



**INSTITUTE OF RADIOELECTRONICS
AND MULTIMEDIA TECHNOLOGY**

WARSAW UNIVERSITY OF TECHNOLOGY

FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY



ANNUAL REPORT

2025

Warsaw, January 2026

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Faculty of Electronics and Information Technology
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From the Director

Dear Friends and Colleagues,

The year 2025, the results of which are presented in this edition of the Annual Report, was marked by significant events bringing substantial changes to the Faculty of Electronics and Information Technology. We welcomed the following year with high expectations, but also with an awareness of the transformational challenges we face.

Looking back at the past year, I can say with full confidence that the tasks set before the institute in January 2025 have been mostly successfully completed. War just beyond our borders has not disrupted our activities, though our thoughts and feelings are with the brave nation of Ukraine as they defend against the Russian threat. However, as we are looking into the future with an increasing optimism, it's also the time for the brief summary of the past period.

Scientifically, our institute has been steadily growing. This is evidenced by the significant number of solid publications in the JCR list, evaluated between 100 and 200 points by Polish Ministry of Science. Additional. It should be noted that in 2025, six top-level articles, valued at 200 points, were published. The two monographs authored or co-authored by our most active researchers summarize long-term research findings.

A significant part of the Institute's activities involves participating in and leading research grants. The past year has been particularly successful for us, as we were able to continue the existing endeavors and initiate new ones, such as RENEW, OPUS 27 and OPUS 28, LIDER 15, AMBER and OREO. Analyzing the number of the all projects that received funding in 2025, we can proudly say that the obtained funding exceeds 8 million złotys. We hope that these successes will inspire other researchers to triple their efforts to secure financing for their projects. In 2025, the foundations were laid for funding approved projects, such as OPUS 29 and a project financed under NATO.

The Antenna Design Student Club (KNPA) operating at the Institute received a rector's grant for the year 2025/2026 for the implementation of a project titled "Antenna array with adaptive beamforming for receiving signals from low Earth orbit satellites in the L-band". This is the only construction grant awarded to a scientific club from our Faculty, and the Club itself ranked 4th on the ranking list with a very high score of 91.8/100 points.

Last year, the number of PhD students exceeded 30, which provides a rich base for potential new academic staff in the future. Among the mentioned number, 6 new doctoral students joined us in 2025. In terms of didactic activities, our contributions to the Faculty operations have been strong, as usual. This includes managing multiple courses across three levels of study, including the PhD school, with main focus primarily in Electronics, Cybersecurity and Internet of Things Engineering specializations.

This Year was also full of awards, granted to our staff. The most prominent are Knight's Cross of the Order of Polonia Restituta for Ph.D. Jacek Cichocki and Golden Chalk prize granted by the Faculty students for Ph.D. Marcin Lewandowski. We extend our sincere congratulations to all awarded colleagues.

I want to thank all the colleagues working at the Institute for their involvement in our activities and hard work. We are ready for the exciting new challenges of the next year of 2026!



Professor Piotr Bilski

Warsaw, January 2026

Classification of publications presented in this Report
is in accordance with the rules in force in 2025

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1. GENERAL INFORMATION

1.1. Mission of the Institute

In defining its mission, the Institute of Radioelectronics and Multimedia Technology is amenable to contemporary needs of academia, industry, and society. Therefore, it aims at the three measurable objectives: to provide teaching of societal relevance; to seek excellence in scientific research; and to run projects meeting the international standards. Technically, we focus on the well-defined specializations: radioelectronics, multimedia, nuclear and medical electronics. These are very well perceived by our students and partners in national and international activities.

As educators, our staff performs sterling work and exhibit immense stamina. The effects are directly measurable in terms of quality and numbers of supervised diplomas. Our graduates prove competitive on the demanding job market in Poland and abroad. They find employment in telecommunication services, mobile communications, information technology, television, and also in public services. We reach further into these sectors through the successful scheme of continuing education. The offer of courses including Radioelectronics and Multimedia Technology attracts an increasing number of participants.

As researchers, we are faithful to the highest standards of the Faculty and the University. We also feel quite unique due to an extremely broad spectrum of addressed subjects, which comprise:

- In Radioelectronics

We are interested in all theoretical and practical aspects concerning transmitting and receiving parts of radio systems. As radio systems we understand radio broadcasting systems, telecommunication systems including various configurations from point-to-point to multiple input-multiple output systems as well as the radio-location and radio-navigation systems. These systems can operate in narrow band, wide band or ultra-wide band. Special attention has been recently put on reconfigurable and software-defined radio systems (incl. smart and reconfigurable antennas).

The frequency range of our interest spans from kHz range (for high efficiency energy conversion) through all ranges used in classical telecommunication up to the terahertz and optical range.

In our applied research we have a vast experience in designing up-to-date, ready to use parts of the radio systems including various types of antennas, power amplifiers, modulators and even entire TR modules for radar systems.

We also specialize in physical aspects of the propagation of electromagnetic and acoustic waves. The waves are interested in as the means of transmission of the telecommunication information but also as the means of transmitting high power and/or means of investigating the properties of materials (incl. semiconductors, ferroelectrics, graphene, composites etc.).

- In Multimedia

Multimedia at our Institute assembles various lines of research in visual and audio technology. The Multimedia branch comprises people working in two major research and teaching groups: the Multimedia Engineering Division and the Electroacoustics Division. The activities of the Multimedia Engineering Division focus on media compression, recognition, 3D modelling, augmented reality, hardware implementations for real-time video and signal processing, as well as digital processing of measurement signals. Moreover, multimedia applications based on deep neural networks have recently gained increasing attention, extending the traditional scope of research and teaching.

The Electroacoustics Division, in its research and teaching, focuses on fundamental and applied issues in acoustics, electroacoustics, design of sound systems, signal processing for audio as well as various aspects of perception of sound including noise control and its effects on people.

- In Nuclear and Medical Electronics

Nuclear and Medical Electronics assemble designing of the detectors and front-end electronics for high energy physics and neutrino experiments (e.g. AMBER, WCTE – CERN, T2K, HyperK – Japan), software and hardware developments in Magnetic Resonance Imaging (MRI), like studies of hyperpolarization (DNP) with RF and processing methods in functional and structural neuroimaging, data

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analysis in proteomics, software and hardware developments in Electrical Capacitance Tomography and Nanoparticle Magnetic Tomography.

It is also our ambition to implement the new scientific knowledge into a good engineering practice. The Institute covers the full process of technological development, from innovative ideas up to the construction of prototypes.

The Foundation for Development of Radiocommunications and Multimedia Technology plays a special role in perpetuating scientific research within our Institute and the whole Faculty. The Foundation subsidizes undergraduate and graduate scholarships. It monitors and awards the progress of young Polish researchers. Its generous support helps us face the socio-economical obstacles, and compete with commercial opportunities awaiting the young people on the open market.

1.2. Board of Directors

Director of the Institute

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Deputy Director for Research

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1.3. Organization of the Institute

The Institute of Radioelectronics and Multimedia Technology consists of the following research and teaching divisions:

- Electroacoustics Division;
- Nuclear and Medical Electronics Division;
- Radiocommunications and Radiolocation Engineering Division;
- Subterahertz Technology Division;
- Multimedia Engineering Division.

The structure of the Institute includes, Accounting Department, Supply Section.

1.3.1. Electroacoustics Division

Head of Division

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Senior academic staff

Piotr Bilski, Prof. D.Sc., Full Professor
 Piotr Bobiński, Ph.D., Assistant Professor
 Marcin Lewandowski, Ph.D., Assistant Professor
 Robert Łukaszewski, Ph.D., Assistant Professor
 Grzegorz Makarewicz, Ph.D., Assistant Professor (0.5)
 Agnieszka P. Pietrzak, Ph.D., Assistant Professor
 Krzysztof Mroczek, Ph.D., Assistant Professor
 Maciej Jasiński, Ph.D., Assistant Professor

Junior academic staff

Karolina Pondel-Sycz, M.Sc., Assistant (0,5)

Ph.D. Students

Dina Al-Daloo, M. Sc., from Oct. 2023
 Paweł Baran, M.Sc., from Oct. 2025
 Piotr Czarnecki, M.Sc., from Oct. 2019, till Sep. 2025
 Salomea Grodzicka, M.Sc., from Oct. 2019
 Bartosz Kościąg, M.Sc. from Feb. 2021
 Ary Kurniadi Irawan, M.Sc., from Oct. 2023
 Tomasz Markowski, M.Sc., from Feb. 2018
 Łukasz Popek, M.Sc., from Oct. 2023
 Bartosz Połok, M.Sc., from Oct. 2015
 Karolina Pondel-Sycz, M.Sc., from Oct. 2021
 Jakub Tkaczuk, M.Sc., from Oct. 2020, till Feb. 2025

Retired

Zbigniew Kulka, Prof. D.Sc.,
 Ewa Kotarbińska, Ph.D.,
 Andrzej Leszczyński, Ph.D.,
 Maria Tajchert, Ph.D.

The activities of the Division concern electroacoustics and digital audio techniques, including investigations, measurements and applications. They are focused on:

- fundamentals of acoustics;
- electroacoustics;
- psychoacoustics;
- digital audio;
- design and measurements of electroacoustic transducers;
- investigation and modeling of acoustic field distribution;
- noise control and active noise reduction;
- architectural and industrial acoustics;
- sound studio techniques;
- hearing protection.

Current research topics include:

- digital audio signal processing;
- low-level acoustic signals measurements and analysis;
- objective and subjective methods of sound quality evaluation;
- detection of auditory warning signals in the presence of industrial noise;
- elaboration of computation methods for acoustic field radiated in free space by surface acoustic sources and their implementation on a PC.

The other field of interest concerns fundamental and applied research associated with metrology, instrumentation and measuring systems. It is focused on design of automated computer-based measuring systems. Current research topics include:

- modern information technologies, e.g. LabVIEW, Java, XML, and modern communication technologies, e.g. the Internet, GSM, Bluetooth, ZigBee in distributed

- control and measuring systems;
- virtual instrumentation, plug-in boards for data acquisition, IEEE-488 equipment;
- artificial intelligence methods in diagnostics of analog systems;
- non-invasive methods for monitoring and analysis of electricity consumption around the end users.

The Division is equipped with an anechoic chamber and sound studio with two control rooms.

1.3.2. Nuclear and Medical Electronics Division

Head of Division

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Senior academic staff

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 Krzysztof Zaremba, Prof. D.Sc., Full Professor
 Piotr Bogorodzki, Prof. D.Sc., Full Professor
 Waldemar Smolik, Prof. D.Sc., Full Professor
 Grzegorz Domański, Ph.D., Assistant Professor
 Bogumił Konarzewski, Ph.D., Didactic Assistant Professor
 Robert Kurjata, Ph.D., Assistant Professor
 Dariusz Radomski, Ph.D., Research Assistant Professor
 Tymon Rubel, Ph.D., Assistant Professor
 Andrzej Rychter, Ph.D., Assistant Professor
 Damian Wanta, Ph.D., Assistant Professor
 Marcin Ziembicki, Ph.D., Assistant Professor

Junior academic staff

Krzysztof Dygnarowicz, M. Sc., Assistant, from Apr. '25, (0,5 till Mar. '25)
 Kamil Lipiński, M. Sc., Assistant (0,5)
 Mateusz Midura, M. Sc., Assistant (0,25), (from Jan. '25)
 Wojciech Obrębski, M.Sc., Assistant (0.5)
 Michał Wieteska, M.Sc., Assistant (0.5)
 Przemysław Wróblewski, M.Sc., Assistant
 Andrzej Wasilewski, Worker

Ph.D. students

Krzysztof Dygnarowicz, M.Sc., from Feb. 2021
 Mikhail Ivanenko, M.Sc., from Oct. 2023
 Kamil Lipiński, M.Sc., from Oct. 2019, till Sep. 2025
 Mateusz Midura, M.Sc., from Oct. 2019
 Michał Nurek, M.Sc., from Oct. 2024
 Katarzyna Orzechowska, M.Sc., from Oct. 2019, till Sep. 2025
 Ziemowit Pietrucha, M.Sc., from Oct. 2025
 Bartosz Piotrowski, M.Sc., from Feb. 2025
 Przemysław Wróblewski, M.Sc., from Oct. 2021

Retired

Piotr Brzeski, Ph.D.
 Tomasz Olszewski, M.Sc.
 Zdzisław Pawłowski, Prof. D.Sc.,
 Ewa Piątkowska-Janko, Ph.D.,
 Roman Szabatin, Ph.D.

The research and teaching activities carried out in the Nuclear and Medical Electronics Division are concentrated on two areas: biomedical engineering and nuclear electronics. Research in the interdisciplinary area of biomedical

engineering covers a broad range of topics and integrates sophisticated electronics and information technology with elements of medical knowledge. The activity in the area of nuclear engineering is concentrated on the design of electronics systems and data processing software for high energy physics experiments. The Division's research is focused on the following topics:

- nuclear medicine (emission tomography: SPECT, PET);
- magnetic resonance imaging (MRI), functional MRI, advanced applications of MRI;
- quantitative computer-aided tomography;
- tomographic dynamic studies;
- process tomography, impedance tomography;
- analogue and digital radiography;
- medical image processing and recognition;
- methods and instrumentation for electrocardiography;
- medical applications of isotope techniques;
- telemedicine;
- design of apparatus and software for high energy physics experiments;
- data analysis in genetics and proteomics;
- mathematical modeling of physiological and disease processes.

Areas of recent studies include:

- advanced applications of MRI and CT imaging systems, covering: dynamic scanning protocols, a new methodology and instrumentation for functional MRI, fMRI image analysis methods;
- a new contrast media for MRI: functional lung imaging with hyper-polarized agents;
- multi-modal imaging of topographic, tomographic and functional studies in medicine;
- electrical instability of heart study research, high resolution ECG systems;
- digital structural radiography, modeling of radiographic imaging systems;
- optical tomography applications in medicine;
- algorithms for image reconstruction for electrical and process tomography;
- construction of capacitance tomographs and sensors for medical and industrial applications;
- study of a bioelectrical activity of a pregnant uterus and using EHG for telemetric monitoring of upcoming labor;
- application of nonlinear predictive algorithms to control of insulin dosing in diabetic patients;
- algorithms for the data analysis in genomics and proteomics;
- characterization and modeling of photosensor for high-energy physics and astronomy experiments;
- development of detectors, front-end electronics, and test devices for high energy physics experiments;
- applications of "soft-computing" methods.

1.3.3. Radiocommunications and Radiolocation Engineering Division

Head of Division

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Senior academic staff

Józef Modelski, Prof. D.Sc., Full Professor
 Wojciech Wojtasiak, D.Sc., Associate Professor
 Jacek Cichocki, Ph.D., Didactic Assistant Professor (0,4)
 Vitomir Djaja-Joško, Ph.D., Assistant Professor
 Daniel Gryglewski, Ph.D., Assistant Professor

Wojciech Kazubski, Ph.D., Assistant Professor
 Jerzy Kołakowski, Ph.D., Assistant Professor
 Marcin Kołakowski, Ph.D., Assistant Professor
 Przemysław Korpas, Ph.D., Assistant Professor
 Sebastian Kozłowski, Ph.D., Assistant Professor
 Karol Kuczyński, Ph.D., Assistant Professor
 Krzysztof Kurek, Ph.D., Assistant Professor
 Przemysław Miazga, Ph.D. Didactic Assistant Professor
 (till Sep. 2025; 0,75 from Oct. 2025)
 Mirosław Mikołajewski, Ph.D., Assistant Professor
 Tomasz A. Miś, Ph.D., Assistant Professor (0,25 till Oct.
 2025)
 Dawid Rosołowski, Ph.D., Assistant Professor

Junior academic staff

Bartosz Kościug, M.Sc., Assistant (0.5), (from Apr. '25)

R&D Engineer

Dariusz Kołodziej, M.Sc., Support Engineer (0.5)

Technical staff

Mirosław Lubiejewski, Foreman (0.5 till Apr. '25)

Ph.D. students

Łukasz Nowicki, M.Sc., from Oct. 2021
 Marcin Wiśniewski, M.Sc., from Oct. 2021

Retired

Jan Ebert, Prof. D.Sc.,
 Wojciech Gwarek, Prof. D.Sc.,
 Mirosław Lubiejewski, from May '25
 Stanisław Rosłonec, Prof. D.Sc.
 Tomasz Kosilo, Ph.D.,
 Karol Radecki, Ph.D.
 Henryk Chaciński, M.Sc.

The Radiocommunications and Radiolocation Engineering Division conducts scientific and applied research around microwave theory and techniques, radio communication systems and networks, radar systems, and measurement techniques in the field of microwaves and millimeter waves. This includes the subjects of computer-aided design and signal processing. Specific research topics included:

- radiocommunication systems and networks – cellular networks, satellite systems and broadband access networks, and propagation channel analysis and modeling,
- Internet of Things technology and applications – methodologies for the antenna design and embedded software for the Single Board Computer-based systems,
- UWB – wireless ultra-wideband systems – methods and systems for communication and localization,
- re-configurable and software-defined radio systems,
- design of front-ends for wireless systems with power amplifiers linearized using signal processing such as digital pre-distortion techniques,
- design of transmitter/receiver modules for radar applications,
- development of high-power high-frequency stability sources for microwave heating,
- methods of synthesis and computer-aided design of passive and active microwave circuits and devices (couplers, power combiners and dividers, switches, transistor circuits, oscillators, synthesizers, modulators, amplifiers) and microwave semiconductor device modelling,

- design of accurate Q-Factor determination equipment applicable in material characterization using resonant techniques,
- development of high-efficiency resonant power amplifiers (class D, DE, E, F and G), linear wide-band HF amplifiers, high-power amplitude modulators, high-efficiency power supplies, power factor correctors, and high-efficiency AC-DC and DC-DC converters.

1.3.4. Subterahertz Technology Division

Head of Division

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Senior academic staff

Yevhen Yashchyshyn, Prof. D.Sc., Full Professor
 Krzysztof Derzakowski, D.Sc., Associate Professor (till Jul. 28, 2025; 0,5 from Jul. 29, 2025)
 Paweł Kopyt, D.Sc., Associate Professor
 Bartłomiej Salski, D.Sc., Associate Professor
 Paweł Bajurko, Ph.D., Assistant Professor
 Grzegorz Bogdan, Ph.D., Assistant Professor
 Jerzy Cuper, Ph.D., Assistant Professor (0,5), (from Jun. '25)
 Konrad Godziszewski, Ph.D., Assistant Professor
 Maciej Kucharski, Ph.D., Assistant Professor (from Nov. '25)
 Adam Pacewicz, Ph.D., Assistant Professor
 Jakub Sobolewski, Ph.D., Assistant Professor
 Maciej Sypniewski, Ph.D., Didactic Assist. Professor (0.5) (till Sep. '25)

Junior academic staff

Jerzy Cuper, Ph.D., Assistant (0.5), (till May, '25)
 Piotr Czekala, M.Sc., Assistant (0.5), (from Mar. '25)
 Mateusz Kryszicki, M.Sc., Research Assistant

Ph.D. students

Piotr Baprawski, M.Sc., from Oct. 2025
 Chongwen Zhu, M.Sc., from Feb. 2025
 Piotr Czekala, M.Sc., from Oct. 2021, till Sep. 2025
 Maciej Soszka, M.Sc., from Oct. 2018
 Minyu Zhang, M. Sc., from Oct. 2023

Retired

Maciej Sypniewski, Ph.D., from Oct. 2025

The most important research topics of the Division include analysis, development and investigation of:

- sub-terahertz technology;
- antenna measurements;
- antenna design and fabrication;
- accurate, repeatable measurements on-wafer up to 500 GHz;

This includes of measurements in the wide frequency range thanks to a unique set consisted of four-port PNA-X Vector Network Analyzers from Agilent Technologies and six pairs of Frequency Extenders for measurements up to 500 GHz. Each pair of Frequency Extenders is designed for single band of standard rectangular waveguide and allows to measure full two-port scattering matrix (amplitude and phase) with a very high dynamic range (above 100 dB). The wide frequency range and large number of measurement points (up to 32001 points) enables further

processing of the measured data in the time domain. This set is used for measurements of antenna parameters, and is a part of the quasi-optical setup for the characterization of materials in the millimeter-wave and sub-terahertz ranges.

The research and teaching activities are also performed at the Antenna and Sub-terahertz Technology laboratory. The laboratory was partly funded by European Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG) as a part of the Faculty Research Centre FOTEH (Photonics and Terahertz Technologies). The Antenna Laboratory enables research on spatial distributions of the electromagnetic field up to sub-terahertz range to develop and study of antennas, characterization of materials and designing of communication, imaging and radar systems.

The research topics of the Laboratory of Field Methods in the Microwave and Sub-Terahertz Techniques include characterization of low-loss dielectric materials and conductive materials in the range 1–110 GHz by various resonance methods, including the use of a Fabry-Perot open resonator, and ferromagnetic materials in the range 1–30 GHz by resonance methods, electromagnetic modeling of problems related to microwave heating, propagation of electromagnetic waves in the atmosphere, electromagnetic modeling and measurements of the effective reflection surface of absorption panels, designing frequency synthesizers operating in the microwave and millimeter bands, and frequency multipliers operating in the microwave and millimeter bands.

1.3.5. Multimedia Engineering Division

Head of Division

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 Grzegorz Pastuszak, D.Sc., Associate Professor
 Kajetana Snopek, D.Sc., Associate Professor
 Andrzej Buchowicz, Ph.D., Assistant Professor
 Xin Chang, Ph.D., Assistant Professor
 Grzegorz Galiński, Ph.D., Assistant Professor
 Krystian Ignasiak, Ph.D., Didactic Assistant Professor
 Paweł Mazurek, Ph.D., Assistant Professor
 Jakub Wagner, Ph.D., Assistant Professor

Junior academic staff

Grzegorz Gwardys, M.Sc., Assistant (0.5)

Technical staff

Tomasz Krzymień, M.Sc., Administrative Clerk for Health and Safety

Ph.D. students

Grzegorz Czarnecki, M.Sc., from Oct. 2025
 Michał Daniluk, M.Sc., from Oct. 2020
 Szymon Kruszewski, M.Sc., from Oct. 2022, till Dec. 2025
 Michał Salamonowicz, M.Sc., from Oct. 2024

Retired

Andrzej Miękina, Ph.D.,
 Marek Rusin, Ph.D.

The scientific and teaching activities of the Division cover a broad range of modern multimedia technologies — from fundamental concepts to the most advanced and rapidly developing areas. These include digital image processing in multimedia applications, high- and ultra-high-definition (HD and UHD) video processing, deep learning using neural networks, as well as hardware implementations for real-time video and signal processing. Particular emphasis is placed on multimedia-oriented topics such as compression, pattern recognition, 3D modelling, hardware technologies (FPGA and ASIC), and software technologies (Java, Python). The Division's activities also include the development of coherent methodologies for processing measurement data, covering measurand reconstruction, system calibration, and uncertainty evaluation across radar, optical, and acoustic sensing systems.

The Division consists of three research groups:

- Deep Neural Networks in Digital Media;
- Hardware Algorithms in Digital Media;
- Measurement Data Processing.

1.4. Evening Studies and Continuing Education

1.4.1. Postgraduated Studies “Deep Neural Networks – Application in Digital Media”

Head

Władysław Skarbek, Prof. D.Sc., Full Professor.

Secretariat

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1.5. Other Institute's Units

1.5.1. Accounting Department

Head

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Staff

Zdzisława Fenikowska, M.A., Accounting Clerk, till Jul. '25
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Marzena Roguska, M.A., Accounting Clerk from Sep. '25
room: 421, phone: +48 22 2347743
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[Edu4], [Edu5], [Edu46], [Edu65], [Edu78], [Edu95], [Pro2], [Pro12], [Pro20], [Pro26], [Pro28], [Pro29], [BSc9].

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[Edu20], [Edu25], [Edu35], [Edu50], [Pro9], [MSc2], [MSc5], [MSc14], [MSc21], [BSc50], [BSc57], [BSc83], [BSc85], [Pub15], [Pub24], [Pub49], [Pub78], [Pub81], [Pub82], [Pub102].

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[Edu1], [Edu52], [Edu72], [Edu77], [Pro9], [BSc4], [BSc8], [BSc14], [BSc18], [BSc19], [BSc43], [BSc44], [BSc45], [BSc53], [BSc73], [Pub49], [Pub81].

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[Edu32], [Edu44], [Edu53], [Edu75], [Edu95], [Edu97], [Pro2], [Pro23], [Pro25], [BSc34], [BSc64], [Pub35], [Pub68].

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[Edu85], [Edu93], [Edu102], [Pro13], [Pub31], [Pub36], [Pub50], [Pub53], [Pub99], [Pub100].

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[Edu9], [Edu12], [Edu27], [Edu38], [Edu43], [Edu83], [Edu87], [Edu91], [Edu92], [Edu108], [Edu132], [Pro1], [Pro3], [Pro5], [Pro9], [BSc13], [BSc24], [BSc74], [BSc75], [Pub11], [Pub12], [Pub13], [Pub14], [Pub49], [Pub81].

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[Edu6], [Edu37], [Edu47], [Edu61], [Edu78], [Edu80], [Pro7], [Pub21], [Pub26], [Pub70].

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[Edu18], [Edu39], [Edu78], [Edu121], [Pub20].

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[Edu22], [Edu29], [Edu40], [Edu48], [Edu51], [Edu56], [Edu85], [Edu96], [Edu111], [Pro21], [MSc10], [MSc12], [MSc18], [BSc6], [BSc32], [BSc36], [BSc42], [BSc68], [BSc72], [BSc78], [Pub31], [Pub36], [Pub37], [Pub53].

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[Edu9], [Edu12], [Edu13], [Edu38], [Edu43], [Edu83], [Edu87], [Edu108], [Pro1], [Pro3], [Pro5], [BSc12], [BSc20], [BSc31], [BSc59], [BSc60], [BSc87], [Pub11], [Pub12], [Pub13], [Pub14].

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[Edu44], [Edu53], [Edu65], [Edu74], [Edu78], [Edu82], [Edu95], [Edu116], [Edu121], [Edu132], [Pro2], [Pro28], [BSc23], [BSc58], [BSc81], [BSc88], [Pub18], [Pub35], [Pub60].

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[Edu14], [Edu28], [Edu30], [Edu34], [Edu52], [BSc41], [Pub67].

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[Edu2], [Edu11], [Edu13], [Edu41], [Edu60], [Edu64], [Edu76], [Edu88].

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[Edu12], [Edu13], [Edu117], [Edu133], [Pro9], [BSc2], [BSc22], [BSc47], [BSc52], [BSc69], [BSc89], [Pub49], [Pub63], [Pub81], [Pub89].

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[Edu30], [Edu67], [Edu68], [Edu75], [Edu78], [Edu79], [MSc23], [BSc7], [Pub40], [Pub65], [Pub76].

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[Edu6], [Edu37], [Edu44], [Edu45], [Edu50], [Edu80], [Edu106], [Edu115], [Edu116], [Edu121], [Pro6], [Pro7], [BSc54], [Pub21], [Pub26], [Pub70], [Pub90].

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[Edu23], [Edu32], [Edu37], [Edu45], [Edu47], [Edu74], [Edu75], [Edu79], [Edu97], [Edu121], [Pro6], [Pro7], [BSc3], [BSc39], [Pub21], [Pub26], [Pub64], [Pub70], [Pub72], [Pub73], [Pub90].

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[Edu3], [Edu7], [Edu8], [Edu22], [Edu40], [Edu51], [Edu55], [Edu56], [Edu66], [Edu84], [Edu96], [Edu111], [BSc77].

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Printing Works ('19-); Member of the Scientific Council for Automatic Control, Electronics, Electrical Engineering and Space Technologies, WUT ('19, '20-'24). [Edu34], [Edu94], [Edu121], [Pro10], [Pub74], [Pub85], [Pub91].

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[Edu31], [Edu44], [Edu62], [Edu74], [Edu75], [Edu79], [Edu82], [Edu86], [Edu114], [Edu116], [Edu121], [Edu132], [BSc40], [Pub27], [Pub75].

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[Edu11], [Edu30], [Edu53], [Edu65], [Edu68], [Edu78], [Edu114], [Edu116], [Edu120], [Edu121], [BSc33].

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[Edu12], [Edu20], [Edu35], [Edu52], [Edu75], [Edu116], [Edu121], [BSc15], [BSc38], [BSc71], [BSc84].

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Tutorial assistance of Space Engineering Student Scientific Group ('04-); Member of the Committee on Space Research of the Polish Academy of Sciences ('07-).

[Edu53], [Edu78], [Edu107], [Edu112], [Edu113], [Edu114], [Edu116], [Edu121], [Pub30].

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[Edu10], [Edu21], [Edu40], [Edu48], [Edu104],

[Edu119], [Pro1], [Pro3], [Pro4], [Pro5], [Pro8], [MSc19], [BSc10], [BSc17], [BSc27], [BSc37], [BSc46], [BSc56], [Pub2], [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub16], [Pub17].

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[Edu9], [Edu43], [Edu52], [Edu71], [Edu82], [Edu90], [Edu117], [Pro9], [BSc62], [Pub49], [Pub81].

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[Edu1], [Edu77], [Edu114], [Edu116], [Edu121], [BSc65], [Pat1].

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[Edu12], [Edu13], [Edu19], [Edu52], [Edu72], [Edu133], [Pro9], [BSc51], [Pub49], [Pub81].

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[Edu22], [Edu40], [Edu110], [Pro1], [Pro3], [Pro5], [Pro8], [Pub16], [Pub17].

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[Edu12], [Edu33], [Edu55], [Edu57], [Edu58], [Edu82], [Edu105], [Edu108], [Edu132], [Pro9], [BSc86], [Pub29], [Pub49], [Pub81].

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[Edu23], [Edu32], [Edu62], [Edu97].

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[Edu20], [Edu35], [Edu50], [Pub77], [Pub93].

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[Edu18], [Edu24], [Edu26], [Edu35], [Edu36], [Pub43].

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[Edu43], [Edu50], [Edu87], [Pro1], [Pro3], [Pro5], [Pub11], [Pub12], [Pub13], [Pub14], [Pub46].

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[Edu12], [Edu18], [Edu44], [Edu67], [Edu70], [Edu116], [Edu118], [Edu121], [Pub67].

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Member of CLEO ('14-), Reviewer of journals: *IEEE Trans. on Antennae and Propag.* ('10-), *Micro. Theory and Techniques* ('10-), *IEEE Micro. & Wireless Compon. Letters* ('12-); Member of Sect. of Microwaves and Radiolocation of the Electronics and Telecommunication Comm. of the Polish Academy of Sciences ('15-); Founder and President of the Board Council of the Microwave and Radiolocation Foundation ('15-); Tutorial assistance of Electromagnetic Modelling Students Scientific Group ('16-); Member of the Scientific Council for Automatic Control, Electronics, Electrical Engineering and Space Technologies, WUT ('19, '20-'24).
[Edu34], [Edu62], [Pro10], [Pro11], [Pub57], [Pub74], [Pub87], [Pub91], [Pub97], [Pub98], [Pub99], [Pub100], [Pub106], [Pub107], [Pub108], [Pub109].

Władysław Skarbek

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M.Sc. ('72), Ph.D. ('77), D.Sc. ('94); Prof. Title ('03); information technology, image processing, digital media; **Full Professor**.
Member of the Editorial Board of *Fundamenta Informaticae* ('03-), *International Journal of Electronics and Telecommunication* ('13-); Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting ('01).
[Edu81], [Edu89], [Edu103], [Edu122], [Edu123], [Edu124], [Edu125], [Edu126], [MSc9], [MSc13].

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M.Sc. ('91), Ph.D. ('97), D.Sc. ('14), Prof. Title ('25); computer engineering, biomedical engineering, computer tomography; **Associate Professor**, Nuclear and Medical Electronics Division; Head of Division ('24-); Head of the Laboratory of Information Acquisition and Processing Systems in the Nuclear and Medical Electronics Division ('15-); Member of the Faculty Council Committee on Education ('16-); Member of the Scientific Council for Biomedical Engineering, WUT ('19, '20-'24); Member of the Steering Committee - *Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System* - BIO10 Programme; Member of the Education

Committee of the Council of the Faculty of Electronics and Information Technology; Member of the Scientific Council of the Discipline of Biomedical Engineering; Head of the field of study "Biomedical Engineering" at the Faculty of Electronics and Information Technology; Member of the WUT Doctoral School Council.
[Edu85], [Edu100], [Pro22], [BSc25], [Pub25], [Pub36], [Pub37], [Pub56], [Pub71], [Pub84].

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M.Sc. ('91), Ph.D. ('02), D.Sc. ('14); signal and system theory and applications; **Associate Professor**, Multimedia Engineering Division.
Head of the Multimedia Engineering Division ('20-); Head of the "WUT Eagle School" Project at the Faculty of Electronics and Information Technology (POWER Program ('19-); Head of the Scholarship Commission of the Foundation for the Development of Radiocommunications and Multimedia Technology ('21-); Member of the Scientific Council for Technical Informatics and Telecommunications, WUT ('21-24); Member of the Steering Committee - *Intelligent Decision Support System based on the Algorithmic Image Analysis in the Operations of the Justice System* - BIO10 Programme ('20-22); Expert of the Telecommunications Section of KEIT PAS ('22-23); Member of the University Disciplinary Committee for Academic Teachers, WUT (2024-2028); Editor in chief (with W.Wojtasiak and G. Pastuszak) of Special Issue Electronics (mdpi) – "Wireless Communication and Multimedia Technology – Theory and Applications" ('22); Coordinator of the 5th edition of the Engineer 4 Science 2022 engineering diploma thesis competition at FEIT, WUT (Biomedical Engineering) ('22); Session Chair - *23rd Foundation Scholarship Holders Seminar*;
[Edu16], [Edu43], [Edu58], [Edu68], [Edu69], [Edu74], [Edu75], [Pub51].

Jakub Sobolewski

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M.Sc. ('16), Ph.D. ('23); microwave technique; **Assistant Professor**, Sub-Terahertz Technology Division.
[Edu4], [Edu5], [Edu78], [Edu95], [Pro2], [Pro12], [Pro20], [Pro25], [Pro26].

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M.Sc. ('83), Ph.D. ('96); microwave technique; **Didactic Assistant Professor**, Sub-Terahertz Technology Division.
[Edu62], [Edu86], [Edu114], [Edu121].

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M.Sc. ('11), Ph.D. ('20); measurement and instrumentation, **Assistant Professor**, Multimedia Engineering Division.
[Edu12], [Edu16], [Edu58], [Edu68], [MSc7], [BSc28], [BSc79], [Pub54].

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M.Sc. ('84), Ph.D. ('98), D.Sc. ('15); microwave technique; **Associate Professor**, Radiocommunications

and Radiolocation Engineering Division, Head of Division ('20-).

Member of IEEE ('96-); Member of the Scientific Council for Automatic Control, Electronics and Electrical Engineering, WUT ('19); Member of the Scientific Council for Information and Communications Technology WUT ('20-'24).

[Edu27], [Edu28], [Edu30], [Edu67], [Edu116], [Pro24], [Pro27], [MSc8], [Pub75], [Pub79].

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M.Sc. ('16), Ph.D. ('23); medical and nuclear engineering; **Assistant Professor**, Nuclear and Medical Electronics Division.

[Edu1], [Edu7], [Edu8], [Edu17], [Edu59], [Edu85], [Edu100], [Edu111], [Pro19], [Pub25], [Pub36], [Pub37], [Pub56], [Pub71], [Pub84].

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M.Sc. ('79), Ph.D. ('86), D.Sc. ('06), Prof. Title ('16); telecommunications and electronics; **Full Professor**, Sub-Terahertz Technology Division.

Head of Division ('20-24), Deputy Director for Research ('24-), Senior Member of IEEE ('10-); Member of the Committee on Electronics and Telecommunications PAN ('19-24); Member of the TPC of the International Conferences: TCSET ('98-), CADSM ('00-), IMNE ('2018 -); Reviewer of the IEEE Trans. on MTT ('04-), IEEE Trans on AP ('06-) and IEEE Microwave and Wireless Components Letters ('04-); Member of Editorial Board and Reviewer of Radioelectronics and Communications Systems ('09-); Member of the Microwave and Radiolocation Section of the Electronics and Telecommunication Committee of the PAN ('07-); Member of the Programme Committee of the National Conference of Radiocommunications and Broadcasting ('09-); Member of the Faculty Council ('16-); Member of the Scientific Council of the Discipline of Automatic Control, Electronics, Electrical Engineering and Space Technologies, WUT ('19, '20-'24).

[Edu4], [Edu5], [Edu78], [Edu95], [Pro2], [Pro12], [MSc11], [Pub18], [Pub28], [Pub32], [Pub33], [Pub35], [Pub47], [Pub55], [Pub59], [Pub60], [Pub61], [Pub68].

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M.Sc. ('81), Ph.D. ('90), D.Sc. ('03), Prof. Title ('12), biomedical engineering, nuclear electronics; **Full Professor**, Rector of the WUT ('20-); Nuclear and Medical Electronics Division.

Member of CERN ('89-); Member of the Programme Board of the Institute of Applied Researches, WUT ('14-); Member of the Editorial Advisory Board of the *Polish Journal of Medical Physics and Engineering* ('07-), Deputy Chairman of the Board of the Center for Imaging and Biomedical Research ('06-); Member of the Scientific Board of the Automotive Industry Institute ('17-); Member of the Scientific Board of the Institute of the Nuclear Chemistry and Technology ('17-); Member of the Scientific Council for Automatic Control, Electronics and Electrical Engineering, WUT ('19-); Head of the Committee on Education, the Conf. of Rectors of Academic Schools in Poland, ('20-); Member of the Plan for Work and Development Council (21-).

[Pro1], [Pro3], [Pro4], [Pro5], [Pro8], [Pub3], [Pub16], [Pub17].

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M.Sc. ('02), Ph.D. ('20); nuclear and medical electronics; **Assistant Professor**, Nuclear and Medical Electronics Division.

[Edu22], [Edu29], [Edu40], [Edu48], [Pro1], [Pro3], [Pro4], [Pro5], [Pro8], [Pro16], [MSc4], [Pub2], [Pub3], [Pub4], [Pub5], [Pub6], [Pub7], [Pub8], [Pub9], [Pub10], [Pub16], [Pub17].

Jan Żera

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e-mail: jan.zera@pw.edu.pl

M.Sc. ('76), Ph.D. ('90), D.Sc. ('04); acoustics, Prof. Title ('17); electroacoustics, psychoacoustics, noise control; **Full Professor**, Electroacoustics Division, Head ('13).

Member of Polish Acoustical Society ('78-), European Acoustics Association ('01-), Acoustical Society of America ('90-), Audio Engineering Society ('11-), Member of Committee on Acoustics Polish Academy of Sciences ('24-), Member of the Technical Committees of the Polish Committee for Standardization ('09-); Vice-President of the Scientific Council of Central Institute for Labour Protection – National Research Institute ('21-), Member of Editorial Board of Archives of Acoustics.

[Edu54], [Edu99], [Edu131], [Pub63], [Pub89], [Pub111].

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e-mail: przemyslaw.wroblewski@pw.edu.pl

2.3. Ph.D. students (the third-level studies)**Ph.D. Student (tutor)**

Dina Al.-Daloo, M.Sc.	(P. Bilski)
Piotr Baprawski, M.Sc.	(B. Salski)
Paweł Baran, M.Sc.	(J. Żera)
Piotr Czekala, M.Sc.	(B. Salski)
Grzegorz Czarnecki	(G. Pastuszek)
Piotr Czarnecki, M.Sc. *)	(P. Bilski)
Michał Daniluk, M.Sc. *)	(G. Pastuszek)
Krzysztof Dygnarowicz, M.Sc.	(J. Marzec)
Salomea Grodzicka, M.Sc.	(P. Bilski)
Ary Kurniadi Irawan, M.Sc.	(P. Bilski)
Mikhail Ivanenko, M.Sc.	(W. Smolik)
Bartosz Kościug, M.Sc.	(P. Bilski)
Szymon Kruszewski, M.Sc.	(R. Z. Morawski)
Kamil Lipiński, M.Sc.	(P. Bogorodzki)
Tomasz Markowski, M. Sc. *)	(P. Bilski)
Mateusz Midura, M.Sc.	(W. Smolik)
Łukasz Nowicki, M.Sc. *)	(W. Wojtasiak)
Michał Nurek, M.Sc.	(J. Marzec)
Katarzyna Orzechowska, M.Sc.	(K. Zaremba)
Ziemowit Pietrucha, M.Sc.	(P. Bogorodzki)
Bartosz Piotrowski, M.Sc.	(J. Marzec)
Karolina Pondel-Sycz, M.Sc.	(P. Bilski)
Bartosz Połok, M.Sc.	(P. Bilski)
Łukasz Popek, M.Sc. *)	(P. Bilski)
Michał Salamonowicz	(W. Skarbek)
Maciej Soszka, M.Sc. *)	(Y. Yashchyshyn)
Jakub Tkaczuk, M.Sc. *)	(P. Bilski)
Marcin Wiśniewski, M.Sc. *)	(W. Wojtasiak)
Przemysław Wróblewski, M.Sc.	(W. Smolik)
Minyu Zhang, M.Sc.	(Y. Yashchyshyn)
Chongwen Zhu, M.Sc.	(Y. Yashchyshyn)

*) implementation doctorate

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Aleksandra Jefimowicz, M.A., Accounting Clerk
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Zdzisława Fenikowska, M.A., Accounting Clerk (till Jul. '25)
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Dariusz Kołodziej, M.Sc., Research Support Eng.
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Tomasz Krzymień, M.Sc., Administrative Clerk for Health and Safety

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Andrzej Laskowski, Worker
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e-mail: andrzej.laskowski@pw.edu.pl

Mirosław Lubiejewski, Foreman (0.5)
room: 532, phone: +48 22 2347633
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Marzena Roguska, M.A., Accounting Clerk (from Sep. '25)
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Beata Rosłon, Accounting Clerk
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Marta Rudnicka, Senior Administrative Clerk
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Anna Smenda, Administrative Clerk
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Full Professors



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Piotr Bogorodzki
Prof. D.Sc.



Janusz Marzec
Prof. D.Sc.



Józef W. Modelski
Prof. D.Sc.



Roman Z. Morawski
Prof. D.Sc.



Władysław Skarbek
Prof. D.Sc.



Waldemar Smolik
Prof. D.Sc.



Yevhen Yashchyshyn
Prof. D.Sc.



Krzysztof Zaremba
Prof. D.Sc.



Jan Żera
Prof. D.Sc.



Krzysztof Derzakowski
D.Sc.



Paweł Kopyt
D.Sc.

Associate Professors



Grzegorz Pastuszak
D.Sc.



Bartłomiej Salski
D.Sc.



Kajetana Snopek
D.Sc.

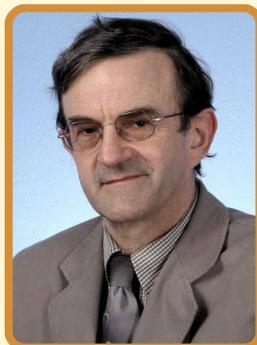


Wojciech Wojtasiak
D.Sc.

Professors Emeriti



Jan T. Ebert
Prof. D.Sc.



Wojciech K. Gwarek
Prof. D.Sc.

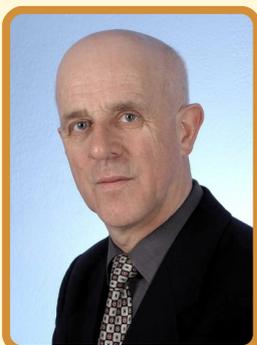


Zbigniew Kulka
Prof. D.Sc.



Zdzisław Pawłowski
Prof. D.Sc.

Assistant Professors



Stanisław Rosłonec
Prof. D.Sc.



Paweł Bajurko
Ph.D.



Piotr Bobiński
Ph.D.



Grzegorz Bogdan
Ph.D.



Andrzej Buchowicz
Ph.D.



Xin Chang
Ph.D.



Jacek Cichoński
Ph.D.



Jerzy Cuper
Ph.D.



Vitomir Djaja-Joško
Ph.D.



Grzegorz Domański
Ph.D.



Grzegorz Galiński
Ph.D.



Konrad Godziszewski
Ph.D.

Assistant Professors



Daniel Gryglewski
Ph.D.



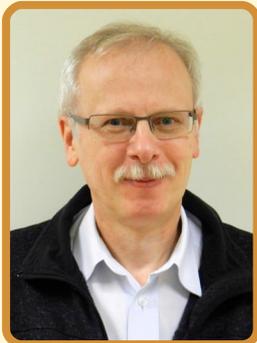
Krystian Ignasiak
Ph.D.



Maciej Jasiński
Ph.D.



Wojsiech Kazubski
Ph.D.



Jerzy Kołakowski
Ph.D.



Marcin Kołakowski
Ph.D.



Bogumił Konarzewski
Ph.D.



Przemysław Korpas
Ph.D.



Sebastian Kozłowski
Ph.D.



Maciej Kucharski
Ph.D.



Karol Kuczyński
Ph.D.



Krzysztof Kurek
Ph.D.



Robert Kurjata
Ph.D.



Marcin Lewandowski
Ph.D.



Robert Łukaszewski
Ph.D.



Grzegorz Makarewicz
Ph.D.

Assistant Professors



Paweł Mazurek
Ph.D.



Przemysław Miazga
Ph.D.



Mirosław Mikołajewski
Ph.D.



Tomasz A. Miś
Ph.D.



Krzysztof Mroczek
Ph.D.



Adam Pacewicz
Ph.D.



Agnieszka Pietrzak
Ph.D.



Dariusz Radomski
Ph.D.



Dawid Rosołowski
Ph.D.



Tymon Rubel
Ph.D.



Andrzej Rychter
Ph.D.



Jakub Sobolewski
Ph.D.



Maciej Sypniewski
Ph.D.



Jakub Wagner
Ph.D.



Damian Wanta
Ph.D.



Marcin Ziembicki
Ph.D.

Assistants



Piotr Czekala
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Krzysztof Dygnarowicz
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Grzegorz Gwardys
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Mateusz Krywicki
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Kamil Lipiński
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Mateusz Midura
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Wojciech Obrębski
M.Sc.



Karolina Pondel-Sycz
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Michał Wieteska
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Przemysław Wróblewski
M.Sc.

R&D Engineer



Dariusz Kołodziej
M.Sc., R&D Eng.

Technical Staff



Marcin Karpisz
B.Sc.



Tomasz Krzymień
Foreman

Technical Staff



Andrzej Laskowski
Worker



Mirosław Lubiejewski
Foreman



Andrzej R. Wasilewski
Worker

Administrative Staff



Karolina Bąk
M.A., Adm. Clerk for Research



Izabela Sierankowska
Adm. Clerk for Teaching



Monika Feluś
M.A., Adm. Clerk for Teaching



Zdzisława Fenikowska
M.A., Accounting Clerk



Aleksandra Jefimowicz
M.A., Accounting Clerk



Marzena Roguska
M.A., Accounting Clerk



Beata Rosłon
Accounting Clerk



Marta Rudnicka
Senior Adm. Clerk



Anna Smenda
Adm. Clerk

3. TEACHING ACTIVITIES

(the summer semester of the academic year 2024/2025 and the winter semester of the academic year 2025/2026)

3.1. Regular studies – main fields of study:

Electronics	[Edu2]	30h/sem; P. Bobiński.
Specialization: Electronics and Computer Science in Medicine		
Head		
Andrzej Rychter, Ph.D., Assistant Professor room: 64, phone: +48 22 2347916 e-mail: andrzej.rychter@pw.edu.pl	[Edu3]	<i>Algorithms and Programming 1</i> (Algorytmy i programowanie 1 - APRO1); 30 h/sem.; K. Ignasiak (Faculty coordinator: the Institute of Telecommunications).
Computer Science	[Edu4]	<i>Analysis of Measurement Data in Medicine</i> (Analiza danych pomiarowych w medycynie – ADP); 45 h/sem.; B. Konarzewski.
Specialization: Computer Science in Multimedia	[Edu5]	<i>Antennas</i> (Anteny – ANT); 45 h/sem.; Y. Yashchyshyn.
Head	[Edu6]	<i>Antennas</i> (Anteny – EANTE); 54 h/sem.; Y. Yashchyshyn (English-medium studies).
Grzegorz Pastuszek, D.Sc., Associate Professor room: 451, phone: +48 22 2347840 e-mail: grzegorz.pastuszek@pw.edu.pl	[Edu7]	<i>Basics of Cellular Systems</i> (Podstawy systemów komórkowych – PSK); 45h/sem.; J. Kołakowski.
Biomedical Engineering	[Edu8]	<i>Basics of Medical Imaging</i> (Podstawy obrazowania medycznego – POMED); 45 h/sem.; P. Brzeski.
Specialization: Biomedical Apparatus	[Edu9]	<i>Basics of Medical Imaging Techniques</i> (Podstawy technik obrazowania w medycynie – PTOM); 60 h/sem.; P. Brzeski, M. Orzechowski.
Head	[Edu10]	<i>Basics of Medical Imaging Techniques</i> (Podstawy technik obrazowania w medycynie – PTOM); 60 h/sem.; P. Brzeski, M. Orzechowski.
Grzegorz Domański, Ph.D., Assistant Professor room: 61, phone: +48 22 2347626 e-mail: grzegorz.domanski@pw.edu.pl	[Edu11]	<i>Basics of Multimedia</i> (Podstawy multimediów – PMUT); 43 h/sem.; A. Buchowicz.
Specialization: Biomedical Information Technology	[Edu12]	<i>Basics of Programming</i> (Podstawy programowania – PPR); 60 h/sem.; R. Kurjata.
Head	[Edu13]	<i>Basics of Programming</i> (Podstawy programowania – POPRO); 30 h/sem.; K. Ignasiak, S. Kozłowski (Faculty coordinator: the Institute of Telecommunications).
Tymon Rubel, Ph.D., Assistant Professor room: 5, phone: +48 22 2347739 e-mail: tymon.rubel@pw.edu.pl	[Edu14]	<i>Basics of Programming 1</i> (Podstawy programowania 1 – PRM1T); 60 h/sem.; A. Buchowicz.
Telecommunications	[Edu15]	<i>Basics of Programming 2</i> (Podstawy programowania 2 – PRM2T); 55 h/sem.; K. Ignasiak.
Specialization: Wireless and Multimedia Technologies (I⁰ studies)	[Edu16]	<i>Basics of Radiolocation and Radionavigation</i> (Podstawy radiolokacji i radionawigacji – PRIR); 45 h/sem.; D. Gryglewski.
Head	[Edu17]	<i>Biomedical Accelerators</i> (Akceleratory biomedyczne – ABM); 30 h/sem.; S. Wronka.
Konrad Godziszewski, Ph.D., Assistant Professor room: 35, phone: +48 22 2347796 e-mail: konrad.godziszewski@pw.edu.pl	[Edu18]	<i>Computing in Engineering</i> (Obliczenia inżynierskie – OINT); 30 h/sem.; R. Z. Morawski.
Specialization: Sound and Image Engineering (II⁰ studies)	[Edu19]	<i>Computer Graphics</i> (Grafika komputerowa – GRK); 30 h/sem.; T. Rubel.
Head	[Edu20]	<i>Computer Systems: Architecture and Programming</i> (Systemy komputerowe: architektura i programowanie - SYKOM); 60h/sem.; K. Derzakowski, K. Mroczek, D. Rosołowski (Faculty coordinator: the Institute of Telecommunications).
Agnieszka P. Pietrzak, Ph.D., Assistant Prof. room: 131, phone: +48 22 2347999 e-mail: agnieszka.pietrzak@pw.edu.pl		
Specialization: Terrestrial and Space Radio Communications (II⁰ studies)		
Head		
Przemysław Korpas, Ph.D., Assistant Prof. room: 548, phone: +48 22 2347624 e-mail: przemyslaw.korpas@pw.edu.pl		
Specialization: Wireless and Multimedia Techniques (II⁰ studies)		
Head		
Andrzej Buchowicz, Ph.D., Assistant Prof. room: 451, phone: +48 22 2347840 e-mail: andrzej.buchowicz@pw.edu.pl		

3.1.1. Basic courses

[Edu1]	<i>Acquisition and Data Processing Using LabVIEW</i> (Akwizycja i przetwarzanie danych z wykorzystaniem LabVIEW – LABV);	[Edu19]	<i>Construction of High Quality Audio Equipment</i> (Konstrukcja urządzeń audio wysokiej jakości – KUA); 45 h/sem.; G. Maka-
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TEACHING ACTIVITIES

- rewicz.
- [Edu20] *Data Analysis Methods* (Metody analizy danych – MADAN; 80h/sem.; P. Bilski.
- [Edu21] *Data Security in Medical Information Systems* (Bezpieczeństwo medycznych systemów informacyjnych – BEMSI); 45 h/sem.; R. Kurjata.
- [Edu22] *Detection of Ionizing Radiation* (Detekcja promieniowania jonizującego - DEPJO); 30 h/sem.; J. Marzec.
- [Edu23] *Digital Circuits* – EDC1; 60 h/sem.; P. Mi-azga (English-medium studies).
- [Edu24] *Digital Circuits* (Technika cyfrowa – TECY), 30 h/sem.; K. Mroczek (Faculty coordinator: the Institute of Telecommunications).
- [Edu25] *Digital Communications* – EDICO; 60 h/sem.; P. Bilski (English-medium studies).
- [Edu26] *Digital Systems* (Systemy cyfrowe – SYCYF), 30 h/sem.; K. Mroczek (Faculty coordinator: the Institute of Telecommunications).
- [Edu27] *Diploma Seminar for Undergraduate Students* (Seminarium dyplomowe inżynierskie – SDI); 30 h/sem.; A. Buchowicz.
- [Edu28] *Electronic Circuits* (Układy elektroniczne – ULET); 60h/sem.; W. Wojtasiak.
- [Edu29] *Electronic Circuits* (Układy elektroniczne – UEL); 60 h/sem.; W. Obrębski.
- [Edu30] *Electronic Circuits and Systems* (Elementy i układy elektroniczne – UKEL); 60 h/sem.; D. Gryglewski.
- [Edu31] *Embedded Systems Software Architecture* (Architektura oprogramowania w systemach wbudowanych – AOSYW); 30 h/sem.; V. Djaja-Joško, P. Korpas (Faculty coordinator: the Institute of Microelectronics and Optoelectronics).
- [Edu32] *Evolutionary Algorithms* (Algorytmy ewolucyjne – AE); 45 h/sem.; G. Bogdan, P. Miazga.
- [Edu33] *Ethical Aspects of Research and Engineering* – EEARE; 30 h/sem; R. Z. Morawski, (English-medium studies).
- [Edu34] *Fields and Waves* (Pola i fale – POFAT); 56 h/sem.; B. Salski.
- [Edu35] *Functional Programming* (Programowanie funkcyjne – PF); 60h/sem.; P. Bilski.
- [Edu36] *Fundamentals of Digital Technology* (Podstawy techniki cyfrowej – PTCY); 30 h/sem.; K. Mroczek (Faculty coordinator: the Institute of Computer Science).
- [Edu37] *Fundamentals of Wireless Communication* (Podstawy transmisji bezprzewodowej – PTB); 57 h/sem.; J. Kołakowski.
- [Edu38] *Image Techniques* (Technika obrazowa-TO); 60 h/sem.; G. Galiński.
- [Edu39] *Influence of Electromagnetic Waves on Living Organisms* (Oddziaływanie fal elektromagnetycznych na organizmy żywe – OFE); 30 h/sem.; K. Derzakowski.
- [Edu40] *Ionizing radiation detectors* (Detektory promieniowania jonizującego – DETPJ); 60h/sem.; J. Marzec.
- [Edu41] *Internet of Things Services and Applications* (Usługi i aplikacje internetu rzeczy – PBL5); 120 h/sem.; K. Ignasiak (Faculty coordinator: the Institute of Telecommunications).
- [Edu42] *Introduction to Medical Science* (Wprowadzenie do nauk medycznych – WNM); 45 h/sem.; R. Józwiak.
- [Edu43] *Introduction to Multimedia* (Wstęp do multimediiów – WMM); 72 h/sem.; G. Pastuszek.
- [Edu44] *Introduction to Telecommunications* (Wprowadzenie do telekomunikacji – WDT); 33 h/sem.; G. Bogdan, V. Djaja-Joško, K. Godziszewski, J. Kołakowski, P. Korpas, D. Rosołowski (Faculty coordinator: the Institute of Telecommunications).
- [Edu45] *IoT Radio Interfaces* (Interfejsy radiowe systemów internetu rzeczy – IRI); 45 h/sem.; J. Kołakowski.
- [Edu46] *Localization and Identification Systems* (Systemy lokalizacji i identyfikacji – SLID); 60 h/sem.; P. Bajurko.
- [Edu47] *Measurements in Radio Electronics* (Pomiary w radioelektronice – POR); 45h/sem.; J. Cichocki.
- [Edu48] *Medical Electronic Instrumentation* (Elektroniczna aparatura medyczna – EAME); 60 h/sem.; A. Rychter.
- [Edu49] *Methodical Aspects of Engineering* (Metodyczne aspekty działalności inżyniera – MADI); 30 h/sem; R. Z. Morawski (Institute of Telecommunications).
- [Edu50] *Microcontrollers and Programmable Circuits* (Mikrokontrolery i układy programowalne – MUP); 60h/sem.; P. Bilski.
- [Edu51] *Microprocessor Technique* (Technika mikroprocesorowa – TEMI); 45 h/sem.; G. Domański.
- [Edu52] *Multimedia applications* (Aplikacje multimedialne – APEM); 54h/sem.; P. Bobiński.
- [Edu53] *Multi-service and Multimedia Networks* – EMSMN; 60 h/sem.; S. Kozłowski (English-medium studies).
- [Edu54] *Musical Acoustics* (Akustyka muzyczna – AM); 45 h/sem.; J. Żera.
- [Edu55] *Neural Networks in Biomedical Applications* (Sieci neuronowe w zastosowaniach biomedycznych – SNB), 45 h/sem.; P. Mazurek.
- [Edu56] *Nuclear Medicine Techniques* (Techniki medycyny nuklearnej – TMENU); 30 h/sem.; G. Domański.
- [Edu57] *Numerical Methods* (Metody numeryczne – MNUB); 45 h/sem.; P. Mazurek.
- [Edu58] *Numerical Methods* – ENUME; 60 h/sem.; R. Z. Morawski, (English-medium studies).

TEACHING ACTIVITIES

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| <p>[Edu59] <i>Object-oriented Programming</i> (Programowanie obiektowe – PROBI); 60 h/sem.; D. Wanta.</p> <p>[Edu60] <i>Object-oriented Programming of Multimedia Applications in Java</i> (Java – obiektowe programowanie aplikacji multimedialnych – OPA); 45 h/sem.; K. Ignasiak.</p> <p>[Edu61] <i>Orientation</i> (Orientacja - ORIT); 8 h/sem.; J. Cichocki.</p> <p>[Edu62] <i>Physics 2 – EPHY2</i>; 60 h/sem.; B. Salski, (English-medium studies).</p> <p>[Edu63] <i>Power Supply in Electrical Equipment</i> (Zasilanie urządzeń elektronicznych - ZUE); 45 h/sem.; M. Mikołajewski</p> <p>[Edu64] <i>Programming of Geoinformation Applications 1</i> (Programowanie aplikacji geoinformacyjnych 1 – ISP); 30 /sem.; K. Ignasiak (for Faculty of Geodesy and Cartography).</p> <p>[Edu65] <i>Radio Transmission</i> (Transmisja radiowa – TRRA); 57 h/sem.; K. Godziszewski.</p> <p>[Edu66] <i>Radiology and Nucleonics</i> (Radiologia z nukleoniką – RN); 45 h/sem.; B. Konarzewski.</p> <p>[Edu67] <i>RF & Microwave Engineering in Telecommunications</i> (Technika mikrofalowa w telekomunikacji – TMT); 45 h/sem.; W. Wojtasiak.</p> <p>[Edu68] <i>Signals and Systems</i> (Sygnały i systemy – SYGSY); 60 h/sem.; K. Snopek.</p> <p>[Edu69] <i>Signals and Systems</i> (Sygnały i systemy – SYSE); 33 h/sem.; K. Snopek (Faculty coordinator: the Institute of Electronic Systems).</p> <p>[Edu70] <i>Software Defined Radio in Telecommunications</i> (Radio programowalne w telekomunikacji – RAPT); 48h/sem.; D. Rosołowski.</p> <p>[Edu71] <i>Sound Recording Technique</i> (Dźwiękowa technika studyjna – DTS); 42 h/sem.; M. Lewandowski.</p> <p>[Edu72] <i>Sound Technique</i> (Technika dźwiękowa – TD); 45 h/sem.; P. Bobiński.</p> <p>[Edu73] <i>Speech Processing</i> (Przetwarzanie mowy – PMO); 60h/sem.; A. Pietrzak.</p> <p>[Edu74] <i>Team Project 1</i> (Projekt grupowy 1 – PROJ1); 13 h/sem.; P. Korpas.</p> <p>[Edu75] <i>Team Project 2</i> (Projekt grupowy 2 – PROJ2); 30 h/sem.; P. Korpas.</p> <p>[Edu76] <i>User Interface Design</i> (Projektowanie interfejsu użytkownika – PIU); 45 h/sem.; K. Ignasiak.</p> <p>[Edu77] <i>Web Applications</i> (Programowanie aplikacji internetowych – PAINT); 45 h/sem.; R. Łukaszewski.</p> <p>[Edu78] <i>Wireless Transmission and Antennas</i> (Transmisja bezprzewodowa i anteny – TBAT); 60 h/sem.; K. Godziszewski.</p> <p>[Edu79] <i>Wired and Wireless Communication</i> (Komunikacja przewodowa i bezprzewodowa – PBL3); 180h/sem.; P. Korpas.</p> | <p>[Edu80] <i>4th and 5th Generation Cellular Systems</i> (Systemy komórkowe 4 i 5 generacji – SYK45); 45h/sem.; J. Kołakowski.</p> <p>3.1.2. Advanced courses</p> <p>[Edu81] <i>Adaptive Image Recognition</i> – EADIR; 60 h/sem.; W. Skarbek (English-medium studies).</p> <p>[Edu82] <i>Advanced Digital Signal Processing</i> – EADSP); 60 h/sem.; M. Lewandowski, P. Mazurek.</p> <p>[Edu83] <i>Advanced image processing</i> (Zaawansowane przetwarzanie obrazów – ZPO); 45h/sem.; A. Buchowicz.</p> <p>[Edu84] <i>Biostatistics</i> (Biostatystyka – BST); 45 h/sem.; Z. Wawrzyniak.</p> <p>[Edu85] <i>Computed Tomography</i> (Tomografia komputerowa – TOM); 60 h/sem.; W. Smolik.</p> <p>[Edu86] <i>Computational Electromagnetics for Telecommunications</i> – ECOET; 60 h/sem.; P. Korpas (English-medium studies).</p> <p>[Edu87] <i>Data Compression</i> (Kompresja danych – KODA); 45 h/sem.; G. Pastuszek.</p> <p>[Edu88] <i>Data Science Product Management</i> (Zarządzanie produktami data science – ZPDS); 45h/sem.; G. Gwardys.</p> <p>[Edu89] <i>Deep Neural Networks for Digital Media</i> (Głębokie sieci neuronowe w mediach cyfrowych – GSN); 60 h/sem.; W. Skarbek.</p> <p>[Edu90] <i>Digital Audio Signal Processing</i> (Cyfrowe przetwarzanie sygnałów audio – CPSA); 60h/sem.; M. Lewandowski.</p> <p>[Edu91] <i>Diploma Seminar for Graduate Students 1</i> (Seminarium dyplomowe magisterskie 1 – SDM1); 30 h/sem.; A. Buchowicz.</p> <p>[Edu92] <i>Diploma Seminar for Graduate Students 2</i> (Seminarium dyplomowe magisterskie 2 – SDM2); 30 h/sem.; A. Buchowicz.</p> <p>[Edu93] <i>Dynamic Medical Image Data Analysis</i> (Analiza medycznych obrazowych danych dynamicznych – AMDD); 45 h/sem.; P. Bogorodzki.</p> <p>[Edu94] <i>Electromagnetic Compatibility</i> – EEMC; 45 h/sem.; P. Kopyt.</p> <p>[Edu95] <i>Electronic devices of wireless systems</i> (Układy systemów bezprzewodowych – USYB); 60h/sem.; Y. Yashchynshyn.</p> <p>[Edu96] <i>Embedded Programming for Medical Devices</i> (Programowanie wbudowane w urządzeniach medycznych – PWUM); 45 h/sem.; G. Domański.</p> <p>[Edu97] <i>Evolutionary Algorithms</i> – EEVAL; 60h/sem.; P. Miazga (English-medium studies).</p> <p>[Edu98] <i>Genetic Engineering</i> (Inżynieria genetyczna – INGE); 15 h/sem.; T. Rubel.</p> <p>[Edu99] <i>Hearing and Sound Perception</i> (Słyszenie i percepcja dźwięku – SPD); 45 h/sem.; J. Żera.</p> |
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TEACHING ACTIVITIES

- [Edu100] *Information Systems in Medicine* (Systemy informatyczne w medycynie – SIM); 60 h/sem.; W. Smolik.
- [Edu101] *Machine Learning in Bioinformatics* (Uczenie maszynowe w bioinformatyce – UMB); 60 h/sem.; T. Rubel.
- [Edu102] *Magnetic Resonance Imaging* (Tomografia rezonansu magnetycznego – TRM); 45 h/sem.; P. Bogorodzki.
- [Edu103] *Mathematics in Multimedia* (Matematyka w multimediami – MATMU); 60 h/sem.; W. Skarbek.
- [Edu104] *Medical IT Systems* (Informatyczne systemy medyczne – ISMED); 45 h/sem.; R. Kurjata.
- [Edu105] *Methodological and Ethical Issues of Technoscientific Research – EMET*; 30h/sem.; P. Mazurek.
- [Edu106] *Microcontrollers in Wireless Systems* (Mikrokontrolery w systemach transmisji bezprzewodowej – MSTB); 45h/sem.; V. Djaja-Joško.
- [Edu107] *Microcontrollers in wireless transmission systems* (Podstawy projektowania systemów kosmicznych – PPSK); 60h/sem.; K. Kurek.
- [Edu108] *Multimedia Research Project* (Multimedialny projekt badawczy – MUPB); 120 h/sem.; A. Pietrzak.
- [Edu109] *Neural Network Compression with Applications – ENNCA*; 60h/sem.; X.Chang (English-medium studies).
- [Edu110] *Noise and Electromagnetic Interference in Electronic Devices* (Szumy i zakłócenia w aparaturze elektronicznej – SZAE); 45 h/sem.; J. Marzec.
- [Edu111] *Nuclear Medicine Techniques – ENUMT*; 60 h/sem.; G. Domański.
- [Edu112] *Organizational and Technological Aspects of Running a Space Project* (Organizacyjne i technologiczne aspekty prowadzenia projektu kosmicznego – OTAP); 45h/sem.; K. Kurek.
- [Edu113] *Radiocommunication System Design* (Projektowanie systemów radiokomunikacyjnych – PSRK); 60 h/sem.; K. Kurek.
- [Edu114] *Reliability and Security of Wireless Systems* (Niezawodność i bezpieczeństwo systemów bezprzewodowych – NBSB); 90 h/sem.; S. Kozłowski.
- [Edu115] *Security of 5G and 6G Networks* (Bezpieczeństwo sieci 5G i 6G – BE5G); 45 h/sem.; J. Kołakowski (Faculty coordinator: the Institute of Telecommunications).
- [Edu116] *Security of the Internet of Things* (Bezpieczeństwo internetu rzeczy – BIR); 180h/sem.; W. Wojtasiak.
- [Edu117] *Spatial Audio System* (Systemy dźwięku przestrzennego – SDP); 60 h/sem.; A. Pietrzak.
- [Edu118] *SRD Technology in Applications* (Techniki radia programowalnego w zastosowaniach – TRPZ); 60 h/sem.; D. Rosołowski.
- [Edu119] *Telemedical Systems* (Systemy telemedyczne - TELM); 60 h/sem.; R. Kurjata.
- [Edu120] *Wideband Transmission in Radio Systems* (Transmisja szerokopasmowa w systemach radiowych – TSSR); 45 h/sem.; S. Kozłowski;
- [Edu121] *Wireless Security* (Bezpieczeństwo komunikacji bezprzewodowej – BEKO); 180 h/sem.; D. Rosołowski.

3.2. Special courses

3.2.1. Post-graduated studies: “Deep neural networks at digital media”

- [Edu122] *2D/3D Modeling* (Modelowanie 2D/3D); W. Skarbek, G. Gwardys.
- [Edu123] *Data Security and Neural Models* (Bezpieczeństwo Danych i Modeli Neuronowych); W. Skarbek, J. Komorowski.
- [Edu124] *Deep Neural Networks-Basics* (Głębokie sieci neuronowe – podstawy); W. Skarbek, X. Chang.
- [Edu125] *Digital Media Compression and Neural Models* (Kompresja Mediów Cyfrowych i Modeli Neuronowych); W. Skarbek.
- [Edu126] *Digital Objects Indexing* (Indeksowanie obiektów cyfrowych); W. Skarbek, G. Gwardys, J. Komorowski.
- [Edu127] *Digital Objects Recognition* (Rozpoznawanie obiektów cyfrowych); P. Cyrta, X. Chang, J. Komorowski.
- [Edu128] *Great Language Models and Their Applications* (Wielkie Modele Językowe i Ich Zastosowania); G. Gwardys, J. Komorowski.
- [Edu129] *New Trends in Neural Modeling* (Nowe Trendy w Modelowaniu Neuronowym); G. Gwardys, X. Chang, P. Cyrta.
- [Edu130] *Programming deep neural networks* (Programowanie głębokich sieci neuronowych); G. Gwardys, D. Gronkiewicz.

3.3. International co-operation

- [Edu131] Within the Advanced Technology Higher Education Network / Socrates (ATHENS), the course "*Ethical Aspects of Research and Engineering*" was given by **Roman Z. Morawski**, and the course "*Sound: Hearing and Acoustical Measurements*" was given by **Jan Žera**. The students who attended these courses were from the following European institutions of higher education:
- Chimie ParisTech (France) – 1 person;
 - École des Ponts ParisTech (France) – 1 person;
 - Telecom ParisTech (France) – 11 persons;

- Budapest University of Technology and Economics (Hungary) – 1 person;
- České vysoké učení technické v Praze (Czechia) – 5 persons;
- Instituto Superior Técnico (Lisbon, Portugal) – 5 persons;
- Warsaw University of Technology (Poland) – 1 person;
- İstanbul Teknik Üniversitesi (Turkey) – 3 persons;
- Katholieke Universiteit Leuven (Belgium) – 6 persons;
- Politecnico di Milano (Italy) – 2 persons;
- Technische Universität München (Germany) – 5 persons;
- Universidad Politécnica de Madrid (Spain) – 3 persons;
- Universitatea Politehnica din București (Romania) – 2 persons.

3.4. Educational projects

[Edu132] **OMNIS2 “Open. Modern. New. Integrated. Social”** (OMNIS2 “Otwartość. Modernizacja. Nowoczesność. Integracja. Społeczność”).

Andrzej Buchowicz, A. P. Pietrzak, K. Godziszewski, P. Korpas, P. Mazurek;
May 01, 2024 – Jun. 30, 2029

Funded by the National Centre for Research and Development

The goal of the project "OMNIS2 Open. Modern. New. Integrated. Social." is to adapt the teaching offer of Warsaw University of Technology to the needs of the labor market, as well as to strengthen the competitiveness of the University's graduates.

The scope of the project includes 14 substantive tasks related to adapting or rationalizing the offer of first-cycle studies, new solutions in the field of education in second-cycle studies, pilot implementation of uniform master's studies and expanding the offer of studies in English. One central task was also planned in terms of improving the competences of teaching staff.

Each task implemented by the selected Faculties includes a package of activities: (1) modification of educational programs in cooperation with practitioners and entities from the socio-economic environment; (2) additional elements of education - trainings/courses, additional classes conducted by industry specialists, study visits for students; (3) activities to reduce dropout - compensatory classes for students, activities leading to recruitment of informed candidates; (4) raising the competence of teaching staff in digital competence, development of awareness and skills for green transformation, but also teaching competence, including the use of modern teaching methods.

The changes will include the majors: technical physics, geodesy and cartography, mechatronics, automation, robotics and industrial computer science, telecommunications, internet of things engineering, biomedical engineering, papermaking and printing, civil engineering, applied computer science, spatial planning.

Nine Faculties of the Warsaw University of Technology are implementing the project: Physics, Geodesy and Cartography, Mechatronics, Civil Engineering, Mechanics and Petrochemistry, Electronics and Information Technology, Mechanical and Industrial

Engineering, Civil Engineering, Electrical Engineering, and the College of Economics and Social Sciences in Plock.

3.5. Noise Control Study

[Edu133] **E. Kotarbińska, M. Jasiński, G. Makarewicz, J. Witkowska**

Oct. 11, 2025 – Jan. 25, 2026

The Noise Control Study covered key aspects of noise protection in both external environment and workplaces. The program was designed for professionals responsible for environmental protection, employees of environmental laboratories, acoustic consultants, and workplace safety personnel.

The course was conducted by academic staff from the Warsaw University of Technology, as well as experts from other universities, research institutes, and industry professionals specializing in noise measurement, acoustic modelling, noise control solutions, and legal regulations related to noise protection.

The study followed a blended learning approach. Lectures were held online, while practical workshops took place during in-person weekend sessions at the Warsaw University of Technology.

The total duration of the program was 105 hours, divided into seven weekend sessions, combining remote lectures with hands-on workshops. This was the 10th edition of the course, initiated by Ewa Kotarbińska, PhD.

4. RESEARCH ACTIVITIES

4.1. International projects

- [Pro1] **Super-Kamiokande to Hyper-Kamiokande (SK2HK)**
Marcin Ziembicki, J. Marzec, K. Zaremba, A. Rychter, R. Kurjata, K. Dygnarowicz, W. Obrębski, G. Pastuszek, A. Buchowicz, G. Galiński;
 Nov. 01, 2019 – Feb. 28, 2026
Horizon 2020 EU Framework Programme
MSCA-RISE Action

The study of the neutrino properties and interactions has been key in the development of the Standard Model of fundamental interactions and it is providing first clues on the understanding of its deeper foundations. In this aspect the Super-Kamiokande (SK) detector (ICRR, U. Tokyo, Japan) for many years has played a crucial role. It contributed to the discovery of oscillations of atmospheric neutrinos, thus establishing their 'massive' character. Because of this discovery, Takaaki Kajita, the "person in charge of this proposal" from our main Third Country partner ICRR, was awarded with the Nobel Prize in Physics 2015. With SK2HK we aim to continue the very successful SKPLUS, through extension of participation of European institutes in the state-of-the-art experimental program related to the SK, the SK-Gd and the Hyper-Kamiokande (HK) experiments. We want to gain insight and even discover the hypothesized charge-parity violation in the leptonic sector with SK and the future HK. We want to discover the "Diffuse Neutrino Supernova Background" with SK-Gd and to explore in depth the Grand Unification with SK and the future HK. Those measurements are key to the complete understanding of the most fundamental concepts of Physics. An important aspect of this proposal is significant amount of hardware R&D related to HK, especially given the decision to start HK construction in 2020. Timely finalization of these activities is crucial to the success of HK and requires even closer cooperation with our partners. Given the uniqueness of the technologies that are being developed, it is efficient to do some work at the location where most of the infrastructure needed for the R&D is. In this project those are the ICRR of the Univ. of Tokyo and the TRIUMF laboratory in Canada, as well as several European laboratories, incl. the applying institutions. The proposed secondment program offers a unique opportunity to fulfil these goals while working with World leading experts.

- [Pro2] **Novel Technologies and Materials for TeraHertz Radiation Control** (Nowoczesne technologie i materiały do kontroli promieniowania terahertzowego).
Yevhen Yashchyshyn, P. Bajurko, K. Godziszewski, G. Bogdan, J. Sobolewski
 Jan. 01, 2023 – Jun. 30, 2028
TeraHertz, Horizon Europe EU Framework Programme, **MSCA Staff Exchanges Action**

The project focuses on developing novel technologies and materials characterization that are to be used synergistically to create advanced possibilities for terahertz radiation control. International team expertized in materials synthesis and terahertz science will direct its efforts towards the development of innovative quasi-optical technologies which will help finding the solution for efficient use of dielectric and

semiconductor crystalline materials, including nanocomposites and coplanar structures, and their application as

functional elements in terahertz radiation control devices, ultimately targeting market-ready innovative products. A range of such materials will be considered for thorough investigations of potential application in electro/acousto-quasioptical devices to control THz radiation. Optimization of transmission, absorption, refraction indexes, loss tangent, the dielectric constant will be made based on experimental measurements and computer simulations. The project's scope will include semiconductor materials in which lightinduced photogeneration of charge carriers is possible. The effect of photogeneration on the parameters of these materials will be used to develop efficient quasi-optical cells, which are key elements of control devices. The project brings together an international multidisciplinary network of organizations from academia and industry that will work coherently on the innovative research program on quasi-optical technologies and related material engineering. Participants will exchange skills and share knowledge, strengthening links between countries and promoting interaction between involved economics sectors. Reaching the goals related to the implementation of advanced quasi-optical technologies will open new market possibilities for engaged non-academic project participants, ultimately becoming beneficial for European society globally.

4.2 Projects granted by the Ministry of Science and Higher Education (National Centre for Research and Development, and National Science Centre)

4.2.1. International grants

- [Pro3] **Hyper-Kamiokande (HK)**
Marcin Ziembicki, Andrzej Rychter, J. Marzec, K. Zaremba, R. Kurjata, K. Dygnarowicz, W. Obrębski, G. Pastuszek, A. Buchowicz, G. Galiński;
 Dec. 01, 2022 – Nov. 30, 2027
 Programme: **"Support for the participation of Polish research teams in international research infrastructure projects"**.

Hyper-Kamiokande is a next-generation neutrino experiment currently under construction in Japan and scheduled to launch in 2027. One of the key components of this experiment will be two new underground water detectors of Cherenkov radiation: a far detector with a mass of 250 kt (the world's largest man-made object of this type) and an intermediate detector. The physics program of the Hyper-Kamiokande experiment will address the most important unsolved issues in physics, such as the violation of charge-space symmetry of CP in neutrino oscillations and the decay of nucleons. The WUT team is responsible for the preparation of multi-PMT photodetection modules, which consist of 19 3-inch photomultipliers, high-voltage power supply systems and readout electronics, and the whole is enclosed in a pressurized housing. These modules are being developed together with partners from Italy, Canada, Japan, the Czech Republic and Mexico. The project also includes a test experiment at CERN (Water Cherenkov Test Experiment), which is scheduled to be launched in 2024

- [Pro4] **T2K experiment (Tokai-to-Kamioka)** (Eksperyment T2K) (Tokai-to-Kamioka).
Andrzej Rychter, K. Zaremba, R. Kurjata, M. Ziembicki, K. Dygmarowicz
2023/WK/04, International project is realized in collaboration with the National Center for Nuclear Research, Department Basic Research BP3, University of Warsaw, Faculty of Physics University of Silesia in Katowice, Faculty of Science and Technology, University of Wrocław, Faculty of Physics, Institute of Nuclear Physics of the Polish Academy of Sciences;
 Mar. 01, 2023 – Dec. 31, 2027
Funded by the Ministry of Science and Higher Education

This application concerns the participation of Polish groups in the T2K experiment in the period March 1, 2023 - December 31, 2027 and is a continuation of the project for financing participation in this experiment in the period October 1, 2017 - September 30, 2022. Further participation in the T2K experiment will be carried out in parallel with the construction of the Hyper-Kamiokande detector. The tasks to be carried out in the submitted application are related to supporting the participation of Polish groups in measurements carried out in the T2K experiment as research infrastructure.

- [Pro5] **Amber experiment at CERN** (Eksperyment AMBER w CERN).
Robert Kurjata, A. Rychter, K. Zaremba, J. Marzec, M. Ziembicki, K. Dygmarowicz, A. Buchowicz, G. Galiński, G. Pastuszek
 Jun. 1, 2025 – May 31, 2030
 Consortium: University of Warsaw (coordinator), National Centre for Nuclear Research, Warsaw University of Technology;
 Programme: "Support for the participation of Polish research teams in international research infrastructure projects";
Funded by the Ministry of Science and Higher Education

AMBER is an international collaboration of physicists investigating the structure of subatomic particles and their point-like constituents—quarks and gluons—at CERN. Its objectives are:

- 1) to measure elastic muon–proton scattering at small angles, providing the missing information required to complete our understanding of the so-called “proton radius puzzle”;
- 2) to investigate the mechanism of hadron mass generation through measurements of parton distribution functions in mesons using the Drell–Yan process in π/K –proton collisions;
- 3) to study properties of cosmic radiation by measuring antiproton production in proton–proton and proton–helium interactions.

The AMBER-PL consortium will participate in these measurements, as well as in the construction and maintenance of the AMBER spectrometer (CEDAR detectors and SFH detector modules), and in the analysis, interpretation, and publication of the results. Its members contribute broad and internationally recognized expertise in this field, acquired, inter alia, through participation in all muon-beam experiments at CERN concerning the partonic structure of the nucleon.

- [Pro6] **Advancing personalized prevention strategies for chronic obstructive pulmonary disease and associated**

comorbidities that utilize existing IT technologies and novel AI based tools (Rozwój spersonalizowanych strategii prewencji przewlekłej obturacyjnej choroby płuc i chorób współistniejących z wykorzystaniem technologii IT i sztucznej inteligencji).

Marcin Kołakowski, J. Kołakowski, V. Djaja-Joško

Oct. 1, 2025 – Sep. 30, 2028

Funded by the National Centre for Research and Development

OREO aligns seamlessly with the aim of the call by advancing person-centered health and care models for patients suffering from COPD, utilizing novel digital technologies along with the consortium's previous results. Our main purpose is to reduce disease worsening by early prediction of exacerbation events, which allows better management and prevention of complications. In the long term, we aim to reduce the burden on the healthcare systems, and indirectly improve access to services. To accomplish this, OREO will pioneer the development of a holistic digital platform, supported by an underlying AI framework, that combines analysis of speech and text narratives collected via a self-assessment app with health parameters related to comorbidities and with a plethora of triggering factors such as sleep related aspects, diet, stress, and environmental variables. We complement our prediction model with personalized profiles of the platform users which reflect indicators and triggers (early predictors) of a patient's exacerbation, concurrently serving as an access point for educational content for all involved stakeholders. By involving patients in three countries, we aim to provide a support for generalization and transferability across diverse healthcare systems, and geographic regions.

- [Pro7] **Reshaping data-driven smart healthcare to optimize resources and personalize care for hypertensive patients through AI and digital twin models** (Optymalizacja opieki zdrowotnej nad pacjentami z nadciśnieniem tętniczym w oparciu o AI i modele digital twins (RENEW))
Vitomir Djaja-Joško, J. Kołakowski, M. Kołakowski, J. Cichoński
 Oct. 01, 2025 – Sep. 30, 2027
Funded by the National Centre for Research and Development

The project target personalized data-driven smart healthcare to benefit hypertensive older adults, their caregivers, and their medical practitioners. Specifically, a digital platform will be developed, using user-centered design, starting from existing solutions of the consortium partners, and leveraging the involvement of a wide range of stakeholders. The platform will offer personalised support to hypertensive patients in managing their health in terms of prevention, prognosis, and economic aspects. It will also support healthcare providers in delivering high-quality and efficient care by facilitating close engagement with patients through remote monitoring services that improve the continuity of care. Reliable data processing will be used along with novel machine learning algorithms to learn and build personalised profiles and the digital twin of hypertensive older adults. Proposed approach is not limited to medical practice improvement; it also offers a solution to the issues related to healthcare systems and policy makers. It supports their strategic management in allocating limited public resources across outpatient and inpatient

healthcare services to achieve maximum improvement in health outcomes. Such approach requires a variety of data such as patient data, medical data, economics and services data which will be collected through a digital platform comprising medical devices, wearable sensors for continuous monitoring, gamification elements and digital questionnaires. The platform will build and develop the achievements of the PerHeart ERA PerMed platform which was designed for heart-failure patients as a proof of concept for the efficiency of a smart data-driven approach to reduce rehospitalization rates in these patients. In RENEW specific elements for particular target groups within a user-centered design will be integrated which will stimulate participant engagement and will ensure adherence and participant engagement during the piloting and validation stages.

[Pro8] **Experiment COMPASS – Study of the Internal Three-Dimensional Structure of the Nucleon** (Eksperyment COMPASS - badanie wewnętrznej trójwymiarowej struktury nukleonu).
Krzysztof Zaremba, J. Marzec, R. Kurjata, M. Ziembicki, A. Rychter;
OPUS 19, International project realized in collaboration with the Andrzej Soltan National Centre for Nuclear Research and Faculty of Physics, University of Warsaw
Funded by the National Science Centre

The goal of this project is to experimentally study the internal, three-dimensional structure of the nucleon at the level of its elemental components. The project is located in a new field of QCD research that goes beyond the one-dimensional description commonly used so far. A description of the three-dimensional structure of the nucleon is possible, either under TMD (Transverse Momentum Dependent Distributions) formalism or under GPD (Generalized Parton Distributions) formalism.

[Pro9] **Intelligent speech processing system for doctors** (Inteligentny system przetwarzania mowy dla lekarzy).
Piotr Biłski; A. Buchowicz, P. Bobiński, P. Gawrysiak, M. Jasiński, M. Lewandowski, G. Makarewicz, P. Mazurek, A. P. Pietrzak;
 Mar. 01, 2023 – Nov. 30, 2025
INFOSTRATEG IV
Funded by the National Centre for Research and Development

The aim of the project will be to develop tools for speech processing (consisting of phrases spoken by the doctor and possibly the patient) and extracting relevant information from the text which will be then be classified semantically in order to, for example define the topic of the conversation and the diagnosis. Critical technologies to be developed in the project will include artificial intelligence methods for Natural Language Processing (NLP): extracting words from the record audio stream (so-called text to speech) and semantic analysis of the extracted text using deep natural networks. The results of the processing will be output to the forms and databases developed for this purpose. The former will be flexible, so that they can be able to automatically generate documents: prescriptions, exemptions or referrals for further diagnostic tests.

4.2.2. Research grants

[Pro10] **Exploring the interplay between magnetocrystalline anisotropy, magnetoelasticity, and dissipative properties in ferromagnetic materials for microwave applications in electronics and spintronics** (Badanie wzajemnych zależności między anizotropią magnetokrystaliczną, magnetoelastycznością i właściwościami dyssypacyjnymi w materiałach ferromagnetycznych do zastosowań mikrofalowych w elektronice i spintronice).

Jerzy Krupka (the Institute of Microelectronics and Optoelectronics), **A. Pacewicz** (head on behalf of the Institut of Radioelectronics and Multimedia Technology, WUT), B. Salski, P. Kopyt.

Jun. 15, 2025 - Jun. 14, 2029

OPUS 27

Funded by the National Science Centre

The project aims to improve the materials used in today's communication systems, especially in 5G and 6G technologies. These materials are crucial for devices such as isolators and circulators that help guide signals, but they often consume too much energy, which reduces their effectiveness. It is also often unclear how to inexpensively assess material quality. The project seeks to optimize these materials and measurement techniques by understanding how different properties affect their performance. As we move toward more advanced networks, there is a growing need for materials that operate efficiently at higher frequencies, such as those used in 5G and 6G technology. By improving these materials, we can develop smaller and more efficient communication devices. The main goal of the project is to understand how different characteristics of these materials, such as magnetic and elastic properties, interact with each other and affect performance. By studying these relationships, the researchers hope to find ways to reduce energy loss and improve efficiency. The research involves creating and testing a variety of materials, including special types of ferrites and metal thin films. These materials will be fabricated using advanced techniques to achieve optimal properties. Researchers will use precision instruments to measure how these materials behave under different conditions. They will analyze how the materials respond to magnetic fields and mechanical stresses, and how they interact with electromagnetic waves. Understanding the connections between these properties is key. Analyzing how different characteristics affect the performance of materials will identify the best ways to optimize them. The results of this research will help design better materials, leading to more efficient and compact communication devices. This research will not only improve communication technologies, but also find applications in fields such as medicine, aerospace and defense. The project is the result of collaboration between experts from different fields to achieve breakthrough results. Developing knowledge and capabilities in these materials aims to support the development of faster, more reliable and more efficient communication networks.

[Pro11] **A new method of ultrasensitive sub-terahertz spectrometry of materials with a Fabry-Perot resonator** (Nowa metoda ultraczułej spektrometrii subterahecowej)

materiałów przy pomocy rezonatora Fabry-Perot).

Bartłomiej Salski, A. Pacewicz, P. Baprawski, P. Polnau, P. Czekala, M. Krysicki;

Feb. 3, 2025 - Feb. 2, 2027

OPUS 27

Funded by the National Science Centre

The goal of this project is to develop new microwave and subterahertz methods for the complex permittivity measurement of low-loss liquids and dielectric pills using higher-order modes present in a Fabry-Perot open resonator.

[Pro12] **Interdisciplinary investigations towards integration of active and passive sub-THz elements into a single monolithic circuit fabricated in advanced nitride technology** (Interdyscyplinarne badania nad integracją aktywnych i pasywnych elementów subterahercowych w jeden monolityczny obwód wykonany w zaawansowanej technologii azotkowej).

Grzegorz Cywiński (Institute of High Pressure Physics PAS), **Yevhen Yashchyshyn** (head on behalf of the Institut of Radioelectronics and Multimedia Technology, WUT), P. Bajurko, J. Sobolewski, M. Kucharski;

Oct. 1, 2025 - Sep. 30, 2029

OPUS 28

Project is aimed at conducting interdisciplinary research on integrating passive and active electronic elements into a single chip fabricated using gallium nitride (GaN)-based technology, optimized for efficient operation in the extremely high-frequency (EHF) range above 100 GHz. The integration of active and passive elements on a GaN-based chip presents significant challenges due to the fundamentally different electrodynamic and technological requirements for these devices. To address this, project seeks to explore innovative solutions for combining radiating passive elements, such as planar antennas, with active electronic components, all fabricated on a wide bandgap GaN semi-insulating and low-loss substrate. This substrate would serve both as a semiconductor and a dielectric support for planar antennas. Preliminary results have demonstrated high antenna gain in systems enhanced with metasurfaces, which effectively reduce parasitic surface wave (SW) excitations.

[Pro13] **Coma and consciousness disorders – new prognostic and diagnostic indicators based on EEG and MRI** (Śpiączka i zaburzenia świadomości – nowe wskaźniki prognostyczne i diagnostyczne oparte o EEG i MRI).

Piotr J. Durka (Warsaw University, Faculty of Physics), P. Bogorodzki (head on behalf of the Institut of Radioelectronics and Multimedia Technology, WUT), P. Bogorodzki, E. Piątkowska-Janko, K. Lipiński;

Jul. 16, 2019 - Jul. 15, 2025

OPUS 16

Funded by the National Science Centre

Awareness-raising mechanisms are one of the greatest mysteries. Among the leading directions to their cognition are the study of patients in states of impaired consciousness (disorders of consciousness, DoC) – both in terms of hopes of broadening the basic knowledge of these processes, as well as the high

demand for a method of diagnosis based on the results of these studies. Existing research in this area has shown promising results in the use of methods of Magnetic Resonance Imaging (MRI) and electroencephalography (EEG). However, the existing use of both methods in assessing the DoC are based on relatively weak methodological analyses of EEG and MRI signals, resulting in suboptimal sensitivity and less than achievable specificity. Furthermore, the absence of a combination of these two methods in the previous literature in longitudinal studies, conducted by all stages of the evolution of consciousness disorder, from the beginning of coma. The completion of these gaps in modern research is the basis of this project.

4.2.3. Grants for young researchers

[Pro14] **Novel sensitive measurement system for thermal dielectric characterization of cooling liquids for energy-efficient next-generation data centers** (Nowy czuły system pomiarowy do termicznej charakteryzacji dielektrycznej płynów chłodzących na potrzeby energooszczędnych centrów danych nowej generacji (SensiCool)).

Adam Pacewicz, P. Czekala, M. Karpisz, M. Krysicki, P. Baprawski, P. Polnau;

Oct. 01, 2025 – Oct. 01, 2028

LIDER XV

Funded by the National Centre for Research and Development

The proposed project concerns the development of a new measurement system for broadband measurement of electrical permeability and dielectric losses of low-loss liquids in the microwave and millimeter wave frequency range as a function of temperature. To the author's knowledge, there is no solution on the market that combines these features, although it should be noted that there are a number of related solutions with significant limitations. The solution proposed to fill the existing product gap will be based on an open Fabry-Perot resonator coupled coaxially with a circuit analyzer. The resonator will be placed in a commercially available climate chamber. Precise knowledge of dielectric properties is of great importance, among other things, for technological progress enabling the reduction of energy consumption and costs of data centers. The proposed approach will draw on the project author's many years of laboratory and commercial experience in the field of resonant methods for characterizing materials, including the use of Fabry-Perot resonators.

4.3 Projects granted by the University

4.3.1 Priority Research Area Grants

[Pro15] **Analysis of the impact of ambisonic speaker configuration on sound scene perception in VR applications** (Analiza wpływu konfiguracji głośników ambisonicznych na percepcję sceny dźwiękowej w aplikacjach VR).

Agnieszka. P. Pietrzak, Karolina Pondel-Sycz, Andrzej Budny, Jan Brzeziński, Łukasz Pokorzyński, Mateusz Zych, Maciej Marcinkiewicz

Jun. 18, 2024 – Jun. 30, 2025

The aim of this research project is to analyze the impact of ambisonic speaker system configuration on user perception and immersion in a sound scene.

Spatial audio is an essential element in creating immersive VR experiences. The optimal placement of speakers around the listener can significantly enhance the quality and realism of spatial sound, directly influencing user perception and emotional response. Different numbers and arrangements of speakers in space may affect the accuracy of virtual sound source localization as well as the overall evaluation of spatial sound quality. The project aims to identify optimal speaker configurations that can enhance realism and engagement in virtual audio environments.

[Pro16] **Specialized support from the Electronics and Detectors laboratory „Electronics and Detectors for High Energy Physics – ELHEP”** (Wsparcie specjalistycznej pracowni Elektroniczno-Detektorowej "Electronics and Detectors for High Energy Physics – ELHEP").
Marcin Ziembicki
Jun. 01, 2024 – May. 31, 2025

The aim of the project " Electronics and Detectors for High Energy Physics - ELHEP " is to provide manpower, material and logistical support for currently ongoing and planned research activities related to the IDUB-POB-FWEiE project. The activities implemented within the scope of this project include: supporting the design work in related to equipment, modules and complete systems, including detector modules and specialized electronics for physics experiments; supporting the maintenance of experimental equipment; preparation of "proof of concept" experiments; performing comprehensive feasibility studies (concept, visualizations); support for bachelor, masters and doctoral students participating in high-energy projects realized by the institute.

[Pro17] **Discovery of endometriosis biomarkers from proteomic and metabolomic LC-MS/MS data** (Identyfikacja markerów diagnostycznych endometriozy na podstawie danych LC-MS/MS z badań protomicznych i metabolomicznych)
Tymon Rubel
Sep. 02, 2024 – Dec. 31, 2025

The project aims to develop and implement algorithms for selecting protein and metabolite diagnostic markers of endometriosis from liquid chromatography-mass spectrometry (LC-MS/MS) data.

Endometriosis is a common gynecological disease that significantly affects patients' functioning and quality of life. Unfortunately, its etiology remains unclear, and its accurate diagnosis still faces serious difficulties.

A better understanding of endometriosis formation and development is possible through molecular biology research, particularly in proteomics and metabolomics. Both these fields of science extensively use the LC-MS/MS technique, which allows the simultaneous detection of large sets of proteins and metabolites in biological samples. However, combining the knowledge obtained from proteomic and metabolomic studies remains a non-entirely resolved issue. Therefore, this project will mainly focus on integrating results obtained at protein and metabolite levels to increase the biomarkers' diagnostic potential and to achieve a reliable, common biological interpretation.

The project will utilize data from research conducted by Prof. Piotr Laudański from the Medical University of Warsaw, who will also be responsible for the medical verification of the analysis results. A close cooperation

with the Mass Spectrometry Laboratory of the Institute of Biochemistry and Biophysics PAS is also planned, as its team performed LC-MS/MS measurements for the project and is the primary user of the created software.

[Pro18] **Organization of the National Student Conference on Acoustics (OSKA) 2025** (Organizacja Ogólnopolskiej Studenckiej Konferencji Akustyków OSKA 2025)
Agnieszka P. Pietrzak, Karolina Pondel-Sycz, Andrzej Budny, Łukasz Pokorzyński, Mateusz Zych, Maciej Marcinkiewicz, Katarzyna Stec, Tomasz Murawski, Julia Szymła, Wojciech Halber, Daria Kałowska
Dec. 04, 2024 – Nov. 14, 2025

The aim of the project is to organize the National Student Conference on Acoustics (OSKA) 2025, an annual scientific event bringing together students and young researchers in the field of acoustics. The conference, held since 2013 at various Polish universities, serves as a platform for presenting achievements, exchanging experiences, and integrating the academic community. The OSKA 2025 program will cover a wide range of topics, including architectural, musical, and biomedical acoustics, psychoacoustics, signal processing, electroacoustics, and sound engineering. The need for this project arises from the selection of the Electroacoustics Scientific Circle as the organizer of this year's edition. The conference will enhance the university's recognition, strengthen the position of student research groups, and contribute to the promotion of scientific research and student initiatives on a national level.

[Pro19] **Reconstruction of three-dimensional images in electrical capacitance tomography using deep neural networks** (Rekonstrukcja obrazów trójwymiarowych w elektrycznej tomografii pojemnościowej z użyciem głębokich sieci neuronowych).
Damian Wanta,
Apr. 03, 2023 – Apr. 31, 2025
YOUNG, WUT

Electrical capacitance tomography is an imaging technique that enables obtaining a spatial distribution of electric permittivity based on the mutual capacitances measured using a set of electrodes surrounding investigated area. ECT allows for obtaining a very large number of images per second and so can be used to image dynamic processes, like multiphase flow, widely used in the pharmaceutical, petrochemical, and food industries. Due to the limited number of electrodes used, the spatial resolution of the images obtained is low. Increasing the number of electrodes would mean reducing their surface area, and thus limiting measured capacitances to values of the order of hundreds of attofarads. The measurement of such low values would be a significant challenge.

In three-dimensional tomography, data acquisition is performed using electrodes located in several rings. Based on one set of excitations, it is possible to reconstruct the three-dimensional distribution of permittivity in the entire volume of interest. Obtaining good quality images based on three-dimensional data acquisition is possible with the use of non-linear iterative reconstruction algorithms. These algorithms require repeated solving of a forward problem consisting in simulation of electric field distribution. Achieving an accurate

simulation of a three-dimensional electric field requires the use of a very large number of discretization mesh elements, which results in a large computational load. As a result, the time needed to reconstruct a single 3D image with the use of modern personal computers can range from a few to several dozen minutes.

Image reconstruction using deep neural networks is much faster than non-linear inverse problem-solving methods, allowing for many images per second. The aim of this project is to develop a neural network architecture that will allow for obtaining better quality images than in classical reconstruction methods, such as the Lovenberg-Marquard algorithm. It is planned to generate large and diverse training data using both numerical simulation and real measurements. We want to check whether a neural network trained with simulated data will cope well enough with real measurements. The obtained images will be compared with images obtained using non-linear algorithms. For this purpose, a new test object will be proposed for the assessment of spatial resolution, enabling the determination of the modulation transfer function. We want to investigate how the neural network deals with stability when imaging fast-changing processes and whether it is possible to obtain images of better quality in real time measurement.

4.3.2. Internal grants

[Pro20] **New method for high time-resolution measurements of fast microwave switches transient states using a vector network analyzer** (Nowa metoda pomiaru stanów przejściowych szybkich przełączników mikrofalowych z wysoką rozdzielczością czasową za pomocą wektorowego analizatora obwodów).
Paweł Bajurko, J. Sobolewski;
Apr. 23, 2024 – Dec. 31, 2025
Project granted by the Scientific Council for Automatics, Electronics, Electrical Engineering and Space Technologies, WUT.

The aim of this study is to develop a method that enables the application of a vector network analyzer to measure the fast transient states of microwave switches.

[Pro21] **Calorimetric method for measuring the heating power of superparamagnetic nanoparticles in a system of partial thermal insulation** (Kalorymetryczna metoda pomiaru mocy grzania nanocząstek superparamagnetycznych w układzie niepełnej izolacji termicznej).
Grzegorz Domański;
Jun. 03, 2024 – Nov. 30, 2025
Project granted by the Scientific Council of Biomedical Engineering, WUT.

The aim of the project is to develop a calorimetric method for determining the power of superparamagnetic nanoparticles in conditions of incomplete thermal insulation. One of the most reliable methods for measuring the heating efficiency of nanoparticles is calorimetric measurement of the sample temperature during stimulation with an alternating magnetic field. Accurate measurement of heating power requires full thermal insulation, otherwise part of the heat power transferred to the environment will result in a significant underestimation of the heating power of nanoparticles. The aim of the project is to create the best possible thermal insulation system using the circulation of the cooled

liquid and to develop a thermoelectric replacement model from RC components, taking into account both the incomplete thermal insulation of the system, as well as other factors affecting the accuracy of heating power measurement, such as the heat generated by the transmitting coil or ambient temperature fluctuations. Initial calibration measurements made with a source of known heating power will allow the identification of substitute parameters of the model, which in the next step will be used to precisely determine the heating power, taking into account the power losses and the influence of other external factors.

[Pro22] **Comparison of Phantom Fabrication Methods for Conducting Measurements in Medical Electrical Capacitance Tomography** (Porównanie metod wykonywania fantomów do przeprowadzenia pomiarów w medycznej elektrycznej tomografii pojemnościowej).
Waldemar Smolik;
Oct. 6, 2025 – Dec. 31, 2026
Project granted by the Scientific Council of Biomedical Engineering, WUT.

Electrical capacitance tomography uses dry electrodes, which are potentially more comfortable for the patient than the adhesive skin electrodes currently used in electrical impedance tomography. To assess the applicability of dry electrodes, it is necessary to conduct preliminary studies using phantoms with electrical parameters that closely resemble those of living tissues. The aim of the project is to compare methods for fabricating thoracic phantoms for electrical capacitance tomography. As part of the project, various types of phantoms will be developed, and their electrical parameters will be evaluated. Developing a method for producing phantoms with characteristics similar to the human body will enable the transition from simulation-based studies to investigations based on real measurements, moving toward the medical application of electrical capacitance tomography.

[Pro23] **Antenna Array with Adaptive Beam Steering for L-Band Low Earth Orbit Satellite Receiver** (Szyk antenowy z adaptacyjnym sterowaniem wiązki do odbioru sygnałów z satelitów niskiej orbity okołoziemskiej w paśmie L).
Grzegorz Bogdan;
Oct. 6, 2025 – Dec. 31, 2026
Project granted by the Rector.

The main goal of the grant is to create an automated system for receiving meteorological data from a Low Earth Orbit (LEO) satellite. As part of the project, an L-band antenna array with adaptive beam steering is planned to be constructed. The antenna array will be based on the time-modulated antenna array concept. The antenna array will be tested as part of the AHRPT (Advanced High-Definition Picture Transmission) receiving ground station for the European Space Agency's MetOp-B meteorological satellite. The received images, taken by the satellite passing over Poland at an altitude of approximately 800 km, will be posted on a publicly accessible website.

4.4. Other projects

[Pro24] **Designing RF circuits for LTE 450 MHz base station for critical applications** (Projektowanie obwodów RF do stacji bazowej LTE 450 MHz do zastosowań krytycznych).

Wojciech Wojtasiak;

Apr. 06, 2023 – Apr. 30, 2025

Funded by Telco Feng sp.z.o.o.

The aim of this work is to design and test RF circuits for the newly developed LTE base station intended for critical applications. The system is to operate in the LTE 450 MHz band (B31).

The Institute of Radioelectronics and Multimedia Technology acts as a sub-contractor of IT Partners Telco. The contract is carried out as a part of the National Centre for Research and Development project “*LTE - Advanced 450 MHz Micro Base Station for Critical – Mission Systems*”, implemented under the “Path for Mazovia” program.

[Pro25] **Experimental investigation of planar antenna arrays in X-band** (Badania planarnych szyków antenowych w paśmie X).

Grzegorz Bogdan, Jakub Sobolewski

Feb. 8, 2023 – Dec. 31, 2025

Funded by Eycore Sp. z o.o.

Electrical parameters of planar antenna arrays were measured in the frequency range of 9-10.5 GHz with various methods and configurations. Fundamental characteristics as the radiation pattern and the impedance matching were determined separately for individual components (i.e. antennas and feeding networks) and assembled arrays. This involved measurements of scattering matrices of 9-port networks and measurements of the absolute gain in two orthogonal planes with an angular step as low as 0.6 degree.

[Pro26] **Measurements of scattering parameters of circuits and radiation characteristics of two horn antennas in the K band** (Badanie parametrów rozproszenia obwodów oraz charakterystyk promieniowania dwóch anten typu horn w paśmie Ka)

Paweł Bajurko, Jakub Sobolewski

Jan. 31 – Mar. 31, 2025

Funded by Thorium Space S.A.

The work was divided into two parts. In the first part, multiport S-parameter measurements of a set of circuits were carried out. The second part was devoted to radiation pattern measurements of two horn antennas operating in the K band. The antenna measurements were conducted in an anechoic chamber.

[Pro27] **A development of the PA900VX amplifier and the fabrication of 4 device** (Projekt i wykonanie 4 sztuk wzmacniaczy PA900VX)

Wojciech Wojtasiak

Jun. 12 – Sep. 30, 2025

Funded by Vortex Sp. z o.o.

The PA900VX amplifier is indeed a TX/RX block designed as a Front-End for the transceiver NRC7292, operating in TDD mode under IEEE 802.11ah. The main PA900VX amplifier parameters are as follows:
Frequency range: 902 - 928MHz;
Switching time: less than 1us;
TX gain: 38dB;
TX output power: 37dBm;
PAPR: 7dB;
Rx gain: 18-20dB
Noise figure: less than 1dB

[Pro28] **Experimental study of absorbing materials in the 50-75 GHz and 75-110 GHz bands** (Badanie właściwości materiałów absorpcyjnych w pasmie 50-75 GHz oraz 75-110 GHz)

Paweł Bajurko, Konrad Godziszewski

Nov. 25 – Dec. 18, 2025

Funded by Stokvis Tapes Polska Sp. z o.o.

A set of absorptive materials was tested during this work to determine their electrical parameters in the V and W bands (50-75 GHz and 75-110 GHz, respectively). A quasi-optical measurement setup consisted of a vector network analyzer, sub-THz transceivers modules, antennas and a beam-focusing mirror system was used for the measurements.

[Pro29] **Examination of the 4-channel multiband quadrature receiver** (Badanie 4-kanalowego wielopasmowego odbiornika kwadraturowego)

Paweł Bajurko

Oct. 29, 2024 – Nov. 28, 2025

Funded by SIRC Sp. z o.o.

The objective of this study is to examine the operational characteristics of the 4-channel multiband quadrature receiver.

4.5. Other activities**4.5.1 Partnership****4.5.1.1. International Co-operation****CC-Link**

Since 12 May 2005 the Institute of Radioelectronics and Multimedia Technology has been a formal member of the CC-Link Partner Association the world-wide organization of industrial and research institutions working on the development and applications of CC-Link (Control & Communication Link) – a field network system that processes both the control and information data at high speed, to provide efficient integrated factory and process automation. The collaboration with the Association is realized by the Division of Nuclear and Medical Electronics.

China – Poland Exchange Program

The Institute of Radioelectronics and Multimedia Technology (Nuclear and Medical Electronics Division) in collaboration with the Institute of Engineering Thermophysics (IET), Chinese Academy of Sciences, China, realized the new exchange program: “Advanced process monitoring technologies for multi-phase flows”. The aim of this program is to explore how to investigate the multi-phase flows based on process tomography and process CFD simulation to analysis the complex flow characteristics. Exchange plan include scholars from IET visiting the Institute of Radioelectronics and Multimedia Technology, Warsaw University of Technology (WUT). Head of the research group: **Waldemar Smolik**

4.5.1.2. National Co-operation**IUSER**

The new established science and technology platform: “Intelligent Devices and Systems for Distributed Power Generation” is carried out at Institute of Radioelectronics and Multimedia Technology, Military University of Technology, National Institute of Telecommunications, Military Communication Institute, National Chamber of Electronics and Telecommunications, TP SA., Institute of Electron Technology. The main aim of this project is to conduct the research on technologies and products, the implementation of which will create a market opportunity for the development of distributed generation based on renewable energy sources.

Intelligent Transport

The new established science and technology platform is carried out at Faculty of Electronics and Information Technology (Institute of Radioelectronics and Multimedia Technology, Institute of Telecommunications), Faculty of Transport, Faculty of Administration and Social Sciences, Faculty of Automotive and Construction Machinery Engineering. The main aim of this project is to realize the scientific researches in the field of telecommunication and information systems and methods of information in an intelligent transport.

CentriX

The new established science and technology platform CentriX is founded by European Regional Operation Fund 2014 – 2020 for Mazovian Voivodeship. This project is carried out at National Center for Nuclear Research, Institute of Radioelectronics and Multimedia Technology with co-operation of Imagine RT Ltd., and Eastern Wall Technologies Ltd. The main goal of this project is to establish the innovation and scientific center and realize researches in the field of industry radiation techniques. Head of the research group: **Waldemar Smolik**

Outstanding industrial project – co-operation with IT Partners Telco Ltd.

The Institute of Radioelectronics and Multimedia Technology (Microwave and Radiolocation Engineering Division) in collaboration with IT Partners Telco Ltd., realized the project called “Innovative at global level microcell LTE-Advanced working with high RF power in 3.4-3.8 GHz frequency range” founded from EU Innovative Development Operation Program. Institute of Radioelectronics and Multimedia Technology making the equipment available for IT Partners Telco Ltd. to conduct the research activities possible through this project.

Microwave Microscopy for Advanced and Efficient Materials Analysis and Production

Przemysław Korpas;

MMAMA Project - research and innovation programme under European Union **Framework Programme - HORIZON 2020**
2017-2021

Cooperation with QWED company focused on development of accurate microwave Q-Meter device for 10 GHz Split-Post Dielectric Resonators and algorithms for special resolution improvements of scans performed with such a resonator.

4.5.2. Scientific networks

Subsystem Developed Through IMWP for Wireless Communication and Radar Functionalities – WG2 work group, **IMWP for 5G – WG3** work group.

Yevhen Yashchyshyn;

COST – European Cooperation in Science & Technology supported by **EU Framework Programme HORIZON 2020**
2018 - 2022

The WG2 and WG3 are realized in frame of the European Network for High Performance Integrated Microwave Photonics Project.

WG2: The goal is to define the main requirements for implementing IMWP communication and radar subsystems in terms of PIC models and monolithic integration.

WG3: The goal is to identify the IMWP opportunities in terms of generation, SWaP, bandwidth, and integration to unlock the future 5G communications.

Polish Network of Neutrino Physics (Polska Sieć Neutrinowa)

In 2006, the Faculty of Electronics and Information Technology joined the Polish Network of Neutrino Physics. The network comprises several institutes and laboratories working in the field of development of experimental neutrino physics. The Faculty is represented in the network by the Division of Nuclear and Medical Electronics, which has a long-term experience in collaboration with high energy physics (NMC, SMC, COMPASS) and neutrino physics (ICARUS, T2K) experiments.

Polish Network of Particle Astrophysics (Polska Sieć Astrofizyki Cząstek)

In 2006 the Faculty of Electronics and Information Technology joined the Polish Network of Particle Astrophysics. The main goal of the organization is to create a frame for the research collaboration of several institutes and laboratories in the field of development of advanced experimental methods for particle astrophysics. The Faculty is represented in the network by two research groups: from the Institute of Electronics Systems and from Institute of Radioelectronics and Multimedia Technology – namely from the Division of Nuclear and Medical Electronics.

HyperMR - European Network for Hyperpolarization Physics and Methodology in NMR and MRI – TD1103

In 2012 the Faculty of Electronics and Information Technology, Institute of Radioelectronics and Multimedia Technology (the Division of Nuclear and Medical Electronics) joined the project realized in the frame for the research collaboration of several Polish and foreign institutes. The main aim of this Action is to stimulate and accelerate collaborations and joint research efforts between European groups into hyperpolarization physics and methodology with the goal to develop robust strategies for sensitivity enhancement in NMR and MRI. Coordinated short-term scientific missions (STSMs) will make it possible to fully exploit the potential of unique scientific instrumentation which already exists in few European groups. The scientific programme is organised into 5 different working groups that focus on key issues related to the topic of the Action. The scientific programme is supported by a wide range of research groups thus generating a high added value for the European research landscape.

4.5.3. Student research clubs

Student Club Of Antenna Design

Grzegorz Bogdan – tutor.

The Student Club of Antenna Design associates students of the Warsaw University of Technology who have interest in antenna modeling, design, measurements, and applications. Current activities are related to development of ground stations antennas for the Low Earth Orbit satellites.

Space Engineering Student Research Club

Krzysztof Kurek – tutor.

Space Engineering Student Research Club – SKIK (in Polish Studenckie Koło Inżynierii Kosmicznej) was formed in 2004. Members of SKIK participated in different international and internal educational space

projects. i.e. ESEO, PW-Sat, BOBAS balloon missions. Now, the club start activity with new members, preparing the next balloon mission. Now activity of the Club is focused on realization of stratospheric balloon missions to measure air pollution.

The Mobile Applications Student Research Club

Krystian Ignasiak – tutor.

The Mobile Applications Student Research Club (KNAM) builds Flutter skills through hands-on projects: API integration, state management, Google Maps app with AI voice control. Members tackle real-world programming challenges and gain teamwork experience. Our goal is to help members land Flutter developer internships or jobs.

Electromagnetic Modelling Student Research Club

Bartłomiej Salski - tutor

Members of the Electromagnetic Modelling Student Research Club have realized the project: "System for characterization of materials at millimeter spectrum". One of the hurdles in the development of devices and systems working in the millimeter-wave band is that the electromagnetic properties of the materials used for their construction should be well known at the design stage. The goal of the project is to develop a practical and portable test-bench for free-space characterization of planar samples in the frequency range 18-40 GHz. Strengths of the chosen characterization method include a broad analysis bandwidth and non-destruction of the sample. It is hoped that students and faculty members will benefit from both building and utilizing the test-bench for research purposes.

3Z5PW Experimental Amateur Radio Station

Dawid Rosołowski – tutor.

The 3Z5PW is the callsign of the amateur radio club station set up in 2015 with the goal of developing interest in RF and microwave technology among students of The Faculty of Electronics and Information Technology and of the whole WUT. Due to the interdisciplinary character of the contemporary amateur radio, the Experimental Station activities focus on the practical use of the knowledge in the field of analog radio electronics - development of components for transceivers, designing simple and more complicated radio circuits and antennas for educational and experimental purposes, as well as applications of SDR technology and uC programming. All efforts allow the club members to make long distance wireless contacts with other stations in faraway places on the HF, VHF and SHF bands in more conscious way.

Current activities are concentrated on education and training of young radio operators (two editions of amateur radio courses), promotion of ham radio and the development of the radio shack. 3Z5PW station operators: Dawid Rosołowski (SQ5JQI), Grzegorz Grochowski (SP5QWG), Przemysław Korpas (SQ7JHV).

Electroacoustics Scientific Student Research Club

Agnieszka Paula Pietrzak – tutor.

Electroacoustics Scientific Club of Warsaw University of Technology, is affiliated with the Electroacoustics Department of the Institute of Radio electronics and Multimedia Techniques at the Faculty of Electronics and Information Technology. The area of activity of the Electroacoustics Scientific Club includes: design and

construction of electroacoustic devices, design of electroacoustic systems, studio recording sessions and mastering, surround sound, development of software for processing and measuring sound signals, application of Artificial Intelligence (AI) to sound signals, speech acoustics, electroacoustic measurement systems.

Members of the Electroacoustics Scientific Club conduct projects, give speeches at scientific conferences, and support the organization of conferences and fairs (e.g. Audio Video Show Warsaw, polish conferences on acoustics: ISSET, OSA and OSKA). Scientific Club also cooperates with other scientific clubs and student organizations, organizing joint initiatives (e.g. realization of radio studio concerts in the recording studio of the Electroacoustics Department in cooperation with the WUT radio station - Radio Aktywne). The scientific supervisor of the club is Agnieszka Paula Pietrzak, PhD. Board: chairman - Karolina Pondel-Sycz, M.Sc.; vice-chairman - Andrzej Budny, Eng.; treasurer/secretary - Kamil Drzewiecki

4.6. Instrumentation Investments

4.6.1. Centre for Biomedical Technology and Medical Physics

Nuclear and Medical Electronics Division
(**Krzysztof Zaremba** – head)
2008 - 2021

Founded by European Regional Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG).

The project is a part of the CePT (Centre for Preclinical Research and Technology), the biggest biomedical and biotechnological undertaking in Central and Eastern Europe. The CePT project is coordinated by the Medical University of Warsaw in partnership with the University of Warsaw, the Warsaw University of Technology and seven research institutes of the Polish Academy of Sciences. The main objective of the Centre is to establish the network of biomedical engineering and biomaterial technology laboratories which will form the base for scientific research and technology implementation. In this Project participates 8 faculties of Warsaw University of Technology.

4.6.2. Panda 2 Project

2016 – 2021

The Institute of Radioelectronics and Multimedia Technology together with the partners of the CePT Project participates in the implementation of the contract for the execution and financing of the Panda 2 Project, which aims to support the cost of maintaining the readiness of the research infrastructure. The contract was concluded in 2016 with a period of 4 years. According to The National Centre for Research and Development (NCBR) roles the program is aimed at supporting the costs of maintaining R & D infrastructure built or rebuilt thanks to the implementation of projects within the second axis of the Innovative Economy Programme (POIG), for which the final eligible costs was at least 50 million PLN.

4.6.3. Sub-terahertz Technology and Antenna Laboratory

Yevhen Yashchyshyn, P. Bajurko;

2010 – 2021

Funded by European Regional Development Fund (ERDF) in scope of Operational Programme Innovative Economy (POIG).

The project is a part of the Faculty Research Centre FOTEH (Photonics and Terahertz Technologies). The project encompasses modernizing of infrastructure of the Antenna Laboratory that enables research on spatial distributions of the electromagnetic field in the millimetre-wave and sub-terahertz range to develop and study of antennas, characterize parameter of materials and designing of the communication, imaging and radar system.

4.6.4. Fast-X Laboratory: Electrical Capacitance Tomograph (Laboratorium Fast-X: Elektryczny tomograf pojemnościowy).

Waldemar Smolik, J. Kryszyn, R. Szabatin (em.), M. Krzewski, T. Olszewski, B. Radzik, P. Wróblewski, D. Wanta, M. Stosio;

2019-2021

Funded by European Regional Development Fund (ERDF) in scope of Regional Operational Programme for Mazovian Voivodeship – PRO-WM

The project is elaborated in the co-operation with the National Center for Nuclear Research in Świerk, where has been set up a research and implementation centre for CentriX industrial radiation techniques. One of the key equipments, which is established at the National Centre for Research and Development, is the most modern modular accelerator capable of speeding up electrons up to energy of 30 MeV. The accelerator is a part of the Fast-X Laboratory within the CentriX project.

5. TITLES AND DEGREES AWARDED

5.1 Professor Titles

[Prof1] Piotr Bilski – promoted to a professor title (May 5, 2025).

[Prof2] Piotr Bogorodzki - promoted to a professor title (Jan. 14, 2025).

[Prof3] Waldemar Smolik - promoted to a professor title (Jan. 14, 2025).

5.2 Ph.D. Degrees

[PhD1] Jerzy Cuper: “*Accurate Methods of Characterization of Conductive Layers and Dielectric Samples at Millimeter-Wave and THz Frequencies*”, Assoc. Prof. **P. Kopyt** (supervisor), Warsaw, Mar. 18, 2025.

[PhD2] Daniel Mostowski: “*Recommendation systems for laser beam diagnostics based on artificial intelligence algorithms*”, Assoc. Prof. **G. Pastuszak** (supervisor), Warsaw, Sep. 23, 2025.

5.3 M.Sc. Degrees

[MSc1] Marcin Adamczuk: “*Badanie możliwości wykrywania a kierunku nadejścia sygnału z wykorzystaniem modułu DW3000*” (Testing the ability to detect the direction of an incoming signal using the DW3000 module), Assist. Prof. **V. Djaja-Joško** (supervisor).

[MSc2] Chernet Asefa Adaye: “*Analysis of the Safety of UAV-Enhanced Vehicular Communication*”, Prof. **P. Bilski** (supervisor), studies in English.

[MSc3] Paweł Baran: “*Zwiększanie rozdzielczości przestrzennej funkcji HRTF z wykorzystaniem generatywnych sieci neuronowych GAN*” (Spatial resolution enhancement of HRTFs using generative adversarial networks), Assist. Prof. **A. P. Pietrzak** (supervisor), M.Sc. degree with honours.

[MSc4] Aneta Bień: “*Badanie tła w zdarzeniach dyfrakcyjnych rejestrowanych przez detektory ATLAS Forward Proton Detectors w CERN LHC*”, (Study of backgrounds in diffractive events recorded by the ATLAS Forward Proton Detectors at CERN LHC), Assist. Prof. **M. Ziembicki** (supervisor).

[MSc5] Wisdom Chama: “*Development of an Optimized Routing Algorithm for Network Traffic Management*”, Prof. **P. Bilski** (supervisor), studies in English.

[MSc6] Kinga Depko: “*Automatyczna klasyfikacja stylu śpiewu na podstawie wybranych cech czasowo-częstotliwościowych*” (Automatic classification of singing style based on selected time-frequency features), Assist. Prof. **A. P. Pietrzak** (supervisor).

[MSc7] Kiryl Fedaryshkin: “*Estimation of three-dimensional position of selected points on the human body based on data from depth sensors in applications related to human gait analysis*”, Assist. Prof. **J. Wagner** (supervisor), studies in English.

[MSc8] Piotr Gryglewski: “*Charakteryzacja materiałów przewodzących dla technologii 5G z wykorzystaniem rezonatorów mikrofalowych*” (Characterization of conductive materials for 5G technology using microwave resonators), Assoc. Prof. **W. Wojtasiak** (supervisor).

[MSc9] Zofia Jethon: “*Optymalizacja klasyfikatorów neuronowych w technice ISBE*” (Optimization of neural network classifiers using ISBE technology), Prof. **W. Skarbek** (supervisor).

[MSc10] Karina Klekowiecka: “*Program do wspomaganego komputerowo oceny stanu układu krążenia*” (Program for computer-assisted assessment of the condition of the cardiovascular system), Assist. Prof. **G. Domański** (supervisor).

[MSc11] Jiawei Li: “*Dual-band WLAN Antenna Applied in Factory Environment*”, Prof. **Y. Yashchyshyn** (supervisor), studies in English.

[MSc12] Jacek Liśkiewicz: “*Program do analizy danych genetycznych*” (Program for genetic data analysis), Assist. Prof. **G. Domański** (supervisor).

[MSc13] Krzysztof Miśków: “*Integracja modeli dyfuzyjnych z modelami językowymi a predykcja sygnałów giełdowych*” (Integration of diffusion models with language models and prediction of stock signals), Prof. **W. Skarbek** (supervisor).

[MSc14] Bartłomiej Pawełkowicz: “*Projekt muzycznego modelu rekomendacji z wykorzystaniem uczenia maszynowego*” (Web application project using an advanced music machine learning recommendation model), Prof. **P. Bilski** (supervisor).

[MSc15] Ziemowit Pietrucha: “*Dozymetria metodami Monte Carlo na potrzeby terapii radioizotopowej*” (Dosimetry with the Monte Carlo methods for radioisotope therapy), Assist. Prof. **P. Tulik** (supervisor).

[MSc16] Shunqin Rao: “*Self-configurable sensor network based on multidrop Single Pair Ethernet network*”, Assist. Prof. **G. Kasprówicz** (supervisor), studies in English.

[MSc17] Ivan Ryzhankov: “*Application of artificial neural networks to evaluate the quality of data from tandem mass spectrometry*”, Assist. Prof. **T. Rubel** (supervisor), studies in English.

[MSc18] Katarzyna Sendek: “*Zastosowanie metod uczenia maszynowego do analizy i klasyfikacji sygnału PPG*” (Application of machine learning methods to analyze and classify the PPG signal), Assist. Prof. **G. Domański** (supervisor).

[MSc19] Marta Sidorowicz: “*Implementacja i ocena wybranych algorytmów klasyfikacji patologii w sygnałach elektrokardiograficznych*” (Implementation and evaluation of selected pathology classification algorithms in

- electrocardiographic signals), Assist. Prof. **R. Kurjata** (supervisor).
- [MSc20] Krzysztof Suwiński: „*Algorytmy detekcji obiektów kosmicznych w systemie pasywnej radiolokacji wykorzystującym anteny radioteleskopu LOFAR*” (Algorithms for detection of space objects in a passive radar system using antennas of the LOFAR radiotelescope), Assoc. Prof. **K. Jędrzejewski** (supervisor), M.Sc. degree with honours.
- [MSc21] Mebrat Tadele Hailu: „*Methods of increasing security on end-point devices using EDR and XDR Technology*”, Prof. **P. Bilski** (supervisor), studies in English.
- [MSc22] Shuqing Zhao: „*Internet of Things methods in the application of determining the color of the sky, taking into account data from sensors and cameras obtained during field research*”, Assoc. Prof. **M. Borecki** (supervisor), studies in English.
- [MSc23] Mikołaj Zieliński: „*Badanie propagacji fal ultrakrótkich na podstawie sygnałów z radiolatarni lotniczych VOR*” (Study of VHF radio propagation based on VOR beacon’s signals), Assist. Prof. **W. Kazubski** (supervisor).
- #### 5.4 B.Sc. Degrees
- [BSc1] Maciej Bąkowski: „*Synchronizacja czasowa w ORAN*” (Time Synchronization in ORAN), MSc. **P. Araszkiwicz** (supervisor).
- [BSc2] Konstanty Berezowski: „*Projekt i realizacja stanowiska do demonstracji własności sygnałów akustycznych z wykorzystaniem cyfrowego syntezyzatora dźwięku*” (Design and Implementation of a Demonstration Setup for the Analysis of the Properties of Acoustic Signals Using a Digital Sound Synthesizer), Assist. Prof. **M. Jasiński** (supervisor).
- [BSc3] Iga Bernat: „*Uwierzytelnianie użytkowników smartfonów na podstawie wskazań czujników inercyjnych*” (Authentication of Smartphone Users Based on Inertial Sensor Data), Assist. Prof. **M. Kołakowski** (supervisor).
- [BSc4] Michał Bogdanowicz: „*Projekt i realizacja aplikacji webowej wspomagającej proces rehabilitacji pacjentów z uwzględnieniem osób z niepełnosprawnościami*” (Design and implementation of a web application supporting the rehabilitation process for patients, including individuals with disabilities), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc5] Michał Robert Borkowski: „*Opracowanie modułu rejestratora Bluetooth Low Energy z transmisją danych po Wi-Fi*” (Development of the Bluetooth Low Energy advertisement logger with Wi-Fi data transmission), Assist. Prof. **V. Djaja-Joško** (supervisor).
- [BSc6] Alicja Brzóska: „*System do akwizycji sygnałów ze scyntykamery*” (System for acquiring signals from a scinticamera), Assist. Prof. **G. Domański** (supervisor).
- [BSc7] Radosław Budek: „*System monitoringu warunków środowiskowych w domu jednorodzinym*” (Environmental monitoring system for a single-family household), Assist. Prof. **W. Kazubski** (supervisor).
- [BSc8] Anna Celińska: „*Projekt i realizacja adaptacji akustycznej rzeczywistego pomieszczenia w celu spełnienia określonych wymagań*” (Planning and implementation of acoustic adaptation for a real-life space to meet defined requirements), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc9] Qianqian Chen: „*Improvement of vector network analyzer calibration accuracy with low-priced SMA calibration kit*”, Assist. Prof. **P. Bajurko** (supervisor), studies in English.
- [BSc10] Zuzanna Czerwińska: „*Aplikacja mobilna wspierająca diabetyków*” (Mobile application supporting diabetes care), Assist. Prof. **R. Kurjata** (supervisor).
- [BSc11] Tomasz Dawidziuk: „*Metoda rozpoznawania tęczywki wykorzystująca sieci głębokie i zoptymalizowana pod kątem typu danych wejściowych*” (Iris recognition method using deep neural networks optimized for the input data type), Assist. Prof. **M. Trokielewicz** (supervisor), B.Sc. degree with honours.
- [BSc12] Jan Dziewulski: „*Projekt i realizacja systemu monitoringu z automatycznym wykrywaniem i rejestracją zdarzeń*” (Design and implementation of a monitoring system with automatic event detection and recording), Assist. Prof. **G. Galiński** (supervisor).
- [BSc13] Kamil Drzewiecki: „*Realizacja algorytmów detekcji obiektów na urządzeniu NVIDIA Jetson Nano*” (Implementation of object detection algorithms on NVIDIA Jetson Nano device), Assist. Prof. **A. Buchowicz** (supervisor).
- [BSc14] Karolina Górecka: „*Projekt i realizacja aplikacji internetowej do zarządzania historią medyczną pacjenta*” (Design and Implementation of a Web Application for Managing Patients’ Medical History), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc15] Daniel Górski: „*Rozpoznawanie samochodów na zdjęciach przy zastosowaniu algorytmów uczenia maszynowego*” (Car Recognition in Photos Using Machine Learning Algorithms), Assist. Prof. **K. Kuczyński** (supervisor).
- [BSc16] Szymon Maciej Hypiak: „*Lokalizacja pozycji źródeł emisji sygnałów radiowych na podstawie pomiaru różnic czasów przyścia*” (Localization of Radio Signal Emission Sources Based on Time Difference of Arrival Measurements), Prof. **M. Malanowski** (supervisor).
- [BSc17] Mateusz Jangas: „*Przenośny pulsoksymetr z interfejsem Bluetooth*” (Portable pulse oximeter with Bluetooth interface), Assist. Prof. **R. Kurjata** (supervisor).

TITLES AND DEGREES AWARDED

- [BSc18] Mikołaj Jankowski: „Projekt i realizacja wtyczki VST do symulacji pogłosu z wykorzystaniem metody geometrycznej analizy pola akustycznego” (Design and implementation of a VST plugin for reverb simulation using geometrical acoustic field analysis method), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc19] Patrycja Jaworek: „Projekt i realizacja aplikacji do automatycznej oceny zrozumiałości mowy w obecności zakłóceń i różnych warunkach akustycznych” (Design and implementation of an application for automatic evaluation of speech intelligibility in the presence of interference and various acoustic conditions), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc20] Oliwia Jędrzycka: „Aplikacja na urządzenia mobilne do wspomagania segregacji odpadów” (Mobile application for supporting waste segregation), Assist. Prof. **G. Galiński** (supervisor).
- [BSc21] Alicja Jurzysta: „Klasyfikacja danych z badań metabolomicznych przy użyciu sztucznej sieci neuronowej” (Classification of metabolomic research data using an artificial neural network), Assist. Prof. **T. Rubel** (supervisor), B.Sc. degree with honours.
- [BSc22] Paweł Jan Kabała: „Ocena wierności auralizacji nagrań sygnałów instrumentów muzycznych” (The accuracy of auralization of recordings of musical instruments), Assist. Prof. **M. Jasiński** (supervisor).
- [BSc23] Filip Kalinowski: „Urządzenie do automatycznego wydawania suchej karmy” (Automated pet food dispenser), Assist. Prof. **K. Godziszewski** (supervisor).
- [BSc24] Adrian Kawczyński: „Wykrywanie niebezpiecznych zdarzeń w sekwencjach rejestrowanych przez systemy monitoringu wizyjnego” (Detection of dangerous events in sequences recorded by video monitoring systems.), Assist. Prof. **A. Buchowicz** (supervisor).
- [BSc25] Szymon Klimaszewski: „Rekonstrukcja obrazów w elektrycznej tomografii pojemnościowej za pomocą sieci głębokiej z warstwami w pełni połączonymi” (Image reconstruction in electrical capacitance tomography using a deep neural network with fully connected layers), Prof. **W. Smolik** (supervisor).
- [BSc26] Agata Koguciuk: „Bezprzewodowe urządzenie do rejestracji sygnału EEG” (Wireless device for recording EEG signal), Assist. Prof. **A. Rychter** (supervisor).
- [BSc27] Kamil Koloński: „Internetowy System SOS” (Web based emergency calling system), Assist. Prof. **R. Kurjata** (supervisor).
- [BSc28] Mateusz Kozłowski: „Lokalizacja stawów kolanowych i stóp człowieka na podstawie obrazów głębi” (Localization of human knee joints and feet based on depth images), Assist. Prof. **J. Wagner** (supervisor).
- [BSc29] Sebastian Krysiak: „Asystent gry w kółko i krzyżyk” (Tic Tac Toe Game Assistant), Prof. **A. Przelaskowski** (supervisor).
- [BSc30] Natalia Krzykała: „Opracowanie aplikacji na tablet do rejestracji danych medycznych” (Development of the tablet application for the medical data recording), Assist. Prof. **V. Djaja-Joško** (supervisor), B.Sc. degree with honours.
- [BSc31] Jakub Kubiński: „Aplikacja do archiwizacji paragonów i analizy wydatków”, (An application for receipt archiving and expense analysis), Assist. Prof. **G. Galiński** (supervisor).
- [BSc32] Marta Kwiatkowska: „Wykrywanie zmian nowotworowych na obrazach mammograficznych przy pomocy uczenia maszynowego” (Detecting cancer lesions in mammographic images using machine learning), Assist. Prof. **G. Domański** (supervisor).
- [BSc33] Zuzanna Kwiatkowska: „Odbiornik radia FM z dekodowaniem informacji RDS z wykorzystaniem techniki radia programowalnego” (FM radio receiver with RDS information decoding using software defined radio technique), Assist. Prof. **S. Kozłowski** (supervisor).
- [BSc34] Hang Li: „Dielectric resonator antenna with 3D printed elements”, Assist. Prof. **G. Bogdan** (supervisor), studies in English.
- [BSc35] Yaowen Liang: „6-axis IMU Library for Raspberry Pi Single Board Computer”, Assist. Prof. **M. Rupniewski** (supervisor), studies in English.
- [BSc36] Xunzhi Liao: „Comparison of different methods for the probabilistic density function fitting”, Assist. Prof. **P. Domański** (supervisor), studies in English.
- [BSc37] Jacek Lipiński: „Mobilna aplikacja e-zdrowie” (Mobile application e-health), Assist. Prof. **R. Kurjata** (supervisor).
- [BSc38] Xiaozan Lu: „Remote Monitoring System for Electricity Consumption of IoT Devices”, Assist. Prof. **K. Kuczyński** (supervisor), studies in English.
- [BSc39] Alicja Łakomska: „Aplikacja do nawigacji wewnątrz gmachu wydziału” (Faculty building navigation application), Assist. Prof. **M. Kołakowski** (supervisor), B.Sc. degree with honours.
- [BSc40] Filip Łapicz: „Bezpieczna komunikacja radiowa dla urządzeń IoT - stanowisko dydaktyczne” (Secure radio communication for IoT devices - educational platform), Assist. Prof. **P. Korpas** (supervisor).
- [BSc41] Piotr Łuszczczyk: „Wzmacniacz Doherty'ego na pasmo C dla LTE/5G NR (New Radios)” (Doherty Amplifier for the C-Band for LTE / 5G NR (New Radio)), Assist. Prof. **D. Gryglewski** (supervisor).
- [BSc42] Hubert Majkowski: „Urządzenie do wielopunktowego monitorowania temperatury

- ciała pacjenta z łączem bezprzewodowym*" (A device for multi-point monitoring of the patient's body temperature with a wireless connection), Assist. Prof. **G. Domański** (supervisor).
- [BSc43] Adam Mąkosa: "*Projekt i realizacja zestawu urządzeń IoT dla inteligentnego studia nagrań dźwiękowych*" (Design and Implementation of an IoT Device Set for a Smart Sound Recording Studio), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc44] Michał Nagawski: "*Projekt i realizacja syntezy dźwięku w postaci aplikacji webowej*" (Design and implementation of a sound synthesizer as a web application), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc45] Piotr Niewiński: "*Projekt i implementacja aplikacji webowej do planowania i relacjonowania podróży z wykorzystaniem treści multimedialnych*" (Design and implementation of a web application for travel planning and reporting using multimedia content), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc46] Dominik Pasierbiewicz: "*Oprogramowanie do klasyfikacji ciałek krwi z wykorzystaniem technik uczenia maszynowego*" (Blood cell classification software using machine learning techniques), Assist. Prof. **R. Kurjata** (supervisor).
- [BSc47] Anna Maria Pawłowska: "*Projekt i realizacja sygnalizatora poziomu ciśnienia akustycznego*" (Design and Implementation of a Sound Pressure Level Indicator), Assist. Prof. **M. Jasiński** (supervisor).
- [BSc48] Jakub Pawłowski: "*Wyostrożenie zdjęć SARowskich z wykorzystaniem uczenia maszynowego*" (Enhancement of SAR images with use of machine learning), Prof. **K. Kulpa** (supervisor).
- [BSc49] Weronika Pędzimaż: "*Grupowanie danych o aktywności genów z użyciem sztucznych sieci neuronowych*" (Clustering of gene expression data using artificial neural networks), Assist. Prof. **T. Rubel** (supervisor).
- [BSc50] Marcin Piechal: "*Implementacja algorytmu ANC w formie wtyczki VST*" (Implementation of the ANC algorithm in the form of a VST plugin), Prof. **P. Bilski** (supervisor).
- [BSc51] Michał Pietrak: "*Projekt rozmieszczenia urządzeń dźwiękowego systemu ostrzegawczego oraz analiza akustyczna dla peronu metra*" (Design of the voice alarm system and acoustic analysis for the metro platform), Assist. Prof. **G. Makarewicz** (supervisor).
- [BSc52] Wojciech Polak: "*Ekstrakcja warstwy wokalne utworu muzycznego przy użyciu sieci neuronowych*" (Extraction of the vocal layer of a musical piece using neural networks), Assist. Prof. **M. Jasiński** (supervisor).
- [BSc53] Sandra Rojek: "*Projekt i realizacja systemu detekcji emocji poprzez analizę dźwięku za pomocą algorytmów uczenia maszynowego*" (Design and Implementation of an Emotion Detection System through Sound Analysis Using Machine Learning Algorithms), Assist. Prof. **P. Bobiński** (supervisor).
- [BSc54] Jan Ronda: "*Opracowanie układu do badania aktywności ruchowej osób starszych poza domem*" (Development of a system for monitoring outdoor physical activity of elderly people), Assist. Prof. **J. Kołakowski** (supervisor), B.Sc. degree with honours.
- [BSc55] Tomasz Rymkiewicz: "*Aplikacja webowa wspierająca proces nauki czytania zapisu języków obcych*" (Web Application for the Learning Process of Reading Foreign Languages' Scripts), Assist. Prof. **P. Witoński** (supervisor).
- [BSc56] Jakub Sałek: "*Cyfrowy dziennik medyczny*" (Digital medical journal), Assist. Prof. **R. Kurjata** (supervisor), B.Sc. degree with honours.
- [BSc57] Piotr Siciński: "*Projekt rozproszonej bazy danych z wykorzystaniem platformy mikroprocesorowej*" (Project of the distributed database using the microprocessor system), Prof. **P. Bilski** (supervisor), B.Sc. degree with honours.
- [BSc58] Jakub Skorupa: "*Elektroniczny zamek do drzwi obsługiwany za pomocą smartfona z NFC*" (Electronic door lock controlled with an NFC-enabled smartphone), Assist. Prof. **K. Godziszewski** (supervisor).
- [BSc59] Antoni Skrobek: "*Aplikacja na urządzenia mobilne do katalogowania książek*" (Book cataloging application for mobile devices), Assist. Prof. **G. Galiński** (supervisor).
- [BSc60] Bartosz Stachyra: "*Projekt i realizacja programu do rozpoznawania w czasie rzeczywistym gestów polskiego języka migowego*" (Design and implementation of a program for real-time recognition of Polish Sign Language gestures), Assist. Prof. **G. Galiński** (supervisor).
- [BSc61] Katarzyna Stec: "*Porównanie modeli sieci neuronowych do automatycznego rozpoznawania emocji w głosie w języku polskim*" (Comparison of deep neural network models for automatic speech emotion recognition in Polish), Assist. Prof. **A. P. Pietrzak** (supervisor).
- [BSc62] Wiktor Styk: "*Wizualizacje wybranych zagadnień DSP z wykorzystaniem biblioteki Manim*" (Visualizations of selected DSP issues using the Manim library), Assist. Prof. **M. Lewandowski** (supervisor).
- [BSc63] Jolanta Sumińska: "*Aplikacja monitorująca wybrane formy aktywności ruchowej z wykorzystaniem opaski Wahoo TICKR X*" (Application for monitoring selected forms of physical activity using the Wahoo TICKR X band), Assoc. Prof. **J. Żmigrodzki** (supervisor).

TITLES AND DEGREES AWARDED

- [BSc64] Radosław Szawłowski: „*Fazowany szyk antenowy na pasmo ISM 2,45 GHz*” (Phased antenna array for the 2.45 GHz ISM band), Assist. Prof. **G. Bogdan** (supervisor).
- [BSc65] Adam Szewczyk: „*Internetowy analizator widma*” (Online spectrum analyzer), Assist. Prof. **R. Łukaszewski** (supervisor).
- [BSc66] Natalia Ślepowrońska: „*Urządzenie do poszukiwania osób zaginionych w terenach górzystych*” (A device for searching for missing persons in mountain areas), MSc. **M. Krywicki** (supervisor).
- [BSc67] Michał Świtalski: „*Urządzenie czujnikowe wykorzystujące technologię IoT do oceny lokalnej optycznej gęstości pokrywy chmur*” (IoT sensor device for local evaluation of the optical density of the cloud layer), Assoc. Prof. **M. Borecki** (supervisor).
- [BSc68] Piotr Targos: „*System do identyfikacji użytkownika z wykorzystaniem sygnału elektrokardiograficznego*” (System for user identification using an electrocardiographic signal), Assist. Prof. **G. Domański** (supervisor).
- [BSc69] Alicja Turzyńska: „*Pomiary parametrów dźwięku instrumentów muzycznych w różnych warunkach pogłosowych*” (Measurement of sound parameters of musical instruments in various reverberant conditions), Assist. Prof. **M. Jasiński** (supervisor).
- [BSc70] Katarzyna Tylicka: „*Optymalizacja układu formowania wiązki elektronów akceleratora do badań radiobiologicznych z wysoką mocą dawki (FLASH), za pomocą symulacji Monte Carlo i algorytmów ewolucyjnych*” (Optimization of the electron beam shaping system of an accelerator for radiobiological research with high dose rate (FLASH) using Monte Carlo simulations and evolutionary algorithms), Assoc. Prof. **P. Adrich** (supervisor), B.Sc. degree with honours.
- [BSc71] Yaqi Wan: „*Remote Controlled Station for Measuring Voltage Characteristics of IoT Transducers*”, Assist. Prof. **K. Kuczyński** (supervisor), studies in English.
- [BSc72] Beniamin Wasylów: „*Stetoskop elektroniczny z łączem Bluetooth*” (Electronic stethoscope with Bluetooth connection), Assist. Prof. **G. Domański** (supervisor).
- [BSc73] Dominik Wiącek: „*Projekt i realizacja aplikacji do analizy i interpretacji zapisu badania EKG*” (Design and Implementation of an Application for the Analysis and Interpretation of ECG Recordings), Assist. Prof. **P. Bobiński** (supervisor), B.Sc. degree with honours.
- [BSc74] Szymon Wiśniewski: „*Wykrywanie sygnalizatorów świetlnych w ruchu drogowym*” (Traffic Light Detection in Road Traffic), Assist. Prof. **A. Buchowicz** (supervisor).
- [BSc75] Adam Wiśniewski: „*Syntezytor subtraktywny w technologii VST 3.0*” (Subtractive synthesizer in VST 3.0 technology), Assist. Prof. **A. Buchowicz** (supervisor).
- [BSc76] Gyumin Woo: „*Biometric password protection for IoT devices*”, Prof. **M. Borecki** (supervisor), studies in English.
- [BSc77] Kamil Wojnicz: „*Program symulacyjny do modelowania zależności kontrastu w radiografii od napięcia na lampie rentgenowskiej*” (Simulation program for modeling radiography contrast dependence on X-ray tube voltage), Assist. Prof. **B. Konarzewski** (supervisor).
- [BSc78] Michał Wojtyński: „*Jednokanałowe urządzenie do pomiaru sygnału elektrokardiograficznego z wyświetlaczem LCD*” (Single-channel device for measuring electrocardiographic signals with an LCD display), Assist. Prof. **G. Domański** (supervisor).
- [BSc79] Daniel Wójtowicz: „*Analiza i transkrypcja muzycznych sygnałów dźwiękowych*” (Analysis and transcription of musical sound signals), Assist. Prof. **J. Wagner** (supervisor).
- [BSc80] Tomasz Wróbel: „*Projekt, wykonanie i charakteryzacja adaptera falowodowego pracującego w paśmie D*” (Design, fabrication and characterization of a waveguide adapter operating in the D-band), MSc. **M. Krywicki** (supervisor).
- [BSc81] Maja Zglinicka: „*Aplikacja do symulacji propagacji fal radiowych w środowiskach miejskich i podmiejskich*” (Application for simulating radio wave propagation in urban and suburban environments), Assist. Prof. **K. Godziszewski** (supervisor).
- [BSc82] Xuan Zhang: „*6-axis IMU Library for Raspberry Pico Controller*”, Assist. Prof. **M. Ruppeniewski** (supervisor), studies in English.
- [BSc83] Lin Zhang: „*Automated anomaly detection system for the Secure Smart Home*”, Prof. **P. Bilski** (supervisor), studies in English.
- [BSc84] Heyang Zhang: „*Self-Copying System for 433MHz Remote Controls*”, Assist. Prof. **K. Kuczyński** (supervisor), studies in English.
- [BSc85] Yanan Zhou: „*Path Optimization in WSN using Bat Algorithm*”, Prof. **P. Bilski** (supervisor), studies in English.
- [BSc86] Szymon Ziółkowski: „*Aplikacja wspomagająca poprawne dopasowanie roweru do budowy ciała rowerzysty*” (Application to help correctly fit the bike to the cyclist's body structure), Assist. Prof. **P. Mazurek** (supervisor).
- [BSc87] Zofia Maria Zubrzycka: „*Aplikacja do wirtualnego przymierzania ubrań z wykorzystaniem sieci neuronowych*” (Application for Virtual Clothing Try-on using Neural Networks), Assist. Prof. **G. Galiński** (supervisor), B.Sc. degree with honours.
- [BSc88] Michał Żakiet: „*Bezprzewodowy sterownik rolety okiennej*” (Wireless roller blind controller), Assist. Prof. **K. Godziszewski** (supervisor).
- [BSc89] Jakub Żelechowicz: „*Projekt i realizacja narzędzia do weryfikacji poprawności wymowy*”

TITLES AND DEGREES AWARDED

w nauce języka angielskiego" (Design and implementation of a pronunciation verification tool for English language learners), Assist. Prof. **M. Jasiński** (supervisor).

[BSc90] Katarzyna Żmijewska: "*Zindywidualizowane wkładki ortopedyczne wytwarzane z użyciem druku 3D*" (Customised orthotics manufactured using 3D printing), Assist. Prof. **S. Cygan** (supervisor).

6. PUBLICATIONS

6.1. Scientific and technical books, chapters in books

- [Pub1] S. Rosłonec: "Wybrane zagadnienia techniki antenowej z przykładami projektowania" (Selected Problems of Antenna Technology with Design Examples), *Wydawnictwo Wojskowej Akademii Technicznej*, 2025, ISBN: 978-83-7938-414-3, 430 pp.

6.2. Scientific and technical papers in journals

6.2.1. Part A

This subsection contains the list of papers published in the journals indicated on the list of the Ministry of Education and Science including those listed in the Thomson-Reuters Journal Citation Reports.

Papers authored by more than 10 persons from outside of the Faculty of Electronics and Information Technologies, WUT, have been specified in a simplified way, viz.: only the first author and all the authors from the Faculty have been listed and the number of other authors has been provided in brackets.

- [Pub2] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (378 external authors): "First Differential Measurement of the Single π^+ Production Cross Section in Neutrino Neutral-Current Scattering", *Physical Review Letters*, vol. 135, no. 17, 2025, doi: 10.1103/6d32-1452, pp. 1-8.
- [Pub3] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, K. Zaremba, M. Ziembicki (570 external authors): "First Joint Oscillation Analysis of Super-Kamiokande Atmospheric and T2K Accelerator Neutrino Data", *Physical Review Letters*, vol. 134, no. 1, 2025, doi: 10.1103/PhysRevLett.134.011801, pp. 1-13.
- [Pub4] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (395 external authors): "First measurement of neutron capture multiplicity in neutrino-oxygen neutral-current quasielasticlike interactions using an accelerator neutrino beam", *Physical Review D*, vol. 112, no. 3, 2025, doi: 10.1103/qh28-4znk, pp. 1-26.
- [Pub5] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (396 external authors): "First Measurement of the Electron-Neutrino Charged-Current Pion Production Cross Section on Carbon with the T2K Near Detector", *Physical Review Letters*, vol. 135, no. 15, 2025, doi: 10.1103/klhv-7t6h, pp. 1-8.
- [Pub6] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (595 external authors): "Joint neutrino oscillation analysis from the T2K and NOvA experiments", *Nature*, vol. 646, no. 8086, 2025, doi: 10.1038/s41586-025-09599-3, pp. 818-824.
- [Pub7] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (498 external authors): "Measurement of muon neutrino induced charged current interactions without charged pions in the final state using a new T2K off-axis near detector WAGASCI-BabyMIND", *Physical Review D*, vol. 112, no. 11, 2025, doi: 10.1103/fpqb-j6nv, pp. 1-24.
- [Pub8] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (404 external authors): "Results from the T2K Experiment on Neutrino Mixing Including a New Far Detector μ -like Sample", *Physical Review Letters*, vol. 135, no. 26, 2025, doi: 10.1103/gh5j-5cwv, pp. 1-11.
- [Pub9] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (378 external authors): "Signal selection and model-independent extraction of the neutrino neutral-current single π^+ cross section with the T2K experiment", *Physical Review D*, vol. 112, no. 7, 2025, doi: 10.1103/wcn1-4tyl, pp. 1-17.
- [Pub10] K. Abe (...), K. Dygmarowicz, R. Kurjata, A. Rychter, M. Ziembicki (349 external authors): "Testing T2K's Bayesian constraints with priors in alternate parameterisations", *European Physical Journal C*, vol. 85, no. 12, 2025, doi: 10.1140/epjc/s10052-025-14836-0, pp. 1-16.
- [Pub11] F. Acerbi (...), A. Buchowicz, G. Galiński, G. Pastuszek (314 external authors): "Benchmarking the design of the cryogenics system for the underground argon in DarkSide-20k", *Journal of Instrumentation*, vol. 20, no. 02, 2025, doi: 10.1088/1748-0221/20/02/p02016, pp. 1-46.
- [Pub12] F. Acerbi (...), A. Buchowicz, G. Galiński, G. Pastuszek (299 external authors): "Flow and thermal modelling of the argon volume in the DarkSide-20k TPC", *Journal of Instrumentation*, vol. 20, no. 06, 2025, doi: 10.1088/1748-0221/20/06/p06046, pp. 1-41.
- [Pub13] F. Acerbi (...), A. Buchowicz, G. Galiński, G. Pastuszek (302 external authors): "Production, quality assurance and quality control of the SiPM Tiles for the DarkSide-20k Time Projection Chamber", *European Physical Journal C*, vol. 85, no. 11, 2025, doi: 10.1140/epjc/s10052-025-14940-1, pp. 1-27.
- [Pub14] F. Acerbi (...), A. Buchowicz, G. Galiński, G. Pastuszek (288 external authors): "Quality Assurance and Quality Control of the 26 m² SiPM production for the DarkSide-20k dark matter experiment", *European Physical Journal C*, vol. 85, no. 5, 2025, doi: 10.1140/epjc/s10052-025-14196-9, pp. 1-22.
- [Pub15] D. Al-Daloo, P. Bilski: "Classification of Music Structural Functions using Deep Learning", *International Journal of Electronics and Telecommunications*, vol. 71, no. 3, 2025, doi: 10.24425/ijet.2025.153608, pp. 1-6.

- [Pub16] G.D. Alexeev (...), R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (165 external authors): "Multiplicities of positive and negative pions, kaons, and unidentified hadrons from deep-inelastic scattering of muons off a liquid hydrogen target", *Physical Review D*, vol. 112, no. 1, 2025, doi: 10.1103/q4rb-bhcg, pp. 1-16.
- [Pub17] G.D. Alexeev (...), R. Kurjata, J. Marzec, A. Rychter, K. Zaremba, M. Ziembicki (167 external authors): "Measurement of the hard exclusive π^0 muoproduction cross section at COMPASS", *Physics Letters B*, vol. 870, no. art. 139832, 2025, doi: 10.1016/j.physletb.2025.139832, pp. 1-15.
- [Pub18] A. Belous, O. V'yunov, L. Kovalenko, V. Khitrovskiy, K. Godziszewski, Y. Yashchyn: "Development of High-Performance Single- and Multiphase Dielectrics for Advanced Microwave Applications", *Science and Innovation*, vol. 21, no. 4, 2025, doi: 10.15407/scine21.04.021, pp.21-36.
- [Pub19] X. Chang: "Smoothed Per-tensor Weight Quantization: A Robust Solution for Neural Network Deployment", *International Journal of Electronics and Telecommunications*, vol. 71, no. 3, 2025, doi: 10.24425/ijet.2025.153629, pp. 1-7.
- [Pub20] K. Derzakowski, A. Abramowicz: "New structure of dielectric resonator with greater separation of higher order modes from fundamental mode", *International Journal of Electronics and Telecommunications*, vol. 71, no. 3, 2025, doi: 10.24425/ijet.2025.155448, pp. 1-9.
- [Pub21] V. Djaja-Joško, M. Kołakowski, J. Cichocki, J. Kołakowski: "Improving Performance of Bluetooth Low Energy-Based Localization System Using Proximity Sensors and Far-Infrared Thermal Sensor Arrays", *Sensors*, vol. 25, no. 4, 2025, doi: 10.3390/s25041151, pp. 1-22.
- [Pub22] K. Dygmarowicz: "Production line and quality assurance of mPMT photosensors for WCTE", *PoS - Proceedings of Science*, vol. 468, no. art. 107, 2025, doi: 10.22323/1.468.0107, pp. 1-6.
- [Pub23] W. Gwarek, M. Celuch, Ł. Nowicki: "A Novel Q-Choked Sapphire Sandwiched Resonator for Wideband Measurements of Flat Dielectric Samples", *IEEE Microwave and Wireless Technology Letters*, vol. 35, no. 6, 2025, doi: 10.1109/lmwt.2025.3568534, pp. 1-4.
- [Pub24] A. Irawan, P. Bilski, G. Gwardys: "Comparative Features Reduction Investigation for Android Malware Detection on Boolean Data", *International Journal of Electronics and Telecommunications*, vol. 71, 2025 no. 4, doi: 10.24425/ijet.2025.155487, pp. 1-6.
- [Pub25] J. Jeschke, M. Ivanenko, W. Smolik, D. Wanta, M. Midura, P. Wróblewski: "Machine Learning-Based Image Reconstruction in Wearable CC-EIT of the Thorax: Robustness to Electrode Displacement", *Sensors*, vol. 25, no. 21, 2025, doi: 10.3390/s25216543, pp. 1-22.
- [Pub26] M. Kołakowski (...), V. Djaja-Joško, J. Kołakowski, J. Cichocki (15 external authors): "CAREUP: An Integrated Care Platform with Intrinsic Capacity Monitoring and Prediction Capabilities", *Sensors*, vol. 25, no. 3, 2025, doi: 10.3390/s25030916, pp. 1-25.
- [Pub27] K. Koszewski (...), P. Pałka, P. Korpas (11 external authors): "Utilizing IoT Sensors and Spatial Data Mining for Analysis of Urban Space Actors' Behavior in University Campus Space Design", *Sensors*, vol. 25, no. 5, 2025, doi: 10.3390/s25051393, pp. 1-27.
- [Pub28] S. Krukovskiy, M. Vakiv, Y. Yashchyn, V. Arikov, A. Voronko, D. Novikov, D. Verbitskii, O. Kryvets: "Properties of Low-Temperature GaAs Obtained by LPE Method for Terahertz Devices", *Radioelectronics and Communications Systems*, vol. 67, no. 8, 2025, doi: 10.3103/s0735272724080041, pp. 430-437.
- [Pub29] S. Kruszewski, P. Mazurek, R. Z. Morawski: "Comparison of data-processing procedures for fall detection in impulse-radar-based systems for monitoring human activity", *IEEE Sensors Journal*, vol. 25, no. 16, 2025, doi: 10.1109/jsen.2025.3583638, pp. 31796-31806.
- [Pub30] K. Kurek, K. Seweryn, A. Tkacz, G. Just: "Detection of Lunar Regolith Acquired by Excavator Using Radiofrequency (RF) Sensors", *Sensors*, vol. 25, no. 3, 2025, doi: 10.3390/s25030751, pp. 1-20.
- [Pub31] K. Lipiński, G. Domański, P. Bogorodzki: "Coherent flow effects on IVIM-based perfusion measurements: A phantom study in 3 T", *Magnetic Resonance Imaging*, vol. 124, no. art. 110533, 2025, doi: 10.1016/j.mri.2025.110533, pp. 1-8.
- [Pub32] Y. Liu, C. Wu, G. Wan, Y. Yashchyn: "A Line-Multinetwork (LmN) Self-Calibration Technique—Analysis With a VNA", *IEEE Transactions on Microwave Theory and Techniques*, vol. 73, no. 11, 2025, doi: 10.1109/tmtt.2025.3582021, pp. 8991-9001.
- [Pub33] Y. Liu, Y. Wang, Ch. Wu, Y. Yashchyn: "Self-Calibration Technique and Permittivity Measurement Using a Slotted Rectangular Waveguide", *IEEE Transactions on Microwave Theory and Techniques* 2025, vol. 73, no. 1, doi: 10.1109/tmtt.2024.3419799, pp. 582-591.
- [Pub34] P. Małeck, A. P. Pietrzak, F. Zakrzewski, M. Matyjewski, R. Perz: "Dynamic mechanical characterization of composite and traditional luthier wood samples for musical instruments", *Vibrations in Physical Systems*, vol. 36, no. 2, 2025, doi: 10.21008/j.0860-6897.2025.2.18, pp. 1-14.
- [Pub35] R. Maneiro-Catoira, G. Bogdan, K. Godziszewski, J. Bregains, J. Garcia-Naya,

- Y. Yashchyshyn, L. Castedo: "Joint Beam Steering and Direct Antenna Multimodulation Using Time-Modulated Arrays", *IEEE Internet of Things Journal*, vol. 12, no. 20, 2025, doi: 10.1109/jiot.2025.3594557, pp. 42702-42716.
- [Pub36] M. Midura, G. Domański, D. Wanta, P. Wróblewski, W. Smolik, K. Lipiński, M. Wieteska, P. Bogorodzki: "Impedance Analysis of a Two-Layer Air-Core Coil for AC Magnetometry Applications", *Sensors*, vol. 25, no. 17, 2025, doi: 10.3390/s25175339, pp. 1-17.
- [Pub37] M. Midura, W. Smolik, P. Wróblewski, D. Wanta, G. Domański, X. Hou, X. Yan, M. Ivanenko: "The Lumped-Parameter Calorimetric Model of an AC Magnetometer Designed to Measure the Heating of Magnetic Nanoparticles", *Applied Sciences*, 2025, vol. 15, no. 6, doi: 10.3390/app15063199, pp. 1-15.
- [Pub38] T. A. Miś (...), (13 external authors): "Electrical Response of Photovoltaic Power Cells to Cosmic Radiation in the Stratosphere", *Electronics (Switzerland)*, vol. 14, no. 5, 2025, doi: 10.3390/electronics14050991, pp. 1-21.
- [Pub39] T. A. Miś: "Experimental Estimation of Kinematic Viscosity of Low-Density Air Using Optically Derived Macroscopic Transient Flow Parameters", *Sensors*, vol. 25, no. 11, 2025, doi: 10.3390/s25113375, pp. 1-12.
- [Pub40] T. A. Miś, W. Kazubski, M. Zieliński: "Preliminary Analysis of Atmospheric Front-Related VHF Propagation Enhancements for Navigation Aids", *Sensors*, vol. 25, no. 14, 2025, doi: 10.3390/s25144455, pp. 1-15.
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7. RESEARCH REPORTS

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- [Rep3] Piotr J. Durka (Warsaw University, Faculty of Physics), P. Bogorodzki, E. Piątkowska-Janko, K. Lipiński: "Śpiączka i zaburzenia świadomości – nowe wskaźniki prognostyczne i diagnostyczne oparte o EEG i MRI" (Coma and consciousness disorders – new prognostic and diagnostic indicators based on EEG and MRI), Final report for the National Science Centre, Warsaw, Jul. 2025.
- [Rep4] Piotr Bilski; A. Buchowicz, P. Bobiński, P. Gawrysiak, M. Jasiński, M. Lewandowski, G. Makarewicz, P. Mazurek, A. P. Pietrzak: „Inteligentny system przetwarzania mowy dla lekarzy” (Intelligent speech processing system for doctors (INFOSTRATEG IV)), Final report for the National Centre for Research and Development, Warsaw Nov. 2025
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8. PATENTS AND PATENT APPLICATION

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9. SCIENTIFIC EVENTS

9.1. Scientific events co-organized by the Institute

- [Con1] *Ogólnopolska Studencka Konferencja Akustyków, OSKA 2025 (National Student Conference of Acousticians)*, (Warsaw, Poland, Mar. 27-30, 2025), M. Jasiński, M. Lewandowski, A. P. Pietrzak (Scientific Committee), K. Pondel-Sycz (organizing committee, speaker).

9.2. International scientific events

- [Con2] *IEEE/MTT-S International Microwave Symposium - IMS 2025*, (San Francisco, USA, Jun. 15-20, 2025), J. Modelski (MTT-S observer).
- [Con3] *11th Convention of the European Acoustics (EuroNouse 2025)*, (Malaga, Spain, Jun. 23-26, 2025), A. P. Pietrzak (speaker).
- [Con4] *59th Annual Microwave Power Symposium (IMPI 59)*, (Edmonton, Canada, Jun. 24-26, 2025), P. Korpas (speaker).
- [Con5] *21st International Conference on Artificial Intelligence Applications and Innovations (AIAI)*, (Limassol, Cyprus, Jun. 26-29, 2025), Ł. Popek (speaker).
- [Con6] *SUMMER SCHOOL – International Traveling Summer School on Terahertz Science and Technology (ITSS-TSaT)*, (Vienna, Austria, Jul. 13-18, 2025), Y. Yashchyshyn (speaker).
- [Con7] *50th International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz 2025)*, (Helsinki, Finland, Aug. 17-22, 2025), P. Kopyt (speaker).
- [Con8] *26th International Workshop on Neutrinos from Accelerators (NuFact 2025)*, (Liverpool, UK, Aug. 31- Sep. 07, 2025), K. Dygnarowicz (speaker).
- [Con9] *XII International Workshop on Ring Imaging Cherenkov Detectors (RICH 2025)*, (Mainz, Germany, Sep. 15-19, 2025), A. Rychter (speaker).
- [Con10] *13th Microwave Materials and their Applications Conference (MMA 2025)*, (Saint-Brieuc, France, Sep. 16-19, 2025), P. Kopyt, A. Pacewicz, B. W. Salski (speakers).
- [Con11] *2025 European Microwave Conference (EuMC 2025)* (Utrecht, Netherlands, Sep. 23-25, 2025), J. Modelski (member of the Programme Committee).
- [Con12] *15th EASN International Conference*, (Madrid, Spain, Oct. 14-17, 2025), Ł. Popek (speaker).
- [Con13] *2025 IEEE International Conference on Imaging Systems and Techniques (IST 2025)*, (Strasbourg, France, Oct. 15-17, 2025), D. Wanta (Session Chair, speaker), M. Ivanenko (speaker).
- [Con14] *Autumn School Series in Acoustics: ASSA 2025*, (Eindhoven, Netherlands, Nov. 3-7,

2025), M. Jasiński, A. P. Pietrzak, K. Pondel-Sycz (participants).

- [Con15] *33rd Telecommunications Forum (TELFOR 2025)*, (Belgrade, Serbia, Nov. 25-26, 2025) V. Djaja-Joško (speaker).

- [Con16] *7th International Workshop on new Photon-Detectors (PD 2025)*, (Bologna, Italy, Dec. 3-5, 2025), B. Piotrowski (speaker).

9.3 National scientific events

- [Con17] *6th Polish Conference on Artificial Intelligence (PP-RAI 2025)*, (Katowice, Poland, Apr. 7-9, 2025), M. Ivanenko (participant).

- [Con18] *158th Audio Engineering Society Convention (AES 2025)*, (Warsaw, Poland, May 22-44, 2025), J. Żera (Convention Co-Chairs; speaker), M. Jasiński (speaker).

- [Con19] *IEEE EUROCON 2025 - 21st International Conference on Smart Technologies*, (Gdynia, Poland Jun. 4-6, 2025), K. Zaremba (Honorary Chair), J. Modelski (Honorary General Chair), K. Godziszewski (Treasurer), P. Bilski (speaker).

- [Con20] *13th International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2025)*, (Gliwice, Poland, Sep. 4-6, 2025), P. Bilski (participant), K. Pondel-Sycz (speaker).

- [Con21] *LXXI Otwarte Seminarium z Akustyki (LXXI Open Seminar on Acoustics – OSA 2025)*, (Szczyrk, Poland, Sep. 8-12, 2025), A. P. Pietrzak, K. Pondel-Sycz, M. Zych (speakers), J. Żera (Scientific Committee).

- [Con22] *Konferencja Radiokomunikacji i Teleinformatyki: KRiT 2025 (3rd Conference on Radiocommunication and ICT)*, (Gdańsk, Poland, Sep. 10-12, 2025), J. Modelski, K. Snopek, W. Wojtasiak, Y. Yashchyshyn (members of the Programme Committee), G. Bogdan, M. Kołakowski, W. Kazubski (speakers).

- [Con23] *II EU Workshop on Water Cherenkov Experiments for Precision Physics*, (Cracow, Poland, Sep. 17-19, 2025), M. Ziembicki (Scientific Organizing Committee), K. Dygnarowicz (participant).

- [Con24] *20th International Symposium on Sound Engineering and Tonmeistering '2025* (Poznań, Poland, Oct. 8-10, 2025), A. P. Pietrzak, M. Lewandowski (speakers).

10. AWARDS AND DISTINCTIONS

State Medals

Jacek Cichocki, Ph.D.

Krzyż Kawalerski Orderu Odrodzenia Polski (Knight's Cross of the Order of Polonia Restituta).

Grzegorz Galiński, Ph.D.

Medal Srebrny za Długoletnią Służbę (Silver Medal for the Long-lasting Service)

Awards of the Rector

Grzegorz Pastuszak, D.Sc.

Individual I^o award for the scientific achievements.

Kajetana Snopek, D.Sc.

Roman Z. Morawski, Prof. D.Sc.,

Individual I^o award for the teaching achievements.

Andrzej Rychter, Ph.D.,

Marcin Ziembicki Ph.D.,

Janusz Marzec, Prof. D.Sc.,

Krzysztof Zaremba, Prof. D.Sc.,

Robert Kurjata, Ph.D.,

Grzegorz Pastuszak, D.Sc.

Andrzej Buchowicz, Ph.D.,

Grzegorz Galiński, Ph.D.

Wojciech Obrębski, M.Sc.,

Krzysztof Dygnarowicz, M.Sc.,

Michał Nurek, M.Sc.,

Bartosz Piotrowski, M.Sc.

Team I^o award for the scientific achievements.

Piotr Bilski, Prof. D.Sc.,

Karol Kuczyński, Ph.D.,

Karolina Pondel-Sycz, M.Sc.,

Bartosz Kościug, M.Sc.

Team II^o award for the scientific achievements.

Waldemar Smolik, Prof. D.Sc.,

Damian Wanta, Ph.D.,

Przemysław Wróblewski, M.Sc.,

Mateusz Midura, M.Sc.,

Mikhail Ivanenko, M.Sc.,

Aleksander Smolik M.Sc.,

Team II^o award for the scientific achievements.

Awards of the students of the Faculty

Marcin Lewandowski, Ph.D.

"Golden Chalk" Awards.

Awards granted by international bodies

Prof. Roman Z. Morawski has been listed in the World's TOP 2% Scientists 2025 ranking, prepared by Stanford University in cooperation with Elsevier Publishing House and SciTech Strategies company.

Awards of the Foundation for the Development of Radiocommunications and Multimedia Technologies for the Best Ph.D. Thesis.

Jerzy Cuper, Ph.D.

Degree with honours for the dissertation titled: "*Accurate Methods of Characterization of Conductive Layers and Dielectric Samples at Millimeter-Wave and THz Frequencies*" supervisor: **Paweł Kopyt, D.Sc.**, Konferencja Radiokomunikacji i Teleinformatyki: KRiT 2025 (Radiocommunication and Teleinformatics Conference), (Gdańsk, Poland, Sep. 10-12, 2025).

Scholarships of the Foundation for the Development of Radiocommunications and Multimedia Technologies granted in 2025.

Piotr Czekala

Karolina Pondel-Sycz

For preparing Ph.D. thesis

Piotr Baprawski

Piotr Polnau

Jan Sosulski

Mateusz Zych

Paweł Baran

Piotr Gryglewski

Karina Klekowicka

Aleksandra Fabrycy

Grzegorz Rusinek

Dawid Ruciński

For preparing M.Sc. thesis

Jan Ronda

Katarzyna Stec

Michał Borkowski

Igor Popławski

Błażej Marciniak

Rafał Mięgoć

Agnieszka Jegier

Dominik Pawlak

Julia Burzyńska

Maciej Panasiuk

For preparing B.Sc. thesis

APPENDIX:

EXPLANATORY NOTE ON POLISH ACADEMIC AND PROFESSIONAL TITLES, DEGREES AND POSTS

This note contains the definitions of academic and professional titles, degrees and posts held by the staff of the Institute of Radioelectronics and Multimedia Technology.

The following professional titles are awarded by Polish higher-education institutions:

- the *inżynier (inż.)* title, translated here as **B.Sc.**, is awarded to the students completing undergraduate studies in the fields of study related to engineering and technology;
- the *magister (mgr)* title, translated here as **M.Sc.**, is awarded to the students completing graduate studies in the fields of study related to sciences;
- the *magister (mgr)* title, translated here as **M.A.**, is awarded to the students completing graduate studies in arts and humanities;
- the *magister inżynier (mgr inż.)* title, translated here as **M.Sc.**, is awarded to the students completing graduate studies in the fields of study related to engineering and technology.

The academic degrees, the *doctor* and *doctor habilitowany* degrees, are awarded by the scientific councils of higher-education institutions or other scientific institutions.

The degree of *doktor (dr)*, translated here as **Ph.D.**, is conferred on a person who:

- is the holder of the professional title of *magister* or *magister inżynier*;
- has successfully passed doctoral examinations in a selected research discipline;
- has submitted and successfully defended a doctoral thesis, favorably assessed by two reviewers.

The doctoral thesis, prepared under the supervision of a research adviser, should provide an original solution of a research problem and demonstrate general theoretical knowledge of the candidate in a given research discipline, as well as confirm his/her skills to conduct research work autonomously.

The degree of *doktor habilitowany (dr hab.)*, translated here as **D.Sc.**, is conferred on a person who:

- is the holder of the academic degree of *doktor*;
 - has remarkable scientific achievements;
 - has significantly contributed to the development of a given research discipline;
- and his/her contribution has been favorably assessed by four reviewers and approved by the scientific council of a higher-education institution or other scientific institution. The holder of the *doktor habilitowany* degree is authorized to be the advisor of Ph.D. students.

The academic title of *profesor (prof.)* is conferred by the President of the Republic of Poland. This title may be conferred on a person who:

- is the holder of the degree of *doktor habilitowany*;
- has scientific achievements significantly exceeding those required of *doktor habilitowany*;
- has remarkable academic achievements, including formation of academic staff.

The combination of the *profesor* title and the *doktor habilitowany* degree (**profesor doktor habilitowany – prof. dr hab.**) is translated here as **Prof. D.Sc.**

The minimum requirements concerning the academic posts are as follows:

- for the post of *asystent*, translated here as **Assistant** – the professional title of *magister* or *magister inżynier*;
- for the post of *wykładowca*, translated here as **Lecturer** – the professional title of *magister* or *magister inżynier*;
- for the post of *starszy wykładowca*, translated here as **Senior Lecturer** – the *doktor* or *magister inżynier* degree;
- for the post of *docent*, translated here as **Reader** – the *doktor* degree;
- for the post of *adiunkt*, translated here as **Assistant Professor** – the *doktor* degree;
- for the post of *profesor uczelni*, translated here as **Associate Professor** – the *doktor habilitowany* degree;
- for the post of *profesor*, translated here as **Full Professor** – the professor title.

More details concerning academic and professional titles, degrees and posts may be found in the Act on Higher Education from 2018 (with further addendments)