

Faculty of Electrical Engineering



Faculty of Electrical
Engineering



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Wrocław University
of Science and Technology



HR EXCELLENCE IN RESEARCH

unite!



University Network for Innovation,
Technology and Engineering



History of the Faculty

The Faculty of Electrical Engineering was established as an independent unit of the Wrocław University of Science and Technology in 1946 as a result of the division of the Faculty of Mechanical Engineering and Electrotechnology that had been created at the time of the founding of Wrocław University of Science and Technology in 1945.

Since 1968 the Faculty of Electrical Engineering has consisted of three Institutes. At that time these were: the Institute of Electrical Power Engineering, the Institute of Electromachine Systems and the Institute of Electrical Metrology. Now it comprises the Department of Electrical Engineering and Technology Fundamentals, the Department of Electrical Power Engineering and the Department of Electrical Machines, Drives and Measurements.





Wrocław
University
of Science
and Technology

Faculty on the Campus

Faculty of Electrical Engineering

27 Wybrzeże Stanisława Wyspiańskiego st.

50-370 Wrocław

weny.pwr.edu.pl/en/



Faculty of Electrical
Engineering



Faculty Leadership



Dean

Waldemar Rebizant, Ph.D., D.Sc., Full Prof.

Vice-Dean

(full- time studies)

Janusz Staszewski, Ph.D., Assc. Prof.

Vice-Dean

(part-time studies and international programs)

Robert Lis, Ph.D., D.Sc., Assc. Prof.

Vice Dean for Scientific Research and Environmental Cooperation

(research, evaluation, strategy, risk management)

Mateusz Dybkowski, Ph.D., D.Sc., Assc. Prof.

Vice-Dean for Student Affairs, Promotion and Community Development of the Electrical Engineering Faculty

(students'affairs and promotion)

Piotr Serkies, Ph.D., D.Sc., Assc. Prof.





Figures



Faculty of Electrical
Engineering

235

Graduates

2nd Master's Degree
(PL+ENG)

150

1st Degree Students
(full-time + part-time)

1230

27

Phd Students

93

Academic Staff

53

Laboratories

(21 teaching laboratories,
26 research and teaching,
6 research laboratories)

3

Departments



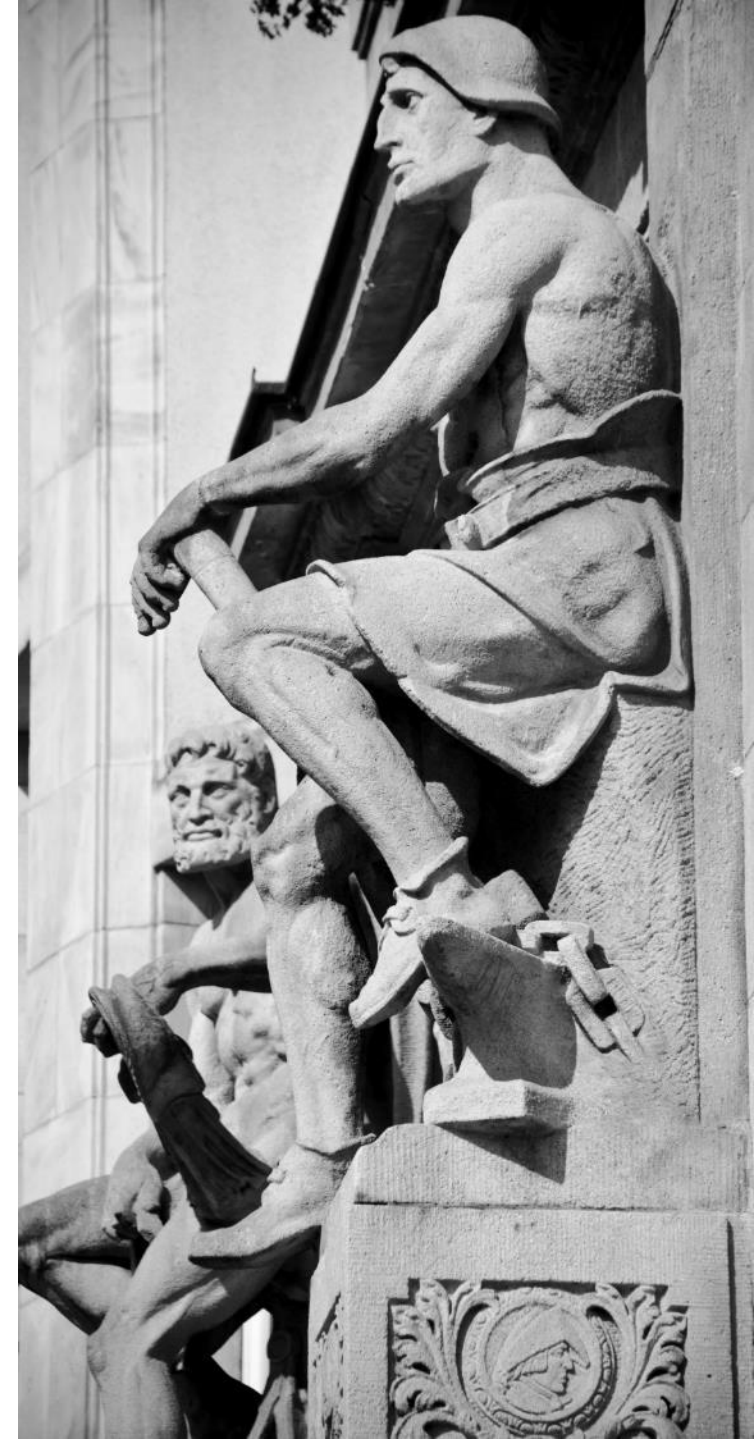
Wrocław
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and Technology

Mission and Strategy

The mission of the Faculty is to set directions of development and contribute to the development of engineering and technical sciences in the leading discipline of automation, electronics, electrical engineering and space technologies, to determine directions of application of research results in the economic environment, to shape creative, critical and tolerant personalities of students, to comprehensively develop scientific staff and to actively participate in the implementation of strategic initiatives of the Wrocław Tech. The Faculty also conducts interdisciplinary research and teaching activities. The mission, vision and strategic goals of the Faculty are related to the University strategy.



Faculty of Electrical
Engineering





Faculty Structure

Department of Electrical Power Engineering

Contact

ke.pwr.edu.pl

+ 48 71 320 26 55

ke@pwr.edu.pl

Head:

Marcin Habrych, Ph.D., D.Sc., Assc. Prof.

Dep. Director (R&D):

Bartosz Brusilowicz, Ph.D.

Dep. Director (Education):

Mirosław Kobusiński, MSc

Department of Electrical Machines, Drives and Measurements

Contact

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+ 48 71 320 34 67

kmnipe@pwr.edu.pl

Head:

Krzysztof Szabat, Ph.D., D.Sc., Full Prof.

Dep. Director (R&D):

Grzegorz Tarchala, Ph.D., D.Sc., Assc. Prof.

Dep. Director (Education):

Krzysztof Dyrz, Ph.D.

Department of Electrical Engineering Fundamentals

Contact

kpee.pwr.edu.pl

+ 48 71 320 28 59

K38@pwr.edu.pl

Head:

Tomasz Sikorski, Ph.D., D.Sc., Full Prof.

Dep. Director (R&D):

Paweł Żyłka, Ph.D., D.Sc., Assc. Prof.

Dep. Director (Education):

Anna Kisiel, Ph.D.





Accomplishments

- The Electromobility major is under the patronage of LG Energy Solution Wrocław and PSNM (Polish Association of New Mobility)
- Scientific category A in the discipline of Automation, Electronics, Electrical Engineering and Space Technologies
- Participation in international projects, conducting double diploma programs
- In the Perspektywy Ranking, since 2016, the Electrical Engineering major has been in the top three of the best Electrical Engineering majors in Poland





New electromobility laboratory

The university's Faculty of Electrical Engineering has opened a new electromobility laboratory. Its launch was made possible thanks to the support of LG Energy Solution Wrocław, which funnelled a donation of 600,000 PLN into the project.





Priority Research Areas

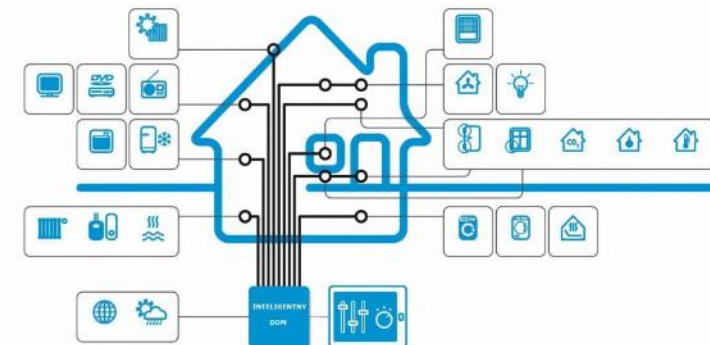
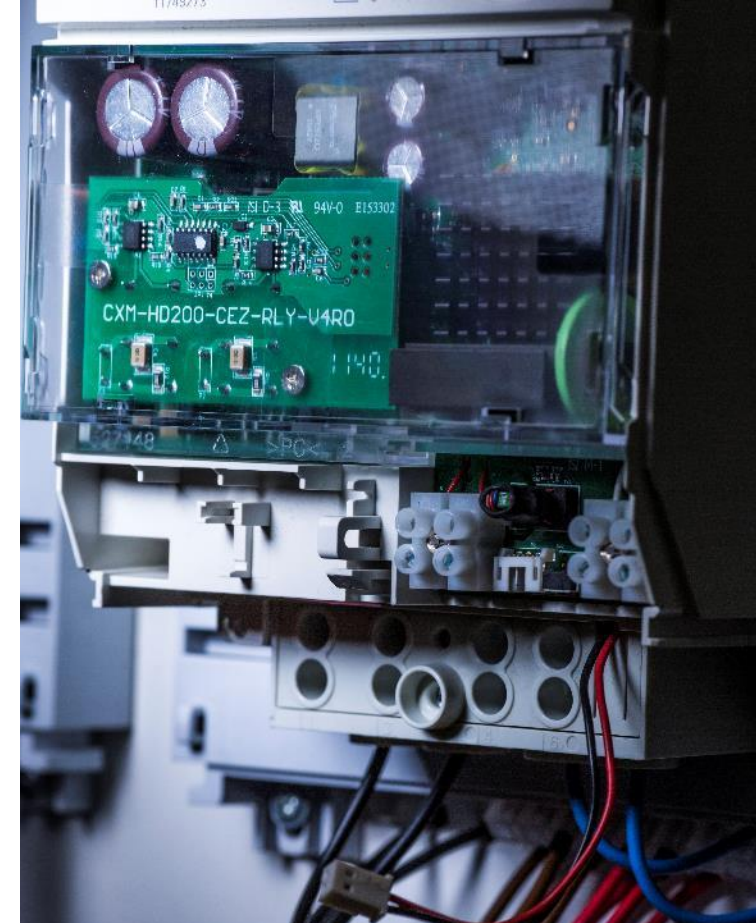
- Information Technology, Data Science, and Artificial Intelligence
- Innovative Materials and Advanced Manufacturing
- Smart Cities and Future Society
- Health and Medical Technologies
- Extreme Technologies
- Basic Research for Technology and Innovation





Scientific and research laboratories

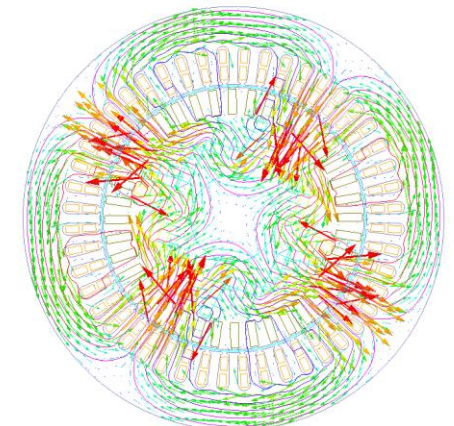
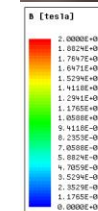
- Electrical Devices and Installations Laboratory
- Intelligent Electrical Installations Laboratory
- Power Electronics and Static Converters Laboratory
- Electricity Transformation Laboratory
- Electrical Safety Laboratory
- Fiber Optic Technology Laboratory
- Power Systems and Networks Laboratory
- Digital Modeling Laboratory
- Digital Techniques Laboratory
- Modern Electrical Devices Laboratory
- Power Protection Laboratory
- Mining Electrical Engineering and Automation Laboratory





Scientific and research laboratories

- Magnetic Quantity Measurement Laboratory
- Electrical Signal Processing and Analysis Laboratory
- Electrical Engineering Laboratory
- Electrical Machine Simulation Testing Laboratory
- Electrical Measurement Laboratory
- Electrical Machines Laboratory
- Digital Measurement Systems Laboratory
- Power Electronics Laboratory
- Industrial Device and Drive Control Laboratory
- Electrical Drive Laboratory
- Industrial Automation Laboratory
- Laboratory of Research and Diagnostics of Electric Machines and Drives
- Laboratory of Electric Drive Automation
- Laboratory of Microprocessor Technology



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Scientific and research laboratories

- Laboratory of Digital Signal Processing
- Laboratory of Dielectrics and Electrostatics Research
- Laboratory of Electrotechnology
- Laboratory of Electrical Metrology, Sensors and Calibration of Electrical Devices
- Laboratory of High Voltage and Electromagnetic Compatibility
- High Voltage Hall
- Inter-Cathedral Laboratory of Renewable Energy Systems (K38/K36)





Research offer

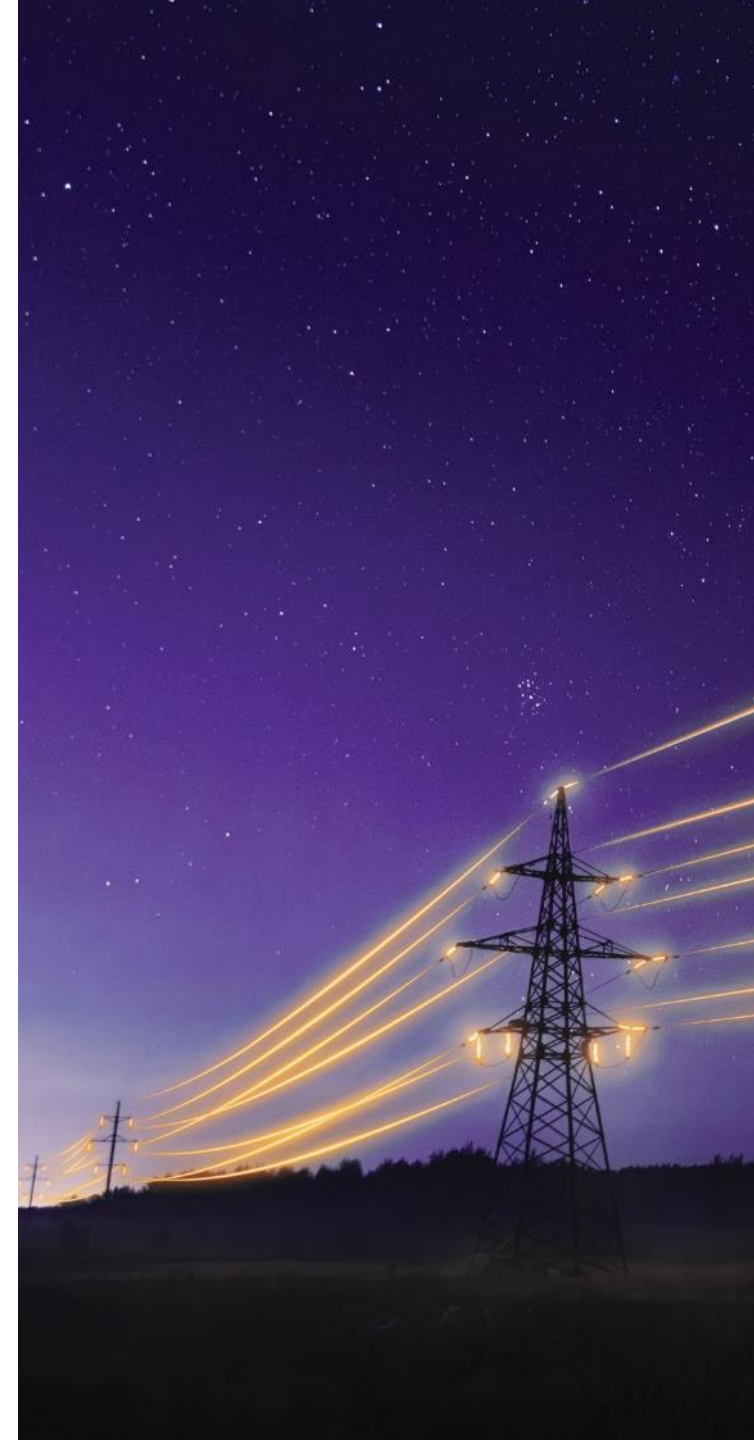
- Research on material properties of different elastomers used in electret-elastomer piezoactive structures
- Application of nonthermal plasma to enhance the biodeterioration process
- Application of nonthermal plasma to the surface treatment of polymeric materials
- Application of electrospinning process for the fabrication of nanofibers with antimicrobial activity
- Energy harvesting - obtaining energy from various types of renewable sources
- Microgrid systems with local generation and energy storage, mathematical modelling of microgrids
- Management of multi-carrier (i.e. electricity, natural gas and thermal energy) energy systems in an intelligent distribution network taking into account demand response
- Short-term management of the energy hub in a smart environment





Research offer

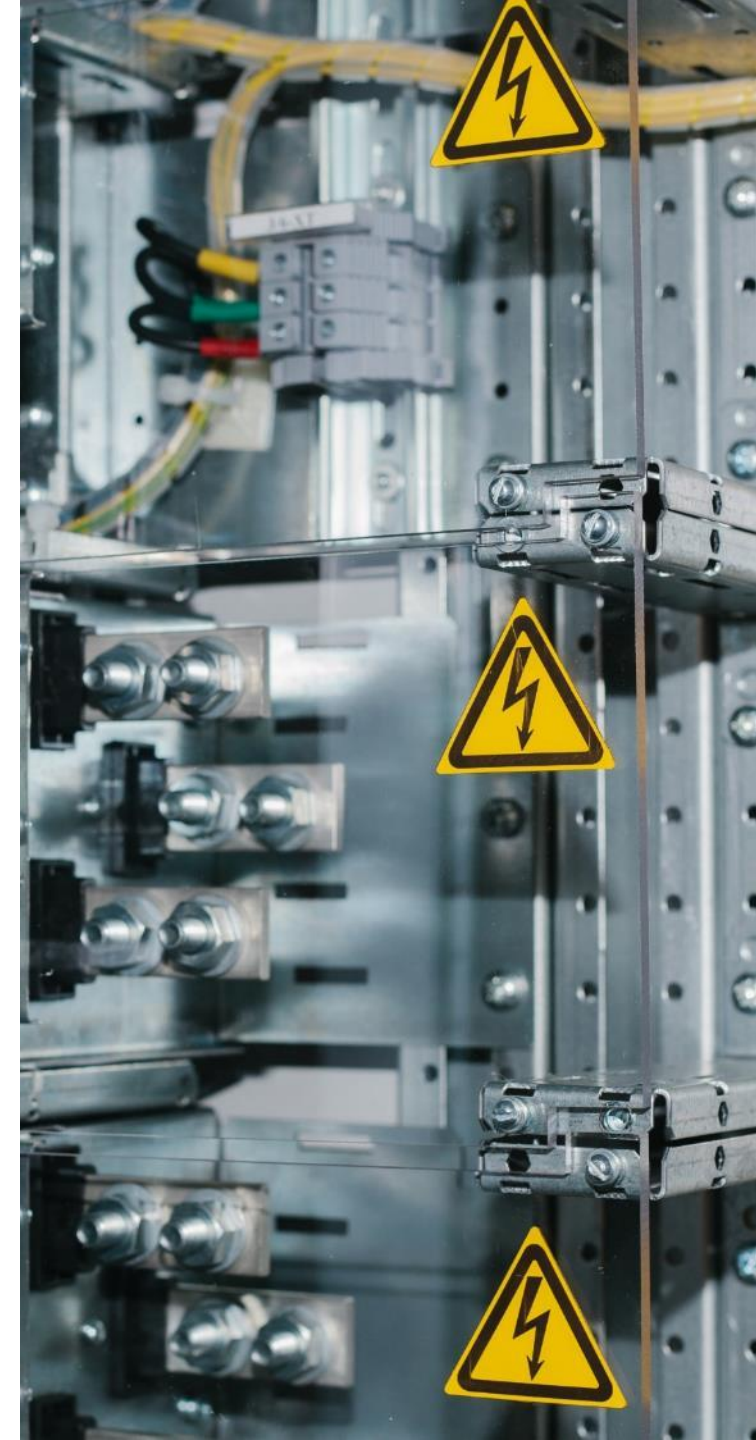
- Design, modelling and analysis of AC motors
- Fault tolerant control of AC motor drives
- Structures of control and estimation of state variables and parameters in electric drive systems with elastic connection
- Testing and diagnostics of AC machines under conditions of variable supply voltage frequency
- Data processing in control and diagnostic systems of drive systems with AC motors
- Estimation of motor parameters, state variables and angular speed for sensorless AC voltage motors





Research offer

- Integration of energy storage (requirements, actions, interfaces) for different actors, regions and roles for today's and future energy system application
- Earthing arrangements in power systems for island mode operation
- Comprehensive design and testing of power system automation components, including digital signal processing for power system protection
- Communication effectiveness analysis of PLC (Power Line Communication) and BPL (Broadband over Power Line Communication) technologies in LV and MV networks

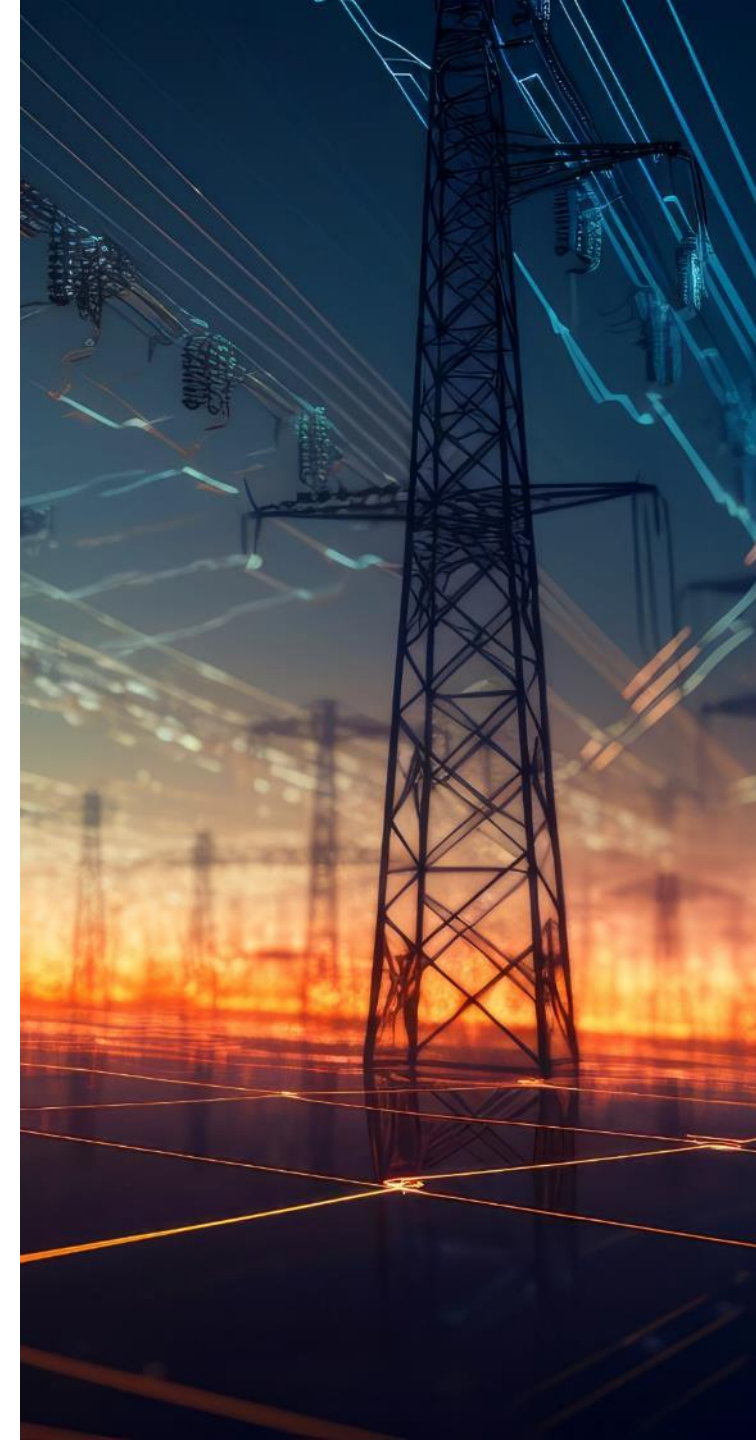




Department of Electrical Power Engineering

Basic areas of the research activities:

- Power system simulation
- Protection of power system components (transmission networks, medium voltage distribution networks, renewable Energy sources)
- Measurement and decision making algorithms for digital protective relays
- Artificial intelligence & adaptive techniques for power system protection and control
- Fault location on power networks
- Design of electrical apparatuses and installations
- Intelligent installations
- Economical and legal aspects of power system operation
- Investigation of electrical arc phenomena
- Power quality
- Energy savings in industry
- Investigation of overvoltages during switching operations
- Electrical safety – regulations and technical means
- Measurement of electrical fields under overhead power lines
- Influence of electrical fields on human beings
- Power system analysis and state estimation
- Diagnosis of blackouts in national power grid
- Integration of renewable energy sources into a power grid
- Power quality
- Pricing electricity at deregulated power market

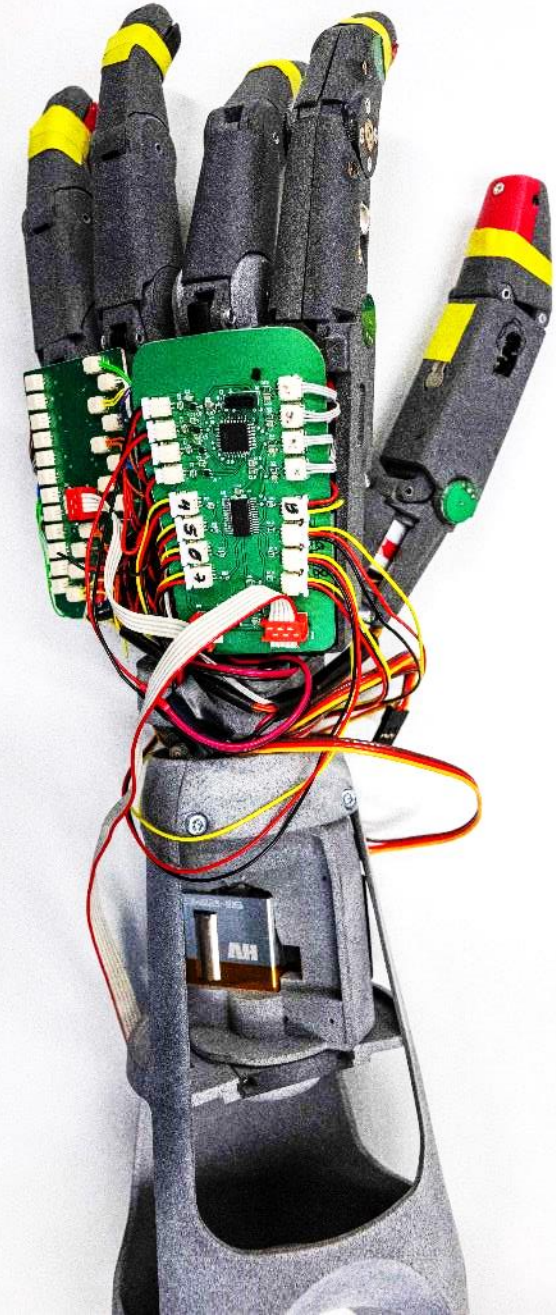




Department of Electrical Machines, Drives and Measurements

Basic areas of the research activities:

- Construction and design of DC and AC machines (including permanent magnet machines),
- Modeling and testing of electrical machines based on 2D/3D field and circuit-field modeling
- Measurement theory
- Methods and measuring circuits
- Magnetic measurements
- Electromagnetic compatibility
- Sensors, transducers, measurement standards
- Controlled electrical drives
- Power electronics
- Diagnostics
- Industrial automation and informatics
- Monitoring and diagnosis of electrical drives
- Industrial automation and informatics
- Traction drives, sensorless drives, drives with complex mechanical couplings, safety drives
- Application of sliding-mode control, predictive control, adaptive and neuro-fuzzy control in AC motor drives





Department of Electrical Engineering Fundamentals

Basic areas of the research activities:

- Mathematical methods in electrical engineering
- Digital signal processing
- Power quality assessment, wide area monitoring, LV distributed generation
- Modeling of electrical and magnetic circuits
- High voltage insulation
- High voltage measurement techniques
- Electromagnetic compatibility
- Lightning and overvoltage protection
- 1.8 MV pulse generator, sphere gap (1.5 m diameter)
- Polymeric HV insulators, anti-vandal, light, strong, hydrofobic
- Charge decay investigations
- Dielectrics, meas. & tech.
- Applied electrostatics
- LT plasma generation and application
- High Resistance Transfer with a double insulation system
- PP-non-woven shielding
- Back Corona in LTAP Plasma Reactor





Research Teams

Department of Power Engineering

Power System Control and Protection

Head – Eugeniusz Rosołowski
Ph.D., D.Sc., Full Prof.

Electrical Apparatus and Electrical Engineering for Industry

Head – Waldemar Dołęga, Ph.D.,
D.Sc., Assc. Prof.

Power Networks and Systems

Head – Robert Lis, Ph.D., D.Sc.,
Assc. Prof.

Department of Electrical Machines, Drives and Measurements

Electrical Machines and Measurements

Head – Marek Ciurys, Ph.D., D.Sc.,
Assc. Prof.

Electrical Drives, Mechatronics and Industrial Automation

Head – Marcin Kamiński, Ph.D.,
D.Sc., Assc. Prof.

Department of Electrical Engineering Fundamentals

Theory of Electrical Engineering

Head – Jacek Rezmer, Ph.D., D.Sc.,
Assc. Prof.

High Voltage Technology

Head – Maciej Jaroszewski, Ph.D.,
D.Sc., Full Prof.

Electrotechnology

Head – Paweł Żyłka, Ph.D., D.Sc.,
Assc. Prof.



World's TOP 2% Scientists (2023)



Prof. Teresa Orłowska-Kowalska,
PhD, DSc, Eng.



Michał Jasiński,
PhD, DSc, Eng., Assoc. Prof.



Maciej Skowron
PhD, Eng.



Prof. Zbigniew Leonowicz,
PhD, DSc, Eng.



Prof. Krzysztof Szabat,
PhD, DSc, Eng.



Marcin Kamiński,
PhD, DSc, Eng., Assoc. Prof



Patents/know-how

List of selected patents:

- **Method and arrangement for detecting a winding defect in a transformer on the basis of corresponding negative sequence current values**, Siemens Aktiengesellschaft Munchen, Patent Europa, nr EP 3595114
- **Method and device for detection of sub-synchronous oscillations in a power system**, Siemens Aktiengesellschaft Munchen, Patent USA, nr US 11495969
- **Reference signal generating method for distance and directional protection elements**, Schweitzer Engineering Laboratories, Inc. US, Patent USA, nr US 11043803
- **Textile product for attenuation of electromagnetic field**, Institute of Textile, Łódź/Wrocław Tech, Patent Europa, nr EP 2809841





Cooperation with Academia

Key Areas

Joint Teaching and Learning

- Joint master's programs
- Career path collaboration

Joint Research and Innovation

- Research team matchmaking
- Unite! University Network for Innovation, Technology and Engineering

Student Mobility

- Hybrid and on-site courses at partner universities
- T.I.M.E. -Top Industrial Managers in Engineering
- International internships
- Diversity, integration, and team building





Partnership in European projects

- Development of a transformer model to simulate internal earth faults and turn-to-turn faults – **OMICRON electronics**
- Development and testing of a new earth fault detection algorithm used during a single-phase break – **Sprecher Automation**
- Research and development of a new generation of current transformers for applications in the power industry, with digital data transmission, based on the technology of multi-layer and flexible printed circuits with high connection density – **Tele and Radio Research Institute**
- Research on models of components of a scalable e-management system in the field of detection and measurement of disturbances in PLC transmission paths – **Tele and Radio Research Institute**
- Development of a strategy for the acquisition, data collection, reporting and alerting of threats in the project: "Sensors for measuring factors representing threats in the environment – modeling and monitoring of threats" – **Wrocław Tech**





Partnership in European projects

Cooperation with Tauron

- Analysis of the occurrence of electromagnetic disturbances in the frequency range 2-150kHz in the low-voltage power network, supplying end customers
- Development of ontological and semantic models and algorithms for the cooperation of energy microgrid components
- The operation model of distributed energy 2.0-self-balancing areas of the power grid

Cooperation with Siemens:

- Development of power system protection relays





Partnership in European projects





Conferences organised and co-organized by the Faculty

- **The Scientific Conference Generation-Transmission-Utilization (GPW):**
annual event organized by the Faculty of Electrical Engineering at Wrocław Tech and the Wrocław Branch of the Association of Polish Electrical Engineers
- Energy Saving Converter Drives in Industry (ENPP) 2016-2024
- Modern Electric Power Systems 2019-MEPS 2015, 2019
- PAC World 2017 – Protection, Automation and Control (PAC) World Conference
- Electrical Power Networks, EPNet 2016

More: weny.pwr.edu.pl/badania-i-wspolpraca/konferencje





Study at the faculty

BSc studies

- Electrical Engineering
- Industrial Control Engineering
- Electromobility

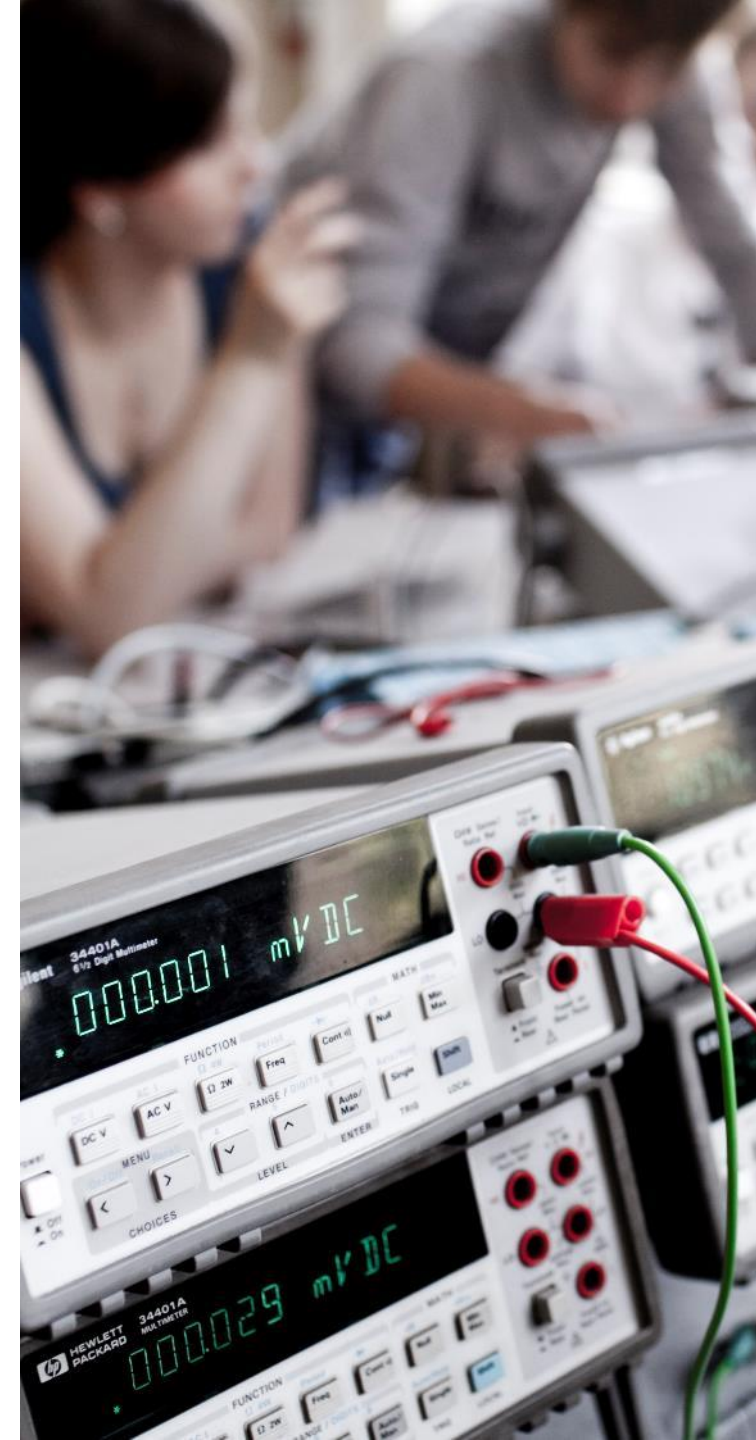
MSc studies

Electrical Engineering

- Fundamentals and Technology
- Electrical Power Engineering
- Renewable Energy Systems
- Control in Electrical Power Engineering

Industrial Control Engineering

- Automation and Control in Power Systems
- Automation of Machines, Vehicles and Devices





Studies in cooperation with foreign universities

Renewable Energy Systems

Joint Master Degree Programme with OvG University
Magdeburg, Germany



Control in Electrical Power Engineering

Joint Master Degree Programme with RWTH Aachen
University, Germany



Control in Electrical Power Engineering

Joint Master Degree Programme with Ryerson University
(RU) Toronto, Canada





Postgraduate studies

- Computer-Aided Design of Electrical Installations and Equipment
- Electric traction – railway traffic control
- Electric shock and fire protection in electrical installations
- Power Control Systems (PLC, DCS)

Contact:

Kazimierz HERLENDER, Ph.D., Assc. Prof.

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kazimierz.herlender@pwr.edu.pl





Summer and Winter Schools Programmes

International Summer and Winter Schools SWITCH

- part of the SPINAKER initiative by NAWA
- Intensive short-term programs, typically held during summer and winter breaks

Benefits

- enhances educational diversity,
promotes cultural exchange
provides flexible learning environments

Contact:

summerschools.pwr.edu.pl





3E+ Summer School

- 60 hours (3 weeks) of specialized courses
- laboratory activities
- 4 ECTS points
- trips, events social activities
- Polish language and culture course
- participants from all over the world

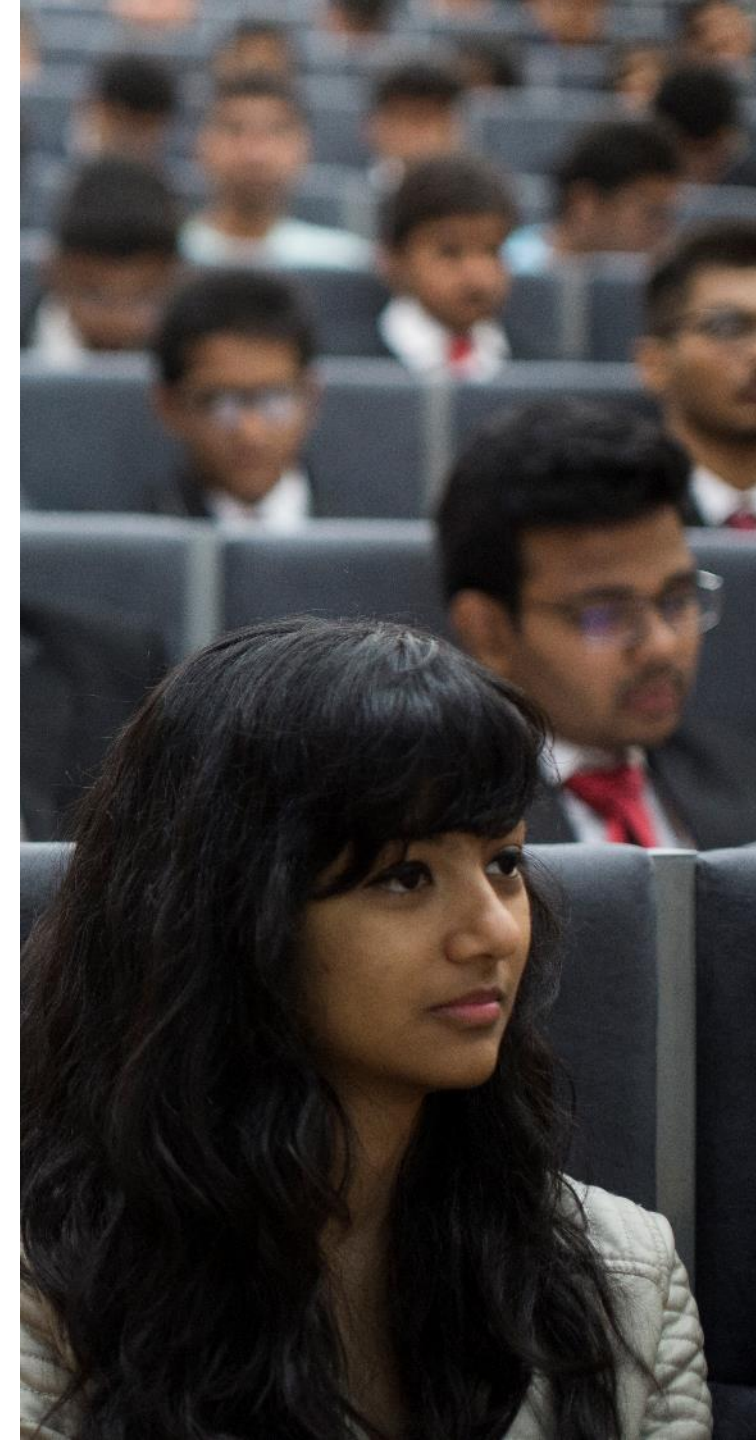
Contact:

Robert Lis PhD, DSc Assc. Prof.

Robert.lis@pwr.edu.pl

+48 782 070 760

summerschools.pwr.edu.pl





Student activities

Student scientific associations

- Automatyk
- Synchron
- Strimer
- Delta Power
- SmartGo!



AUTOMATYK





Teaching projects implemented at the Faculty

Extension of the didactic offer for Industry 4.0 in the Laboratory of Modern Electrical Apparatus of the Wrocław University of Science and Technology. Project in cooperation with ABB.

Seminars with industry for students and PhD students. Speakers included: Siemens Energy, LG Energy Solution Wrocław, Mitsubishi Electric, OPAL, Transition Technologies-Control Solutions, B&R Automatyka Przemysłowa Sp. z o. o., ABB Industrial Solutions Bielsko-Biała and many others.

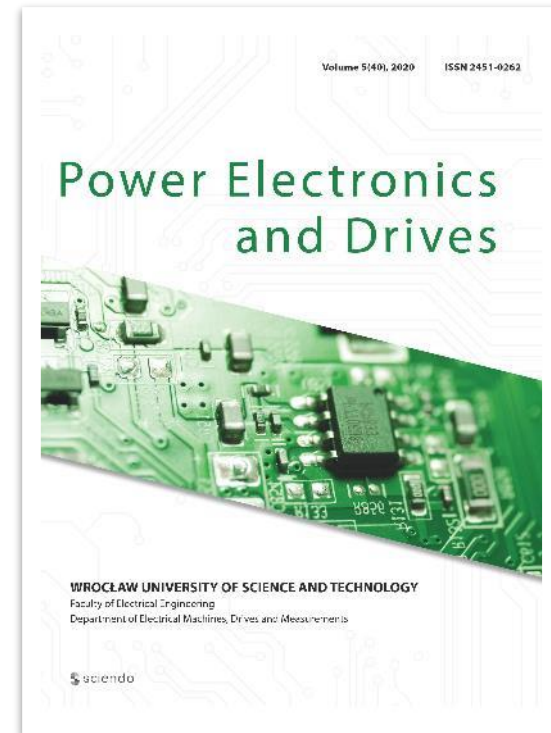




Power Electronics and Drives

Power Electronics and Drives is an open access, peer-reviewed journal which aims to publish original scientific papers (research and survey papers) on new theoretical developments, novel applications, and case studies regarding advances in power electronics and electrical drive systems. The published articles deal with the following subjects:

- power electronic converters
- intelligent control in power electronics and drives
- state variable estimation for AC and DC drives
- diagnostics in power electronics and drive systems
- fault-tolerant control strategies in power electronic converters and drives
- industrial drives, renewable energy systems and smart grid technologies
- power consumption and energy efficiency of converter-fed drives
- electrical machines modeling, simulations and analysis
- motion control, mechatronics
- education issues in power electronics and drives



20	100	14	0.7	0,17	59
MNiSW	ICV	Google H5 2023	IF 2023	JCI 2023	JCR 2023



Contact:
ped.pwr.edu.pl/

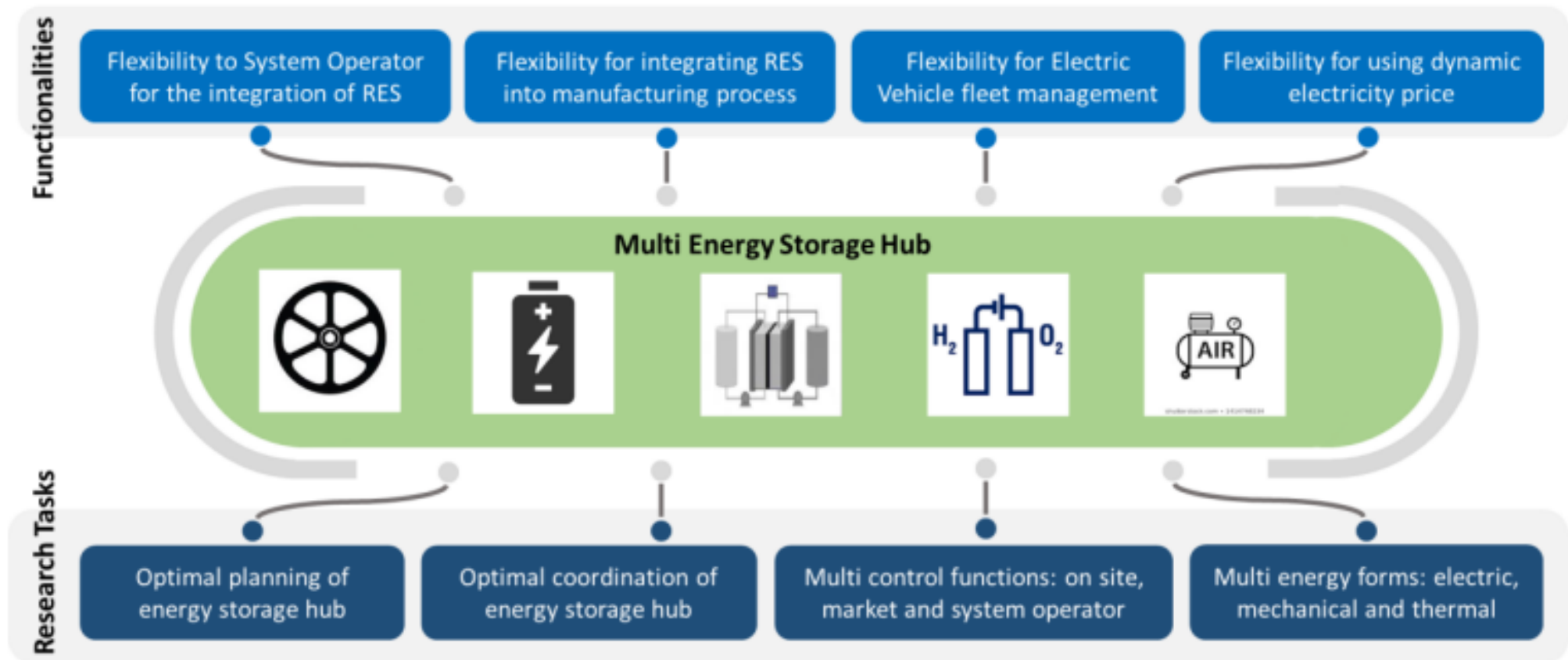


International projects

MESH4U project concept (The Multi Energy Storage Hub will combine several types of storage such as electrical, thermal, mechanical and chemical in order to integrate them in one system across different infrastructures (electrical, thermal, mobility))

Cooperation: Germany, Italy, Switzerland, Poland

MESH4U Concept





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International projects

HORIZON-JU-Clean-Aviation-2022-01, 101101961 — HECATE, Electrical Distribution Solutions for Hybridmelectric Regional Aircraft, 2023-2026

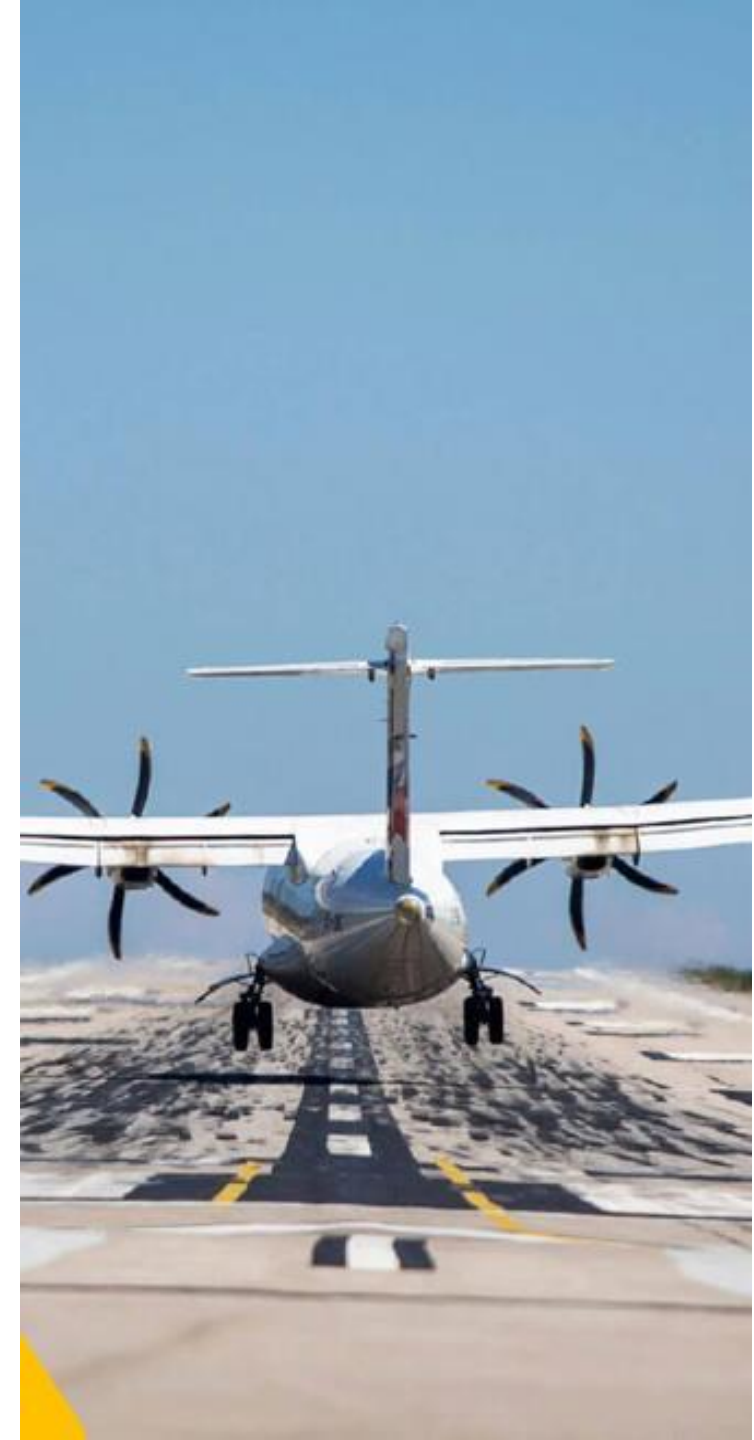


AALBORG UNIVERSITY



Draka

A Brand of Prysmian Group



Faculty of Electrical
Engineering



Completed projects

Hybrid methods of fault detection of synchronous motors with permanent magnets in electric drives with vector control using analytical and neural calculations, NCN/Opus, 2018-2022

Discrete sliding control and estimation of state variables in propulsion systems with induction motors, NCN/Opus, 2016-2020

Research and development of methods for detecting and compensating for electrical and mechanical damage in vector-controlled drive systems with induction motors, in particular for safe systems, NCN/Opus, 2014-2017

Diagnostics of failures of transistors of a vector-controlled rectifier in an induction motor drive, NCN/Preludium, 2015-2018

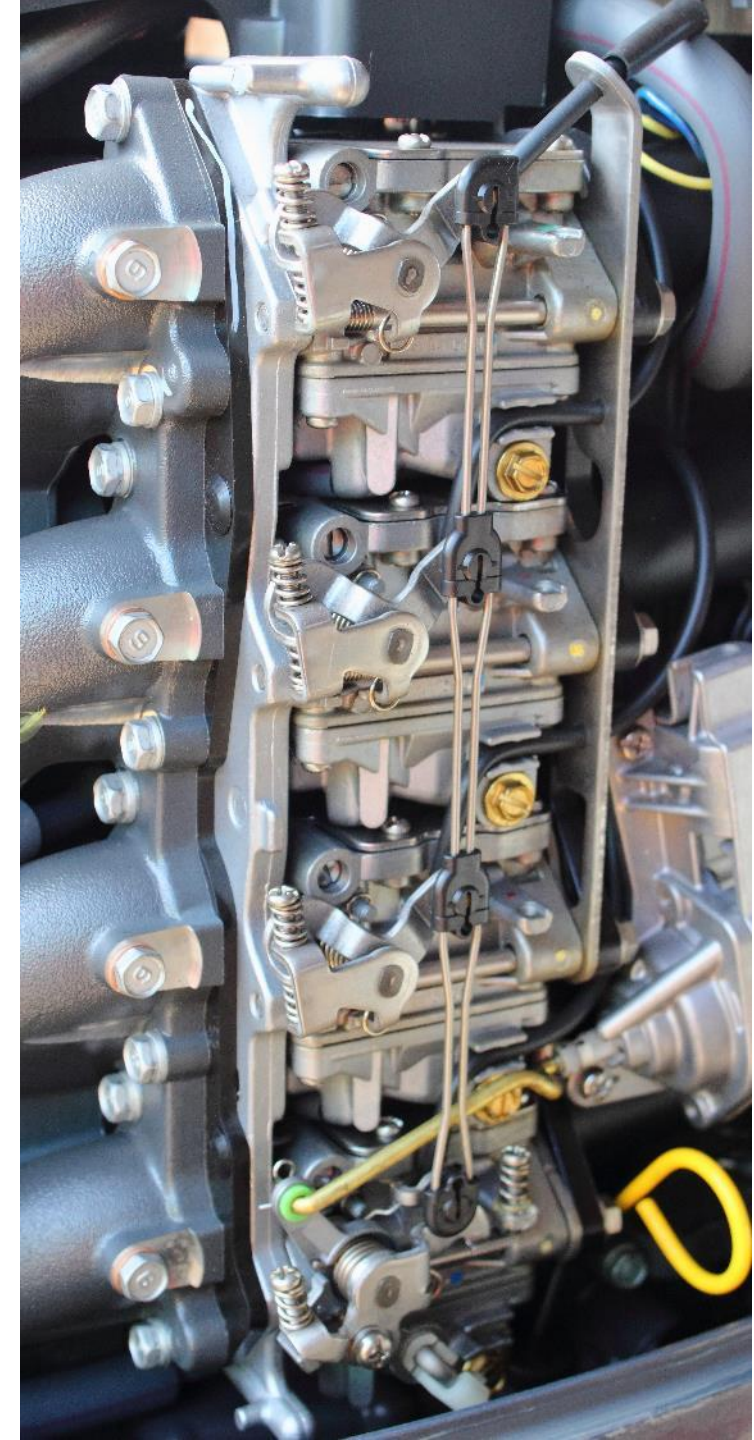
Fabrication of polymer nanofibers with zinc oxide nanoparticles using the electrospinning method, R&D project, 2022 „Miniatura” programme





Research and development projects

- **Methods of detection and compensation of damage to current sensors for drives with induction and synchronous motors based on modified state variable observers, NCN/Opus, 2022-2025**
- **Failure diagnosis of permanent magnet synchronous motors using deep neural networks and transfer learning NCN/Preludium, 2022-2024**
- **Ensuring measurement consistency of high resistance secondary standards with the highest possible accuracy, R&D project 2022-2025 „Polish metrology” programme**
- **EMC Comparative Studies of PV Inverters (Testing the control capacity of PV inverters, optimization of settings for a power grid node, studies of emissions and immunity in terms of conducted disturbances up to 150 kHz) Cooperation: Wrocław Tech EMC LAB, AGH, TAURON, OSD**





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