Lodz University of Technology (LUT)

- Established 1945
- 9 faculties
- 20,000 students
- 3,000 employees
- Courses delivered in Polish, English and French languages
- The 4th place in the Polish technical universities ranking list (2016)
The Faculty of Electrical, Electronic, Computer and Control Engineering

The largest faculty at TUL

- 4,000 students
- 150 doctoral students
- 450 employees
The Faculty of Electrical, Electronic, Computer and Control Engineering

10 courses

- Electrical Engineering
- Automatic Control and Robotics
- Electronics and Telecommunications (PL+EN)
- Computer Science (PL+EN)
- Transport
- Occupational Safety Engineering
- Biomedical Engineering (PL+EN)
- Mechatronics
- Power Engineering
- Smart Buildings

ECTS label

12 Student Science Teams
Faculty Units

Institutes
- I-12 of Electrical Engineering Systems
- I-13 of Automatic Control
- I-14 of Mechatronics and Information Systems
- I-15 of Electrical Power Engineering
- I-16 of Electronics
- I-24 of Applied Computer Science

Departments
- K-25 of Electrical Apparatus
- K-26 of Microelectronics and Computer Science
- K-27 of Semiconductors and Optoelectric Devices
Institute of Electronics

Established in 1975.
26 academic teachers employed (including 5 professors)

Research specialties:
• medical electronics, biomedical signal and image processing
• telecommunications and teleinformatics
• thermography, power electronics
Institute of Electronics

Board of Directors

Director
Prof. Paweł STRUMIŁŁO

Deputy Director, Research
Prof. Michał STRZELECKI

Deputy Director, Teaching
Dr. Krzysztof TOMALCZYK
Institute of Electronics’ structure

Medical Electronics Division
Head: Prof. Piotr Szczypiński

Telecommunications Division
Head: Prof. Sławomir Hausman

Electronic Circuits and Thermography Division
Head: Prof. Bogusław Więcek
Medical Electronics Division research topics

1. Processing and analysis of biomedical signals and images
2. Development of human-machine interfaces, human-computer communications systems, and systems to assist people with disabilities
3. Design of electronic systems: biosignal acquisition and analysis, radio IoT modules
4. Mathematical modeling, machine learning, and data analysis
Processing and analysis of biomedical signals and images

- **Contact:**
  Prof. M. Strzelecki,
  Prof. P. Szczyński,
  Dr. M. Kociński,
  Dr. M. Kociołek

- **Software**
  MaZda, Vesselknife
Design and development of human-machine interfaces and systems to assist people with disabilities

- Contact: Prof. P. Strumiłło
Systems for human-computer communications

- **Contact:** Dr. P. Poryzała, Dr. A. Królak
Mathematical modeling and machine learning

- **Contact:** Dr. A. Klepaczko

Analysis of MR image

Classification errors:
- Teaching: 6/80 [7%]
- Testing: 5/60 [8%]

3D statistical features

Classification of cirrhosis degree
Research projects

Medical Electronics Division
Sound of Vision – Horizont2020, Natural sense of vision through acoustics and haptics

Horizon 29020, 2015-2017

• Project Coordinator: Prof. Paweł Strumiłło

• Consortium of 9 partners: Iceland, Rumania, Poland, Italy, Hungary

• Project objective: design of personal system that will allow visually impaired users to build a rich mental image of the environment and help in independent mobility

• Realised issues: 3D scenes reconstruction (UV disparity), 3D sound, sonification, 3D printing, tests with blind persons and EEG tests.

www.soundofvision.net
NCN OPUS Grant: Interactive sonification of images dedicated to blind people

Duration: 2016-2017

- Project Coordinator: Prof. Paweł Strumiłło

- The main objective is to compare and verify algorithms of interactive sonification. The research is aimed at determining which algorithms allow for quick and correct interpretation of images which are explored by senses of touch.

Sonification of images and maps for mobile devices with a touch screen.
NCN Harmonia Grant: **Numerical modeling of the cerebral arterial and venous blood-vessel system in macro- and mesoscale based on 3D MRI data**

- **Project Coordinator:** Prof. Andrzej Materka
- The aim is to investigate possibilities of increasing the accuracy of numerical modelling and parameterization of the brain blood vessel system, affected by limited resolution and artefacts in magnetic resonance angiography.
- **Cooperation:**
  - University of Jena (Germany),
  - University of Bergen (Norway)

**Duration:** 2013-2016
NCBiR, PBS Grant: **Development of industrial methods of automatic evaluation of technological parameters and classification of grain using image analysis**

**Duration: 2015-2018**

- **Project Coordinator:** Prof. P. Szczyński
- **Project objective:** to develop an automatic and comprehensive technology for evaluation of grain mixture quality for the brewing industry.
- **Consortium:**
  - University of Warmia and Mazury in Olsztyn (the leader)
  - Lodz University of Technology
  - Wroclaw University of Technology
  - Malt-House Soufflet Poland Ltd.
NCN ST7 / OPUS-8 Grant: **Development of numerical methods for modelling and estimation of kidney perfusion using magnetic resonance imaging**

**Duration:** 2015-2018

- **Project Coordinator:** Dr. Artur Klepaczko

- **Objective:**
  - To improve methods for estimating the parameters of perfusion based on magnetic resonance images
  - To design the simulator to visualise the perfusion of the kidney

- **Cooperation:**
  - Prof. Arvid Lundervold, University of Bergen
  - Prof. Jarle Rørvik, Haukeland University Hospital
Cooperation with National Institute of Standards and Technology, Gaitchersburg MD, USA

Dr. Marcin Kociołek

Research topic covers:

- determination of image texture local directivity
- analysis of microscopic cell images
- texture decomposition for its more efficient interpretation
The FP7 UE, European Education Connectivity Solution
Student’s Electronic Card

Duration: 2009-2011
• Contact: Dr. Piotr Dębiec
Telecommunications Division
Research topics

1. Radio wave propagation modelling
2. Modelling and design of antennas and wireless communication systems
3. Body Area Networks, including sensors and e-textiles
4. Automation of complex electromagnetic compatibility measurement procedures
5. Radio waves and inertial sensors based location systems
6. Application of computational intelligence in teleinformatics networks
7. Modelling, design, and testing of specialised integrated circuits
Textile antennas

Contact: Dr. Łukasz Januszkiewicz

- Design of textile antennas
- Design of textile transmission lines
- Optimising methods of manufacturing (embroidery, PVD, printing)
- Measurement of electric/magnetic parameters of conducting materials
Wireless Body Area Networks

Contact: Dr. Łukasz Januszkiewicz, Prof. Sławomir Hausman

Simplified models of human body
- numerical
- physical

Sensors (wireless)
- textile sensor for respiration activity
- pulse sensor with textile electrodes
Methods of microwave systems optimisation

Contact:
Prof. Sławomir Hausman,
Dr. Łukasz Januszkiewicz,
Prof. Paolo Di Barba
(Universita di Pavia, Italy)

- Optimisation of antennas and location of nodes in WBAN
Location Systems

Contact: Dr. P. Korbel, Dr. Ł. Januszkiewicz, Prof. S. Hausman, Dr. P. Wasilewski

Location with application of merging signals
• inertial sensors + IR
• inertial sensors + radio
• particle filters, the Kalman filter
• stochastic forests
• detection of sequences
Protective Environment

**Contact:** Prof. S. Hausman, Dr. Ł. Januszkiewicz

- Presence detection system
- Event generation software
- Fall detectors: personal, bathroom mats
Research works of The Telecommunications Division

Medicator

- Overdosing protection
- Assistant to recognize medicines
- Activity tracking
NCBiR Project: „Fireman II” – Novel personal protections for KSRG salvage services basing on the needs of final users

**Duration: 2011-2014**

**leader: Dr. Ł. Januskiewicz**

- consortium: 10 research units and companies
- Firemen location in a closed environment (inertial and radio systems)
- Design of textile sensors to measure breathing frequency
- Textile antennas optimising
- Design of wearable radio system
Radio monitoring system for fireman’s activity and physiological condition

Gold medal
Brussels-Eureka! 2009
Quasi-anechoic chamber
LOKKOM Project, PBS2/B3/24/2014
Complex methods to determine mobile terminal location which is moving as in open space as in buildings

Contact: Dr. P. Korbel, P. Wawrzyniak, Prof. S. Hausman

Duration: 2014-2016

• Cooperation:
  • Warsaw University of Technology
  • Lodz University of Technology
  • Orange Polska SA
Electronic Circuits and Thermography Division
Research topics

1. Development of sensor and bolometer high sensitivity infrared cameras
2. Thermal impedance measurements
3. Analysis of thermal processes analysis with consideration of electromagnetic phenomena in electronic microstructures
4. Solution of thermal inverse problems
5. Thermal modelling of human skin
Power cables tests

Cooperation with:
- University of Gent
- Aristotle University of Thessaloniki
Cameras and thermovision systems (VOx)

Contact: R. Strąkowski

- Correction of heterogeneity and calibration
- Metrology cameras without shutters
- Artificial intelligence in analysis of thermograms
Multispectral vision system for metallurgy applications
Patents


Institute of Electronics - publications

Publication database is available at:

http://www.eletel.p.lodz.pl/skryba

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<td>Poradnik serwisowy: kompendium praktycznej wiedzy warsztatowej &quot;Samochodowe sieci informacyjne&quot;</td>
<td>2005</td>
<td>Instalator Polski</td>
<td>DOM</td>
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<td>Wstęp do komputerowej analizy obrazów</td>
<td>2009</td>
<td>Politechnika Łódzka</td>
<td>DOM</td>
<td>NOTE</td>
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<td>Wybrane zagadnienia biometryi</td>
<td>2006</td>
<td>Wydawnictwo Komunikacji i Łączności</td>
<td>DOM</td>
<td>MONO</td>
<td>-</td>
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<td>UKŁADY ELEKTROONICZNE i</td>
<td>2009</td>
<td>Politechnika Łódzka</td>
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<td>Zjawiska w strukturach poprzewodnikowych - metody ich modelowania</td>
<td>2005</td>
<td>Politechnika Łódzka</td>
<td>DOM</td>
<td>MONO</td>
<td>-</td>
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<td>Zastosowanie systemów sztucznej inteligencji w rozwiązywaniu wybranych problemów ochrony atmosfery</td>
<td>2005</td>
<td>Polska Akademia Nauk Oddział w Łodzi</td>
<td>DOM</td>
<td>MONO</td>
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<td>Wybrane zagadnienia współczesnej termowizji w podczerwieni</td>
<td>2010</td>
<td>Politechnika Łódzka</td>
<td>DOM</td>
<td>NOTE</td>
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<td>Projektowanie analogowych układów stalowych CMOS o strukturze sieci neuronowej do przetwarzania obrazów</td>
<td>2012</td>
<td>Politechnika Łódzka</td>
<td>DOM</td>
<td>MONO</td>
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<td>Komputerowa analiza obrazów z endoskopu bezprzewodowego dla diagnostyki medycznej</td>
<td>2012</td>
<td>Politechnika Łódzka</td>
<td>DOM</td>
<td>MONO</td>
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<td>Rozpoznawanie biometryczne: nowe metody i oświetleniowej reprezentacji obiektów</td>
<td>2010</td>
<td>Wydawnictwo Komunikacji i Łączności</td>
<td>DOM</td>
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<td>Termowizja w podczerwieni. Podstawy i zastosowania</td>
<td>2011</td>
<td>PAX</td>
<td>DOM</td>
<td>TEX8</td>
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Student Scientific Groups

at the Institute of Electronics
MIPSA – The Student Scientific Group of Microprocessor Autonomic Systems

- www.mipsa.eletel.p.lodz.pl

Cooperation with Intel Corporation Poland
TELIN - The Student Scientific Group of Teleinformatics

- www.telin.eletel.p.lodz.pl
Cooperation with the industry

Ericpol
Course: Digital techniques of signal processing in teletransmission systems

BaZeKo
Development of optimized technology for thin printed circuit boards

Aesculap Chifa
Intraoperative control of limb length during hip joint replacement surgery

Consortium: IMP, Sonopan, PG, MEDITON
Risk management system against deafness in industrial environment III Strategmed (NCBiR)

Eldip
Development of technology for noninvasive detection, identification and location of pipeline defects and determining of the pipeline course
Cooperation with the industry

Intel Corporation Polska
Robot for airsoft battleground SKN MIPSAm

Uniwersytecki Szpital Kliniczny, Łódź
Cheap monitor of sleep (detecting of sleep apnoea)

Consortium Soufflet Agro Polska, Poznań
Development of industrial method for automatic estimation of technological parameters and classification of seeds with video signal analysis

Centrum Medyczne Skopia, Kraków
Colonoscopy image analysis
Cooperation with Orange Labs

The Telecommunications Division of the Institute of Electronics, offers teaching activities and courses prepared in collaboration of Orange Labs Poland:

- Blocks of elective courses
- Problem/Research based projects
- Final project (both at the B.Sc. and the M.Sc. levels)

Orange Labs Open Middleware 2.0 Community coordinator – Dr. Piotr Korbel
Organised conferences

TTP Conferences
Infrared Thermovision and Thermometry
• (organised every 2 years)
• http://thermo.p.lodz.pl/ttp

National Conference of Radiocommunications, Radio Broadcasting and Television KKRRiT 2015
• 8-10 April 2015 – the first time in Lodz
• http://www.eletel.p.lodz.pl/KKRRiT_2015

Conference „Basic MRI Physics”
• 21-25 September 2015 – the second time in Lodz
• http://www.eletel.eu/mri2015
The Institute of Electronics – teaching

- Electronic circuits
- Signal processing
- Image analysis and recognition
- Telecommunication networks
- Wireless telecommunication
- Teleinformatics
- Design thinking
- Problem and research based projects
- Internships and practices
- Final projects
The Institute of Electronics – contact

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