Electrical Engineering Education in Poland: A Case Study

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Abstract

Warsaw University of Technology is one of the largest institutions of higher education in Central Europe. The University offers undergraduate and graduate courses in numerous engineering disciplines. Since 1945, Warsaw University of Technology has been developing academic linkages with European universities. The European Union (EU) educational and research assistance program such as TEMPUS and COPERNICUS have played a key role in the internationalization of the academic curricula offered by Warsaw University of Technology.

The Faculty of Electrical Engineering (EE) has been functioning as an independent unit within Warsaw University of Technology. The EE Faculty, has been actively involved in developing effective academic linkages with universities and colleges in Europe and USA. In addition, the EE Faculty has been actively involved in performing commissioned research for industry. This manuscript provides a full description of the EE Faculty of Warsaw University of Technology.

Introduction

Warsaw University of Technology is one of the largest institutions of higher education in Central Europe[1]. The University was founded in 1826 as the Preparatory School for the Institute of Technology. Warsaw University of Technology has the following 16 faculties in Warsaw: Architecture, Automobile and Heavy Machinery Engineering, Chemical and Process Engineering, Chemistry, Civil Engineering, Electrical Engineering, Electronics and Information Technology, Environmental Engineering, Geodesy and Cartography, Materials Science and Engineering, Mathematics and Information Science, Mechatronics, Physics, Power and Aeronautical Engineering, Production Engineering, Transport. Other units of Warsaw University of Technology are: Business School, College of Social Science and Administration, Foreign Language Centre, English Language Centre, Centre for Physical Education and Sports. Outside Warsaw in Plock there is a branch of Warsaw

University of Technology with the Faculty of Civil Engineering, Mechanics and Petrochemistry and the College of Economics and Social Sciences.

The University offers graduate and postgraduate courses in engineering in numerous fields of advanced technology, leading to B.Sc., M.Sc. and Ph.D. degrees. English language courses are conducted for about 200 foreign students in six faculties. All faculties also have a right to confer D.Sc. degree.

International collaboration

Since 1945, Warsaw University of Technology has had ambition of maintaining and developing international co-operation and to be internationally recognized. Despite the well-known great difficulties, the University kept quite efficient "forbidden" contacts with the Western countries. Agreements concerning research co-operation, participation in international conferences and symposia, and contracts for visiting professors were quite frequent.

Since 1990, the European Union educational and research assistance programs such as TEMPUS, and COPERNICUS had a great impact on the internationalization of all the activities of Warsaw University of Technology.

The Warsaw University of Technology has a few hundred foreign partners in different kinds of agreements, mostly from Germany, then USA and Great Britain. In the year 2000, 2272 persons went abroad to 52 countries and the University hosted 995 foreign guests from 43 countries.

The University is a member of international organizations: SEFI, IACEE, CRE, EAIE, EUROPACE 2000 and others.

The Faculty of Electrical Engineering

The Faculty of Electrical Engineering has been functioning, as an independent unit within Warsaw University of Technology, since 1921. The Faculty is divided into five institutes:

- The Institute of Electrical Power Engineering
- The Institute of the Theory of Electrical Engineering and Electrical Measurements
- The Institute of Power Engineering and High Voltage Technology
- The Institute of Electrical Machines

The Faculty has two institute libraries. The Faculty of Electrical Engineering employs an academic staff of 160, including 23 professors, 10 associate professors and 134 assistant professors. The total number of students is nearly 4000.

Electrical Engineering (EE) Curriculum

Full-time studies leading to the degree of magister inżynier (equivalent to an M.S. degree) last 5 years or ten semesters and cover three fields of education: Electrical Engineering, Automatic Control and Robotics, and Information Technology.

The Electrical Engineering studies are divided into three stages[2]:

- basic subjects, during the first three semesters
- course subjects (from semester IV to VI)
- degree subjects (from semester VII to X)

The basic subjects are the same for all students of the Faculty, but within the framework of the course subjects, students choose from the following four specializations:

- Automation and Computer Engineering
- Power Engineering
- Mechanical Engineering
- Electrical Technology

Starting with the seventh semester, the degree stage of studies requires that students choose from the 20 degree streams available. During this stage, studies are of a specialized nature, covering a narrow area of electrical engineering and preparing students for diploma work.

The Automatic Control and Robotics field is highly specialized and so this field is not divided into specialized subjects, although the studies are divided into three distinct stages:

- the basic stage (semesters I and II)
- the course stage (semesters III, IV and V)
- the degree stage (semesters VI to X)

In the field of Information Technology, the Faculty offers a two-level, flexible system of studies, including:

- first-level (undergraduate) studies leading to the degree of inżynier equivalent to a B.S. degree
- second-level (graduate) studies leading to the degree of magister inżynier equivalent to an M.S. degree.

Full-time studies leading to an M.S. last 5 years (10 semesters) and studies leading to a B.S. last 4 years (8 semesters). During the first 4 semesters, all students take the same subjects. Starting with the fifth semester, students choose from the following two specializations:

- Computer Science in Electrical Power Engineering
- Computer Engineering

Electrical Engineering (EE) Faculty Research

The research conducted at the Institute of Electrical Power Engineering is concentrated on the following areas:

- power system protection and control
- the design and management of power plants
- transmission and distribution networks
- the design and management of power networks
- electrothermics
- lighting technology and photometry

The research conducted at the Institute of the Theory of Electrical Engineering and Electrical Measurement is focused on the following areas:

- computer-aided analysis in the design of electrical circuits
- numerical methods for the analysis and syntheses of electromagnetic fields
- neural networks – methods of learning and applications
- digital signal processing
- digital instruments and automatic measurement systems
- the measurement of dielectric and magnetic materials
- measuring sensors

The research conducted at the Institute of Control and Industrial Electronic is concentrated on the following areas:

- all types of computer implemented controllers, including adaptive and self-tuning controllers
- automatic image analysis, processing and filtering
- computer vision and pattern recognition both classical and advanced, i.e. neural network based or fuzzy based
- neural network theory and applications
- the theory and applications of singular systems
- the theory and applications of robust design controllers
- control theory and automated vision for robotics
- power electronics converters topologies
- resonant converters
- active power filters and reactive power compensators
- uninterruptible power supply systems
- vector control, neural network and fuzzy logic based control of power electronics systems
- AC and DC motor microprocessor controlled drives
- Power conditioning
- The industrial application of power electronics drives
- Hybrid uninterruptible and off-grid power sources

The research conducted at the Institute of Power Engineering and High Voltage Technology is focused on the following areas:

- the designing, testing, and technology improvement of electrical apparatus and cables, CAD/CAM aided

- investigating lighting and switching overvoltages
- solving insulation coordination problems
- studying electromagnetic compatibility
- the investigating and applying of gas discharges
- measuring high voltages and heavy current of arc sources
- designing nuclear power plant equipment and developing nuclear technologies
- improving diagnostic methods and the testing of dielectric materials, insulation and switchgears

The research conducted at the Institute of Electrical Machines is concentrated on the following areas:

- the computer-aided design and construction of electrical machines
- physical phenomena in electrical machines
- measurements and control in electrical machines
- the design of electrical micromachines and machines for automatic control
- vehicle electrotechnics and electronics
- CAD, construction and analysis of electric traction systems for railway and urban transport
- The environmental aspects and management of electric transport

The International Cooperation Activities of EE Faculty

The Faculty of Electrical Engineering is involved in scientific and technical cooperation with the following universities:

- The Technical University RWTH Aachen, Germany
- TH Darmstadt, Germany
- Nottingham Trent University, the UK
- The University of Westminster, London, the UK
- FH Köln, Germany
- The Technical University of Berlin, Germany
- The Technical University of Dresden, Germany
- The University of Rome "La Sapienza", Italy
- The Technical University of Moscow "MEI", Russia
- The Technical University of Brno, the Czech Republic
- The Technical University of Prague, the Czech Republic
- The Technical University of St. Petersburg, Russia
- Université de Technologie de Compičgne, France
- The Rostov State Institute of Transport, Russia
- The University of Genoa, Italy
- The University of Dortmund, Germany
- The University of Bath, the UK

The Faculty participates in the TEMPUS JEP-13157/98 program in cooperation with: the University of Roma, the University of Patras, the Schools of Engineering ECAM Brussels, ISAT Brussels, the IUT Bethune, and the Technical University of Radom.

Future Direction

The future education and research activities of the Electrical Engineering Faculty will focus on:

- Intensifying work to obtain grant funds from State Committee of Scientific Research (KBN) for fundamental research.
- Increasing co-operation with industry by performing commissioned research, expertise and making results of research and development works more practicable.
- Participation in international projects and grants.
- Organizing co-operation with international and Polish societies such as IEE, IEEE, and Polish Academy of Sciences.
- Market-oriented activity in finding other resources for research.
- Finding partners among small private enterprises, which are more flexible and market-oriented and better prepared for incorporating new ideas and solutions.
- Creating closer contacts with technical universities and research centers in Poland.
- Developing new programs of B.S. and M.S. and Ph.D. studies, with EU cooperation within a framework of TEMPUS project.
- Trying to attract more postgraduate and Ph.D. students.
- Enlarging research infrastructure using funds received from State Committee for Scientific Research and commissioned by industry.

Bibliography

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Biography

SOHAIL ANWAR
Sohail Anwar holds a Ph.D. degree in Industrial and Vocational Education from the Pennsylvania State University and a M.S. degree in Electrical Engineering from the University of Texas at Arlington. He completed additional graduate coursework in control theory and applied mathematical sciences at the University of Texas at Arlington. He is currently serving as an associate professor of Engineering and the Program Coordinator of Electrical Engineering Technology at The Pennsylvania State University, Altoona College. Since 1996, he has also served as an invited professor of Electrical Engineering at IUT Bethune, France.

DESIRE D. RASOLOMAMPIONONA
Désiré D. Rasolomampionona holds a M.Sc. (’88) and a Ph.D. (’94) degree in Electrical Engineering from the Warsaw University of Technology (WUT). He is a specialist in Protection of power engineering devices and power automatic and control. Also Désiré D. Rasolomampionona has advanced skills in computer programming, especially in client-server application projects, LAN and WAN network management. Since 1996 he has been involved closely with international relations at the WUT. He is currently serving as an associate professor at the Institute of Power Engineering of WUT. Since 2000, he has also served as an invited professor of Electrical Engineering at IUT Bethune, France.