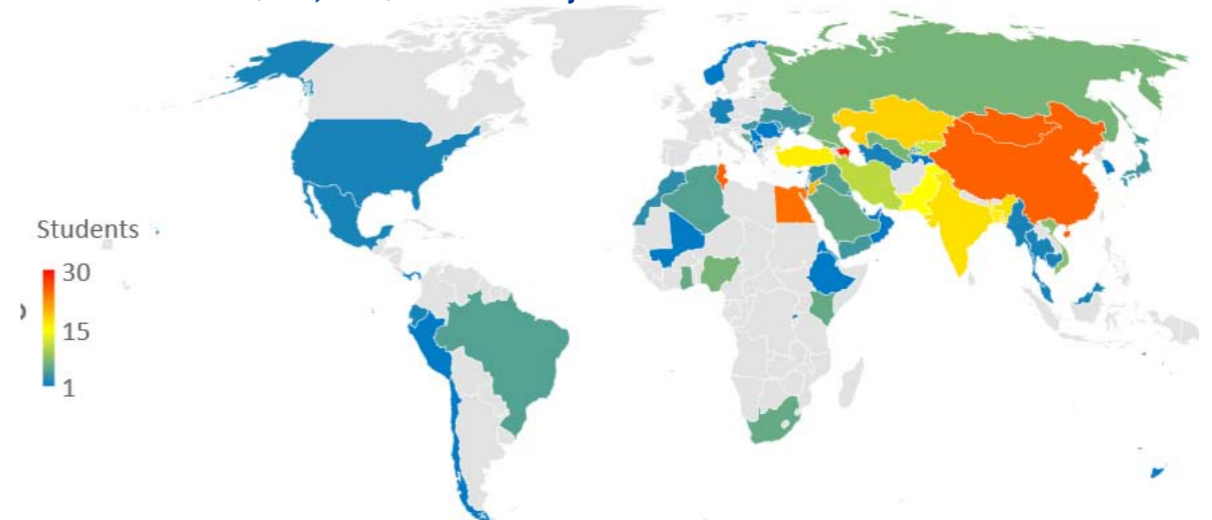
Double degree agreements

- INSA de Rennes (France)
- IMT Atlantique Nantes (France)
- ENSAM (France)
- Politecnico di Milano (Italy)
- Free University Bolzano (Italy)
- University of Trento (Italy)
- University of Bologna (Italy)
- Silesian University of Technology (Poland)
- University of Borås (Sweden)
- KTH (Sweden)
- University of South-Eastern Norway (Norway)
- Karlsruhe Institute of Technology (Germany)
- TU/e (The Netherlands)
- University of Turku (Finland)
- Aalto University (Finland)
- Kyungpook (South Korea)

Formalization

- Memorandum of Understanding at BME level
- International Cooperation Agreement at the faculty level

International Students (BSc, MSc) at the Faculty



Rich international network and embeddness (BME)

- EELISA European University Consortium
- ATHENS (Advanced Technology Higher Education Network / Socrates)
- AUF (Agence Universitaire de la Francophonie)
- CEEPUS (Central European Exchange Program for University Studies)
- CELSA (CentralEurope –LeuvenScientificAlliance)
- CESAER (Conf. of European Schools of Advanced Engineering Education and Research)
- CRP (Conference of Rectors/Presidents of European Techn. Universities)
- ERASMUS+ (1-2 semesters)
- EUA (European University Association)
- EAIE (European Association for International Education)
- SEFI (European Society for Engineering Education)
- T.I.M.E. Network of 54 leading universities of technology. Double diplomas, doctorate cooperation, summer schools etc.
- 4TU League (Regional cooperation of BME, CTU, SUT and TUWien)

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RESEARCH GROUPS



Space technology and wireless systems	Artificial intelligence and data science
Space Technology Radar and Remote Sensing Microwave and optical telecommunication systems Quantum communication and computing Electromagnetic Simulation and Design Antennas, Radiowave propagation and EMC	Stochastic systems and data modeling Artificial Intelligence Control engineering and robotics Intelligent transportation systems Discrete mathematics CrySyS Lab Speech Communication and Smart Interactions Applied IT technology Data Science and Content Technologies
Signal processing	Microelectronics and nanotechnology
Computer graphics and machine vision Radar and Remote Sensing Microwave and optical telecommunication systems Digital signal processing Acoustics 3D geometric modelling	Sustainable Electronics Solid-state lighting systems Photovoltaic systems, nano- and microelectronics Nanotechnology, sensors Packaging technologies Thermal management, electronics cooling and reliability Microelectronics reliability and failure analysis Chip-sized laboratories
Networks	Medical informatics
Stochastic systems and data modeling SmartComLab – Network services and IoT management Microwave and optical telecommunication systems Quantum communication and computing Intelligent transportation systems HSNLab – Network softwerization and cloud systems HSNLab – Sensor networks and IoT HSNLab – Future Internet Network technologies Algorithm theory	Computer graphics and machine vision Biomedical informatics Artificial Intelligence Cognitive computing Speech Communication and Smart Interactions
	Embedded systems
	Critical systems – ftsrg Control engineering and robotics Heterogenous Real-Time Distributed Embedded Systems Digital systems and applications Embedded systems and robotics

RESEARCH GROUPS



3D geometric modelling

aesthetic curves and surfaces • computer-aided geometric design • free-form surfaces • geometric constraints • n-sided surface patches • reverse engineering • segmentation of 3D objects • surface fitting

Acoustics

Acoustical measurements • Aeroacoustics • Electroacoustics • Musical acoustics • Numerical modeling • Psychoacoustics • Sound field synthesis • Vibroacoustics

Antennas, Radiowave propagation, EMC

5G devices • 5G radio networks • antenna design • antenna measurement and simulation • high frequency measurement techniques • physiological effects of electromagnetic fields • radio interference and interference problems (EMI/EMC)

Applied IT technology

applied artificial intelligence • code quality • maintainable development • smart data collection • smart networks

Artificial Intelligence

Artificial intelligence • Bayesian data analysis • bioinformatics • casual discovery • causal inference • chemoinformatics • data and knowledge fusion • decision support • federated learning • image processing • machine learning • multi-agent systems • multimodal diagnostics • natural language processing • semantic technologies

Biomedical informatics

Analysis of biomedical signals • Biomedical equipment • Biometrics • Life process modelling • Measurement of life processes • Medical imaging

BME FASTER RECORD

Artificial intelligence • integration of renewable sources • power system inertia • power system modelling and simulation • Power system planning and operation • power system stability

Business Informatics

creating digital twins in manufacturing • enterprise microservices • industrial IoT • machine learning techniques • Production planning and scheduling • production processes optimisation

Chip-sized laboratories

CFD (computational fluid dynamics) • Electrospinning • Flow chemistry • Magnetic nanoparticle • Microreactor • Pharma 4.0

Cognitive computing

biofeedback • cognitive • ecg • eeg • Item response theory • learning • mental workload

Computer graphics and machine vision

Computer Vision • Deep learning • Games • GPU • Inverse methods • Medical imaging • Monte Carlo methods • Positron Emission Tomography • Rendering • Sampling and reconstruction • Virtual reality • Visualization

Control engineering and robotics

autonomous systems • control engineering • control technology • navigation • path planning • robotics

Critical systems – ftsrg

autonomous vehicles • blockchain • data analysis • dependability • formal verification • model-driven development • proof of correctness • safety-critical systems • software engineering • systems engineering • testing

CrySyS Lab

applied cryptography • computer security • cybersecurity • economics of security and privacy • ethical hacking • game theory • honeypot technology • ICS/SCADA security • information security • IoT security • IT security • machine learning • malware analysis and detection • network security • penetration testing • post-quantum cryptography • privacy • privacy enhancing technologies • provable security • reverse engineering • security of autonomous systems (e.g. vehicles) • security of cyber-physical systems • security of embedded systems • software security • V2X security

Data Science and Content Technologies

Artificial intelligence • Computer Vision • data science • Deep learning • image processing

Digital signal processing

active noise control • AD and DA converters • adaptive systems • nonlinear systems • resonators • sound synthesis • system identification • wireless and distributed systems

Digital systems and applications

communication • computer vision in embedded systems • microcontroller-based and embedded systems • remote monitoring • System-level synthesis

RESEARCH GROUPS



Discrete mathematics

algebraic methods • chromatic number • databases • forbidden sub-configurations in matrices • functional and other dependencies in databases • game theory • graph • graph drawings • Hamiltonian cycle • Hamiltonian path • hypergraph • matroid • optimization • polynomial method • Ramsey theory • Shannon capacity of graphs • Sidon series • spanning tree

Electromagnetic Simulation and Design

computational electromagnetics • electromagnetic wave propagation and scattering • Finite Element Method (FEM) • Integral Equations (IE) • inverse and optimization problems • nondestructive evaluation • numerical field calculation • Specific Absorption Rate (SAR) • surrogate modeling • theory of electromagnetic fields • wireless power transfer

Electrical machines and controlled drives

application of finite element method for electrical machines • controlled electrical drives • direct energy converters • electrical drives • Electrical machines • electrical machines and drives of electric vehicles • electrical machines and drives of renewable energetics • engineering problem solving • measurement technics • microcomputer controlled electrical drives • monitoring systems • servo- and robot drives

Embedded systems and robotics

5G • intelligent robot • IoT • mapping • motion planning • navigation

Heterogenous Real-Time Distributed Embedded Systems

application processor • automotive communications • CAN • clock synchronization • CPU/MCU • Ethernet • FlexRay • FPGA • GPGPU • heterogeneous architecture system chip • high definition video recording and processing • high-speed HW design and implementation • industrial control and instrumentation • LIN • manufacturing and in-service diagnostics • multicore • network interfaces • real-world real-time and embedded distributed system • safety critical distributed and embedded system • sensor network • solar farm diagnostics • TSN • UWB • WiFi

High Voltage Technology

Electrical Cables • Electrical Equipment • Electrostatics • EMC • High Current • High Electric Field • High Magnetic Induction • High Voltage • Lightning Protection • Live-Line Maintenance • Nanotechnology • Protection Against Electric Shock • Transformers

HSNLab – Future Internet

addressing • applied mathematics • combinatorial optimisation • ks • machine learning • network architectures • routing

HSNLab – Network softwerization and cloud systems

AI/ML based optimization • AR/MR/VR applications • Cloud Native technologies • Cloud/Edge/Fog Computing • Industry 4.0 • Network Softwarization • NFV • SDN • Serverless Computing • Service and Resource Orchestration

HSNLab – Sensor networks and IoT

5G • cloud robotics • crowdsensing • LoRa • NBIoT • sensor • sensor network • smart city

Intelligent transportation systems

Artificial intelligence • Intelligent transportation systems • Smart cities • V2X communication

Microelectronics reliability and failure analysis

Corrosion • Failure analysis • Metallography • Quality • Reliability • Traceability

Microwave and optical telecommunication systems

5G and 6G mobile communication systems • broadcasting • channel modelling • DAB • digital and optical communication systems • DRM • DVB • microwave circuits • MIMO interconnects • optical and microwave instrumentation • optical communication devices • software defined radio

Nanotechnology, sensors

3D printing • additive manufacturing • AFM • atomic force microscopy • Biosensors • electrochemical sensors • LSPR • microfluidics • nanocomposites • nanomaterials • nanometrology • Nanotechnology • nucleotide sensors • optical sensors • rapid prototyping • SPR • surface plasmon resonance

RESEARCH GROUPS



Network technologies

AI methods • DNS64 • ICT • IPv6 • NAT64 • Network design • Network sizing • Performance measurements

Packaging technologies

Alloy • IMC • Reflow • SMT • Soldering • Tin whisker • VPS

Photovoltaic systems, nano- and microelectronics

Concentrator solar cell cooling • Microelectronics • Nanoelectronics • Perovskite • Semiconductor gas sensors • Solar cell modelling • Solar cells • Thermal electrical circuits

Power systems

e-mobility • Electric Energy Market • EMC • Energy Conversion • power quality • Power Systems (PS) • Steady State and Transient PS Analysis

Quantum communication and computing

fiber-based quantum communications • free-space • quantum algorithms • quantum key distribution • quantum WiFi • satellite

Radar and Remote Sensing

active and passive radar • antenna systems • beamforming • microwave imaging • multilateration • radio direction finding • remote sensing • sensor fusion • small satellite and ground station technology • space-time adaptive signal processing

SmartComLab – Network services and IoT management

5G • communication networks • FPGA • industrial IoT • machine learning • network and service management • network monitoring • traffic analysis

Smart Power

Control methods • Demand-side management • Grid-connected power electronics devices • HIL/CHIL/PHIL simulations • Intelligent algorithms in system operation • market design • Modeling of electricity markets • Modeling simulation and stability of power systems • Multivariate optimization algorithms • Network and market operating algorithms • Network integration of renewable/distributed producers and storage facilities • Operation control systems • Power system dynamics • Real-time simulation • SCADA

Software modeling

Compiler • Domain-specific languages • Meta-modeling • Modeling • Multi-layer metamodelling

Software technology

CMMI • Code generation • Compilers • Distributed software systems • Harmonisation of software quality approaches • Metamodelling • Process development models • Theoretical and practical problems of cloud computing • TMMi

Solid-state lighting systems

IVL LED characteristics • LED life time • LED reliability • LED measurement • LED aging • Lighting 4.0 • multi-domain modelling

Space Technology

atmospheric effects • on-board measurement data collection • power distribution • satellite communications • satellite power systems • space-qualified devices and small satellites technology • wave propagation studies

Speech Communication and Smart Interactions

aids for the disabled • Artificial intelligence • autonomous vehicles • call center automation • Deep learning • deep reinforcement learning • dialog systems • graph neural networks • human-computer interaction • human-robot interaction • intelligent voice assistants • non-verbal speech processing • self-supervised learning • semantic segmentation • silent speech interfaces • speech acoustics • speech recognition • speech synthesis • statistical methods

Stochastic systems and data modeling

Anomaly detection • Data analytics • Data fitting • Financial data analysis • Markov chains • Markov fluid models • Matrix-analytic methods • Mean-field models • MU-MIMO • Performance evaluation • Queueing systems • Sensor networks

Sustainable Electronics

Circuit design • Circular • Circular economy • e-waste • Electronic substrates • Environmentally friendly • green electronics • SDG • sustainability • WEEE

Theory of algorithm

algorithms • computational complexity • fair assignments - greedoid • matroid - Nash equilibrium • parameterized complexity • preference based matchings • quantum algorithms • QUBO • security measure

Thermal management, electronics cooling and reliability

Thermal transient testing • Thermal simulation • CFD simulation • Compact thermal modelling • Thermal reliability • Integrated microchannel cooling