PROGRESS REPORT

2011/2012
2012/2013

UNIVERSITY OF ZAGREB
**FACULTY OF
ELECTRICAL
ENGINEERING
AND COMPUTING**

**Zagreb, Croatia
December 2013**

FER

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P R O G R E S S
R E P O R T

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FACULTY OF ELECTRICAL ENGINEERING AND COMPUTING

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Dean's preface

The Faculty of Electrical Engineering and Computing (in Croatian: Fakultet elektrotehnike i računarstva - FER) of the University of Zagreb is undoubtedly the leading educational and R&D institution in the fields of electrical engineering, computing, and information and communication technology in the Republic of Croatia and wider. Over the last 94 years (from 1919 until 1956 as the Electrical Engineering Department of the Technical Faculty, from 1956 until 1995 as the Faculty of Electrical Engineering, and from 1995 until the present under its current name), FER has contributed greatly to the development of Croatian industry and businesses in all the mentioned fields. FER's contribution is manifested mostly through the education of versatile engineers, as well as through numerous national R&D projects.

In today's socio-economic circumstances, FER's objective is to ensure the highest possible level of educational, research and professional development for its students and employees. One crucial step towards this goal is establishing an institutional framework which will guarantee both efficient organization of all Faculty services and appropriate care for the development of human resources. In that respect, one can readily identify four strongly interconnected pillars: (1) education, (2) R&D, (3) human resources, and (4) organizational framework. It is clear that FER can maintain its leading position in Croatia only through integrated development of all four pillars. Through such synchronized actions, FER can achieve a better competitive position in the future, enabling us to enter and maintain partnering relationships with similar institutions in the European Research and Education Area.

Scientific research is one of the basic activities of every R&D oriented faculty and, as such, FER is no exception. In that respect, we must maintain the highest possible research standards, not only because of FER's history and position in Croatian society, but also due to our responsibility for developing high-technology products and collaborating/establishing businesses that are associated with such products. FER must be an incubator for new scientific and research ideas that will be transferred to the national economy. Part of this transfer can be achieved through educational activities, such as masters and doctoral studies. Equally important is the licensing of research results and innovations achieved directly from research projects with national and international companies.
I am convinced that FER has the research capacities needed for achieving significantly higher scientific and research productivity. It is my belief that "unlocking" our research potential can be achieved through a combination of clearly defined institutional research objectives, good management of existing resources, and coordination of professional activities. The guidelines for our scientific activities are: (1) basic and applied scientific research, (2) partnership with businesses, with an emphasis on national enterprises, and (3) international collaboration based on R&D projects.

Finally, I would like to express my acknowledgment and gratitude to our faculty, staff, students, graduates and friends who, all together, consolidate their efforts to continuously make FER a more enchanting place to work, teach, study and research.

Prof. Nedjeljko Perić, Ph.D.
Dean

Contents

1. General Information

Faculty of Electrical Engineering and Computing

By the decision of the Parliament of the People's Republic of Croatia, on 26 April 1956, the former College of Engineering of the University of Zagreb was divided into four new faculties, one of them becoming the

Faculty of Electrical Engineering,
which started its independent existence
on July 1, 1956.

This was the start of the third, modern stage in the development of electrical engineering in Croatia, characterised by a turbulent development in electronics, electrical power engineering, electrical industry plants, automation, communications and computing.

The Faculty of Electrical Engineering (ETF - Elektrotehnički fakultet, in Croatian) existed under this name until 7 February 1995 when it was renamed the

Faculty of Electrical Engineering and Computing

Under its new name the Faculty of Electrical Engineering and Computing (FER - Fakultet elektrotehnike i računarstva, in Croatian) continued its development with a commitment to the permanent improvement of its curriculum.

The Faculty buildings "A", "B" and "C" at the present location (Unska 3, Zagreb) were completed and Faculty of Electrical Engineering and Computing equipped in 1963. With the support of the industry and government a new building ("D") was built and inaugurated in 1989 and today the Faculty offers substantial educational and R&D facilities including 35 lecture halls, more than 60 laboratories, Congress centre, teleconference centre, central library and 12 department libraries, student restaurant, sport and recreation facilities on 43308 m^2.

The Faculty is organised in 12 departments which represent the focal points of education, research and development in various fields:

Department of Applied Physics (established in 1945)
Department of Applied Mathematics (1919)
Department of Applied Computing (2005)
Department of Electrical Engineering Fundamentals and Measurements (1924)
Department of Electric Machines, Drives and Automation (1925)
Department of Energy and Power Systems (1934)
Department of Telecommunications (1951)
Department of Electronic Systems and Information Processing (1942)
Department of Control and Computer Engineering (1954)
Department of Electroacoustics (1954)
Department of Electronics, Microelectronics, Computer and Intelligent Systems (1943)
Department of Wireless Communications (1954)

The present research and educational staff comprises 168 professors and 208 teaching and research assistants.

In the last few decades research and development at the Faculty has been carried out through projects promoted and funded by the Ministry of Science, Education and Sports of the Republic of Croatia in the fields of: Electrical Engineering, Computing, ICT as well as in Applied Physics and Mathematics. Additionally, researchers of the Faculty are currently, in 2013, leaders of 18 active FP7 projects as well as the leaders of a number of industrial projects.

Determined to remain a respectable research institution, FER undertakes scientific research at the highest levels of international standing. The Faculty has developed valuable international cooperation with many research institutions around the world, either directly or through inter-university cooperation. The number of international projects in the last two years makes the Faculty of Electrical Engineering and Computing one of the most internationally active institutions in Croatia.

Research staff of the Faculty of Electrical Engineering and Computing of the University of Zagreb	
Professors and lecturers	
Full professors	78
Associate professors	43
Assistant professors	47
Assistants	17
Researchers	191

Nowadays (in 2013), FER counts around 3100 students at the undergraduate and graduate studies, and 500 students at postgraduate studies. All those numbers clearly emphasize our highly spirited activities in teaching and research.

Finally, as an endorsement of the teaching and research excellence, FER has obtained the accreditation for the bachelor and master study programs from the ASIIN agency (Akkreditierungsagentur für Studiengänge der Ingenieurwissenschaften, der Informatik, der Naturwissenschaften und der Mathematik). The accreditation was issued on the 23 March 2006, 23 March 2007, 4 October 2011 and 22 March 2013 by a decision of the Accreditation Commission and is valid until the April 2014.

2. Historical Overview

The first building of the Technical College

When the University of Zagreb was reorganised in 1874 to become the first modern university in Croatia, it offered only the humanistic trivium of the Faculty of Law, the Theological College and the Faculty of Arts and Letters. However, documents show that in the wake of the momentous scientific discoveries at the end of the 19th century, its reformers had already made provision for the future establishment of faculties of natural sciences, engineering and other related disciplines.

Although the Academy traditionally promoted mainly arts and sciences, a strong technical culture and tradition developed alongside, particularly electrical engineering. Zagreb established its first telegraph connection with Vienna as early as 1850, when, on September 28, the first telegram was sent from Vienna to Zagreb by Josip Jelacic, the Civil Governor of Croatia, Slavonia and Dalmatia; in 1875, a major scientific book was printed in Zagreb: Betriebsstörungen oberirdischer Telegraphen-Leitungen, deren Aufsuchung und Behebung, by Ferdinand Kovačević, a pioneer and the first Croatian designer in the field of telegraphy; the first exchange in Zagreb was set up by Wilim Schwarz in 1886 and the first telephone was introduced in 1887; near the city of Šibenik, on the river Krka, on the beautiful waterfalls of Skradinski buk the hydro-power plant "Krka" was put in operation on 28 August 1895 (power generator 320 kVA, frequency 42 Hz), together with a polyphase transmission system (3 kV trans-

The building in Vukotinovićeva street where some departments were located from 1947 to 1963

mission line, 11 km long) to supply the city of Šibenik with electrical power - the first system of this kind in Croatia.

Zagreb was the cradle of the study of electrical engineering and electro technical sciences in Croatia: the first electric bulbs were described by Bogoslav Šulek in 1880, and the book "On Magnetism and Electricity" by Oton Kučera was published in 1891 by the Cultural Society of Croatia (Matica hrvatska). The Society of Engineers and Architects of Croatia and Slavonia, at their Annual Assembly held on 21 February 1898, proposed to establish a Technical College with an Engineering Department in Zagreb. In 1910, Dr. Juraj Žerjavić, the abbot and parson of Marija Bistrica established by a deed of donation a foundation for the establishment and maintenance of the College of Engineering at the University of Zagreb and a year later, the Civil Governor of Croatia, Slavonia and Dalmatia, Dr. Nikola Tomašić, carried out a poll which resulted in the decision to set up a Technical College. At the beginning of the 20th century, the Cultural Society of Croatia published quite a number of books dedicated to the application of natural sciences (electrical engineering), under the common title Modern Time Inventions, in which Oton Kučera, Stanko Plivelic and Juraj Božičević dedicated large chapters to electrical generators, motors, electric vehicles, electric energy transmission and accumulators. At that time, the Hon. Marcel Kiepach, Križevčanin, became known by his patents - the use of the dynamo for illumination (Paris, 1911) and an electric device for remote compass indication (London, 1911).

The Technical College was founded by the decree of the State Commissioners' Council on 10 December 1918 and accepted its first students on 1 October 1919.

Among other departments, the College also had the Department of Electrical Engineering. On 31 March 1926 the Technical College was renamed the

College of Engineering. The newly founded College started work on the 1st of April of the same year. In that year, the University Senate awarded an honorary Ph.D. degree to Nikola Tesla (the inventor of several hundred patents in the field of electromagnetism, polyphase alternating current, high-frequency radio and wireless communications). The first radio broadcast station in Croatia and south-eastern Europe was constructed in Zagreb already in 1926 (the first radio broadcast was on 15 May 1926), only 6 years after the beginning of radio-diffusion in America. One of its initiators was young Dr. Josip Lončar, who worked together with Oton Kučera and Miroslav Plohl. In 1927, Josip Lončar published his first book under the title Construction of Receiving Radio Stations, Part 1 (1927) and Part 2 (1929), where he elaborated the field of radiophony, combining scientific discourse with a popular approach and which promoted him as a pioneer of radiophony in Croatia.

In the thirties, the study of electrical engineering was registered under the name of the Department of Electrical and Mechanical Engineering and at that time all the fundamental electrical engineering subjects were lectured by Josip Lončar, part-time assistant professor (Elements of Electrical Engineering, Electrical Measurements and Introduction to Radio). All other electrical engineering subjects for obtaining a university degree in engineering were lectured by Miroslav Plohl (High-Voltage Techniques, Transmission and Distribution of Electric Energy, Accumulators). The first steps in laboratory and research work were done in the Department of Electrical Engineering, established in the academic year 1928/1929 and situated in a separately constructed building, behind the central building on nowadays Roosevelt Square. The founder of the Department and its first Head was Miroslav Plohl, who was appointed full professor in the same academic year. When Jure Horvat joined the College of Engineering, the subject Power Engineering was introduced, followed by Electric Energy Production in the academic year 1933/1934, by Transient Processes in Electrical Devices in the academic year 1935/1936 and, for the first time, by Low-Voltage Current (lecturer M. Plohl) in the academic year 1936/1937. After the tragic death of professor Plohl in late 1939, Anton Dolenc took over the duty of part-time lecturer in the subjects High-Voltage Techniques and Theory and Manufacturing of Electric Machines and Transformers.

From the very beginning to the 2nd World War, the whole burden of teaching and scientific work in the field was carried by professors Lončar, Plohl and Horvat. Teaching and research work was organised within the Laboratory of Electrical Measurements founded in 1924, which in the academic year

1936/1937 became the Laboratory of Electrical Engineering Fundamentals, and three institutes:

- Department of Electrical Engineering,
- Department of High Voltage (founded in the academic year 1934/35),
- Department of Low-Current Techniques (founded in the academic year 1938/39).

In the Laboratory of Electrical Engineering Fundamentals, professor Lončar (in the academic year 1934/1935 appointed assistant professor and in the academic year 1937/1938 full professor), thanks to his extraordinary persistence and interest, collected a considerable number of precise devices and instruments, which helped with scientific work and were also used for laboratory exercises by students. In such an environment, electrical engineers were educated according to world standards and did not lag behind their colleagues in other countries.

Zagreb soon became known by its international events in the field of electrical engineering. In 1930, Professor Lončar was the first to make the reception of television pictures from London possible in Zagreb. In the same year, he wrote about it in the London Television and the Berlin Fernsehen magazines. As the author of the book About Modern Television, published in Zagreb in 1937, professor Lončar is considered a pioneer of television in Croatia. The first TV-broadcast in Zagreb and Croatia took place in 1939, when there were only two TV-stations in Europe: London and Berlin - the first television station in general having been installed in London in 1936. Also, Josip Slišković, a world known designer of radio and TV-receivers, made possible the first test reception of a London television broadcast in Vienna in 1930.

After the 2nd World War, the Council of the College of Engineering (all departments) comprised 14 full and associate professors, among whom Dr. Josip Lončar, also a full professor. Other lecturers were suspended or their appointments were annulled, because they had been appointed during the war. The Section of Electrical Engineering of the Department of Mechanical Engineering was consequently left with only a few lecturers, and everything had to start again from the very beginning at a time

The building in Savska street 16 where the Dean's Office and three departments of the Faculty of Electrical Engineering were located from 1959 to 1963.

when a large number of students entered University and when the need of the country for engineers was rapidly increasing. Lecturers of other departments held general subjects and mechanical engineering subjects for students of electrical engineering. In that period enormous results were achieved in lecturing and scientific work, particularly in the development of electrical and radio industry.

The first electrical engineer graduated in the academic year 1927/1928 and from that time up to the establishment of the Faculty of Electrical Engineering in 1956 a total of 750 electrical engineers graduated from the University of Zagreb.
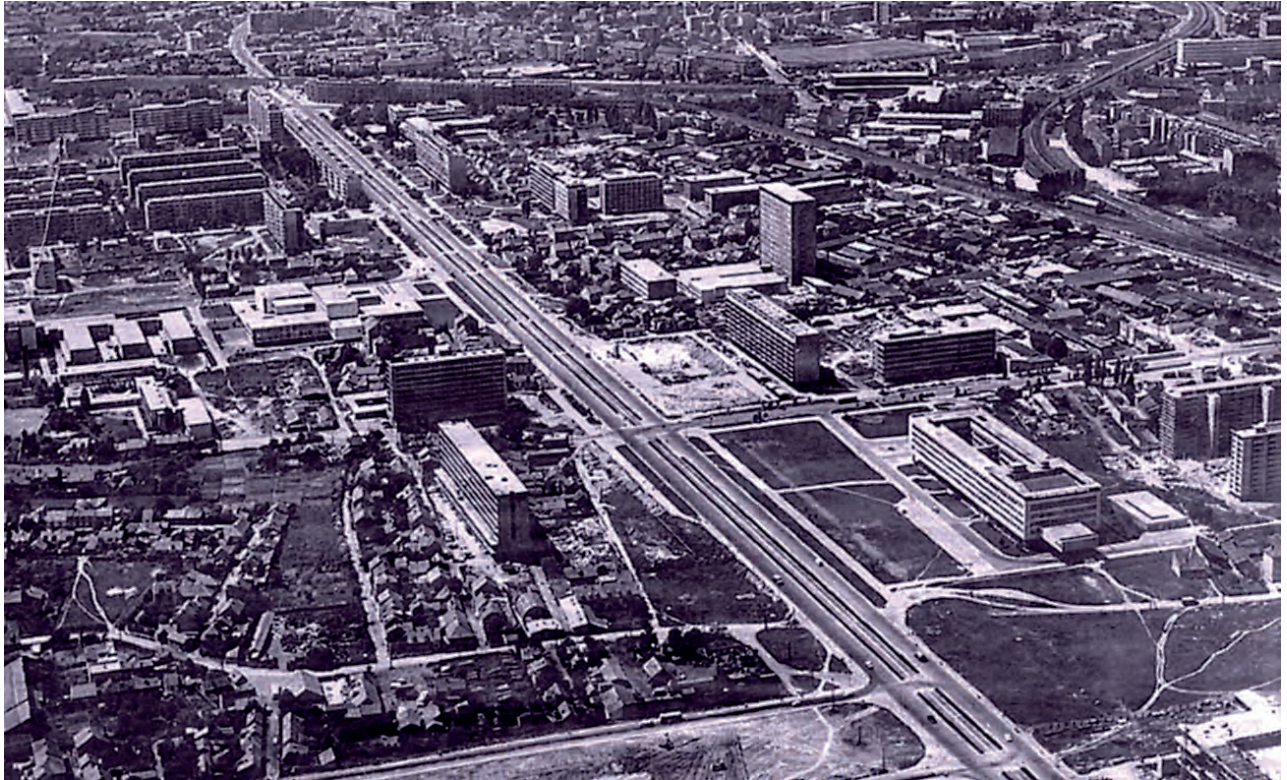
Today's Vukovar Avenue in mid 60-ies.

Construction of Martinovka Sports Hall.

3. Study programs at the Faculty of Electrical Engineering and Computing of the University of Zagreb

STUDY PROGRAM SCHEME

First cycle study programs	1	**Study programs:** • Electrical Engineering and Information Technology • Computing *(common 1st year for both study programs)*	
	2	**Study program: Electrical Engineering and Information Technology**	**Study program: Computing**
	3	*Specializations:* • Wireless Technologies • Electronics • Electronic and Computer Engineering • Control Engineering and Automation • Electrical Power Engineering	*Specializations:* • Software Engineering and Information Systems • Computer Engineering • Telecommunication and Informatics • Computer Science • Information Processing

| Second cycle study programs | 4 | **Study program: Electrical Engineering and Information Technology**

Profiles:
• Control Engineering and Automation
• Electrical Engineering Systems and Technology
• Electrical Power Engineering
• Electronic and Computer Engineering
• Electronics | **Study program: Information and Communication Technology**

Profiles:
• Information Processing
• Telecommunications and Informatics
• Wireless Technologies | **Study program: Computing**

Profiles:
• Software Engineering and Information Systems
• Computer Engineering
• Computer Science |
| | 5 | | | |

Postgraduate study programs	**Postgraduate doctoral study program (electrical engineering / computing)** **Research fields:** Electrical Engineering Computing	**Postgraduate specialist study in transformers**
		Multidisciplinary postgraduate specialist study in electronic communications market regulation
		Postgraduate specialist study in information security
		Postgraduate specialist study in electrical engineering systems in railways

The study of electrical engineering and infor-mation technology as well as the study of computing are classified into studies within the area of engineering sciences. These studies prepare experts and potential young scientists for important areas that have a dominant role in technological and social development. Nowadays, advances in engineering are not achieved only by ingenious inventions, but in most cases are a result of sustainable effort in research and development.

University of Zagreb, Faculty of Electrical Engineering has been offering the university curriculum in the area of electrical engineering for more than fifty years. Computing topics had been introduced into the curriculum by the development of computing and the faculty changed its name to the Faculty of Electrical Engineering and Computing in 1995. At the present time, all areas of electrical engineering are intertwined with information and communication technology as well as with computing.

3.1. First cycle study programs

Common objectives of two first cycle programs are: to educate students for a broad range of professional careers, provide the basis for life-long learning, and prepare students for advanced studies at the graduate level.

All study programs at FER are taught according to the prerequisite system. For every study program, the set of mandatory and the set of elective courses are defined. The student can enrol all courses for which prerequisites have been completed, amounting to around 30 ECTS points per semester. The students are obliged to be present at all forms of teaching. One of the main goals of this study-program reform is the switch from teaching to learning, so the students will have around 20 lecture hours per week. All courses are graded through continuous assessment, consisting of homework, periodical tests, mid-term exams and the final exam.

The first cycle study ends when all mandatory courses are completed and 180 ECTS points are collected. The work on the bachelor thesis, which must be publicly defended, contributes with 12 ECTS points.

The first year of study is common to both study programs, the study of Electrical Engineering and Information Technology and the study of Computing. This first year gives the students the fundamental knowledge of mathematics, physics, electrical engineering and computing. Also, this first year teaches the student to communicate effectively and acquaints them with general principles of engineering. In the second year students broaden the knowledge in mathematics and electrical engineering or computing, but also introduces students to quality management and principles of economy. To emphasize individual work, they conduct and present a seminar.

In the third year, especially in the 6th semester, specializations are introduced by corresponding mandatory and elective courses, which give some practical knowledge for students who will not continue to the second level study. Some knowledge on ecology and law is also given. In the 5th semester, to increase project management and teamwork competences, they complete a project in groups of 6-8 students. The study finishes after the bachelor thesis is successfully completed and publicly defended.

▼ First cycle study program - Electrical Engineering and Information Technology

Electrical Engineering covers the application of physical laws about electromagnetic phenomena in development of products and services that provide a benefit to the mankind. Information technology, which uses computers, computer networks, communication systems and technology to sense, process, store and display the information, today

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has a significant impact on electrical engineering. Nowadays, it is almost impossible to come across an activity within electrical engineering that is not interconnected with information technology. Thus, these areas have been joined into the first cycle study program of Electrical Engineering and Information Technology. This program develops the competencies to analyse and solve engineering problems of medium complexity, to work as an efficient member of a team, and to contribute to design of systems and processes in the area of electrical engineering and information technology. The fundamental knowledge of mathematics, physics, electrical engineering and information technology, backed up with usage of contemporary computer tools, is utilized.

Within the study program of Electrical Engineering and Information Technology, a student can slightly specialize in one among several offered specializations. This specialization is achieved by selecting appropriate group of courses during the third year of study.

Specialization in **Wireless Technologies** is based on electromagnetism as essential wireless communication tool and on widely applied radio systems. Principal topics are: electromagnetic wave properties, propagation, wireless communication phenomenon, basic communication system units, signal processing for communication purposes, mobile wireless systems (public and private), optical communication technologies, multimedia and radio navigation, and wireless systems applications.

Electronics encompasses analysis, design and implementation of electronic systems that contain electronic devices and electronic circuits. The students acquire theoretical and practical knowledge needed for modelling, simulation, design and production of electronic circuits and systems in the fields of microelectronics, radiofrequency and microwave electronics, power electronics, electroacoustics, audio electronics, biomedicine, electronic measurement and testing, as well as other areas in electronics.

Electronic and computer engineering prepares students for employment and advancement
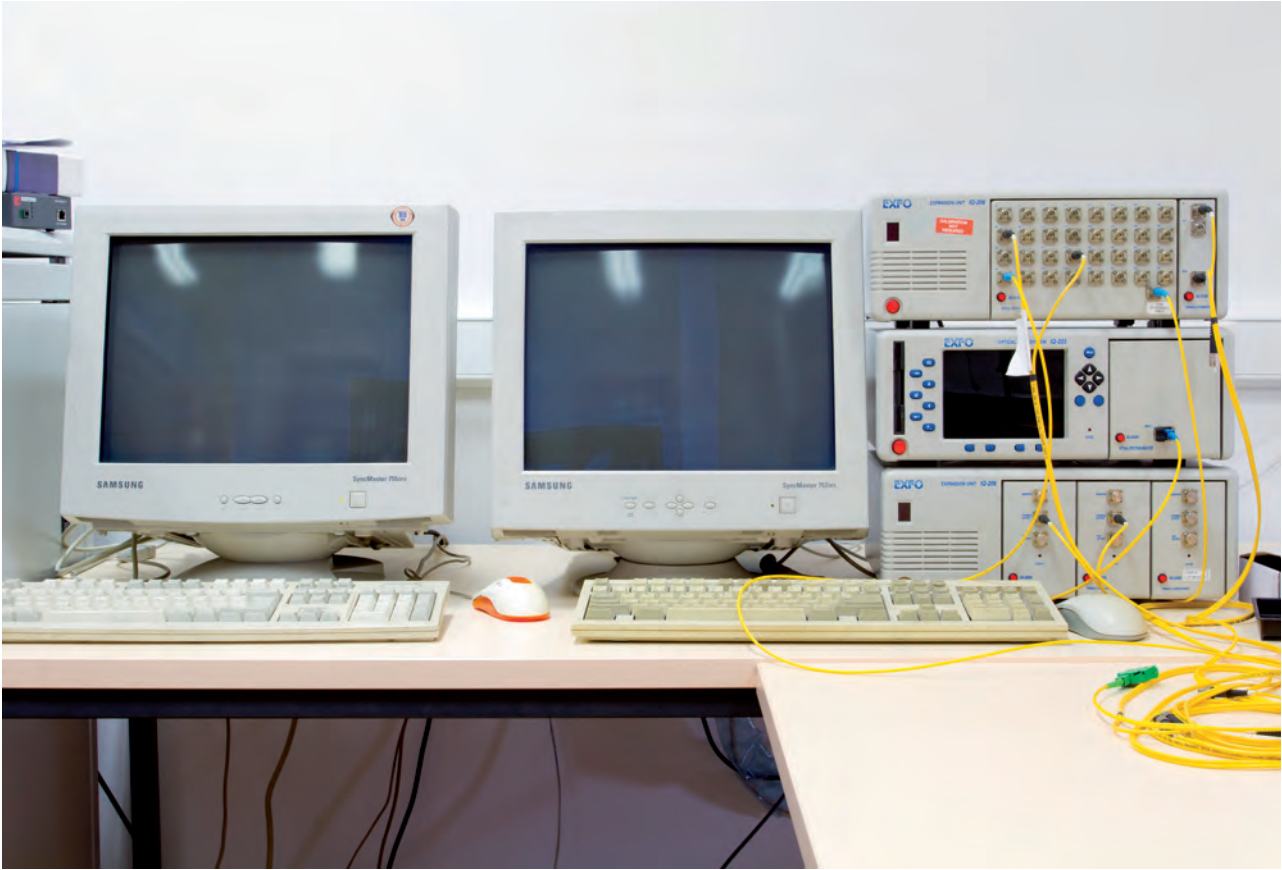
in development, design and realization of systems based on analogue and digital circuits, computers, systems on a chip and development of corresponding software. The program develops a knowledge base in electronic circuits, process monitoring and control, communications, instrumentation and intelligent systems. It comprises measurement of physical quantities, their conversion into electrical signals, analogue and digital processing, application of embedded systems and networks for processing, storage, transmission, analysis and display of information. The emphasis of the program is in integration of multidisciplinary knowledge on circuits, algorithms and software in order to enable students to solve sophisticated problems in planning, management and control of research and development projects in modern enterprises, scientific organizations and services of a contemporary information society.

Control Engineering and Automation as multidisciplinary technological and engineering fields comprise the following knowledge: determination of requirements and criteria for control systems design related to flow of matter, energy and information; im-

plementation of methods for information processing hardware and software for control and automation and data acquisition in the control and automation systems. Control Engineering and Automation systems; implementation of methods for system syllabus qualifies students for design, implementation analysis and design; design and implementation of and commissioning of the less complex systems in the following fields: process automation, automation of manufacturing plants; computer-controlled systems; electromechanical systems, and process measurements and actuators.

Electrical Power Engineering is the branch of engineering science that studies the uses of electricity and the equipment for power generation and. Covers electric power system components, electricity consumption, generation (thermo, hydro, nuclear, renewable), transmission, distribution, electric utility operation, electric power system control, power system protection, power system reliability, government regulation, market operations, risk management etc.

ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY
STUDY PROGRAM SCHEME

Semester	Course	ECTS points	Lecture hours per week	Lab hours per week
I	Mathematics 1	7	6+1	
	Fundamentals of Electrical Engineering	7	6	1
	Digital Logic	6	4	1
	Programming and Software Engineering	6	4	1
	Skills of Communication	3	2	
	Laboratory and Skills - Maths on the Computer	1		1
	Physical Education 1			2
		30	23	
II	Mathematics 2	7	6+1	
	Physics 1	6	5	1
	Algorithms and Data Structures	6	4	1
	Computer Architecture 1	6	4	1
	Management in Engineering	3	2	
	Laboratory and Skills - Autocad	2		1
	Physical Education 2			2
		30	22	
III	Mathematics 3E	5	4+1	
	Physics 2	6	5	1
	Electronics 1	7	5	1
	Electrical Circuits	7	5	1
	Quality Management	3	2	
	Laboratory and Skills - Matlab	2		1
	Physical Education 3			2
		30	22	
IV	Probability and Statistics	5	4	
	Signals and Systems	6	4	1
	Energy Technology	6	4+1	
	Electromagnetic Fields	6	5	1
	Economics and Managerial Decision Making	4	3	
	Seminar	3	2	
	Physical Education 4			2
		30	23	
V	Automatic Control	5	4	1
	Communication Systems	5	4	1
	Information Theory	4	3	1
	Specialization course	4	3	1
	Specialization course	4	3	1
	Sustainable Development and Environment	2	2	
	Project	6		
		30	19	
VI	Specialization course	4	3	1
	Elective course	4	3	
	Elective course	4	3	
	Elective course	4	3	
	Commercial Law	2	2	
	B.Sc. Thesis	12		
		30	14	

First cycle study program - Computing

The principal object of study in Computing is the computer as a universal data processing machine, together with the methods of its application in diverse areas. The holistic approach to hardware, software, and hardware-software dependencies is used. Computing encompasses the theory, methods of analysis and synthesis, design and construction, application and operation of computer systems. This first cycle study program develops the competencies to analyse and solve engineering problems of medium complexity, to work as an efficient member of a team, and to contribute to design of systems and processes in the area of computing. The fundamental knowledge of mathematics, physics and electrical engineering, backed up with usage of contemporary computer tools, is utilized. Within the study program of Computing, a student can slightly specialize in one among several offered specializations. This specialization is achieved by selecting appropriate group of courses during the third year of study.

Software Engineering and Information Systems curriculum combines theoretical knowledge with practical work and experience, developing professional competences in the field of programming, abstraction and conceptual skills in the field of computing. It provides multidisciplinary knowledge in the field of information systems, computer science and management. Focused on application and management of information technology helping to approve efficiency of operations in different kind of businesses, it unites technological knowledge with organizational environments. The graduates can work in the field of information systems management, programming analysis, systems analysis, systems programming, system integration, user requirements analysis, e-business and information technology application.

Computer Engineering program embodies research, design and implementation of computers, computer systems and related software. It includes theory and practical aspects of the design and implementation of computers, computer based systems, mobile and embedded computers, communication systems and other systems that incorporate computers as well as software design with emphasis on applications that provide knowledge and understanding of the complete system. Computer engineering program provides system based approach to the design of computers and software as a whole. This program offers combination of core and advanced knowledge from both computing and electrical engineering required to understand, to design and to be able to envision future complex computers, computer based systems and applications running on those platforms.
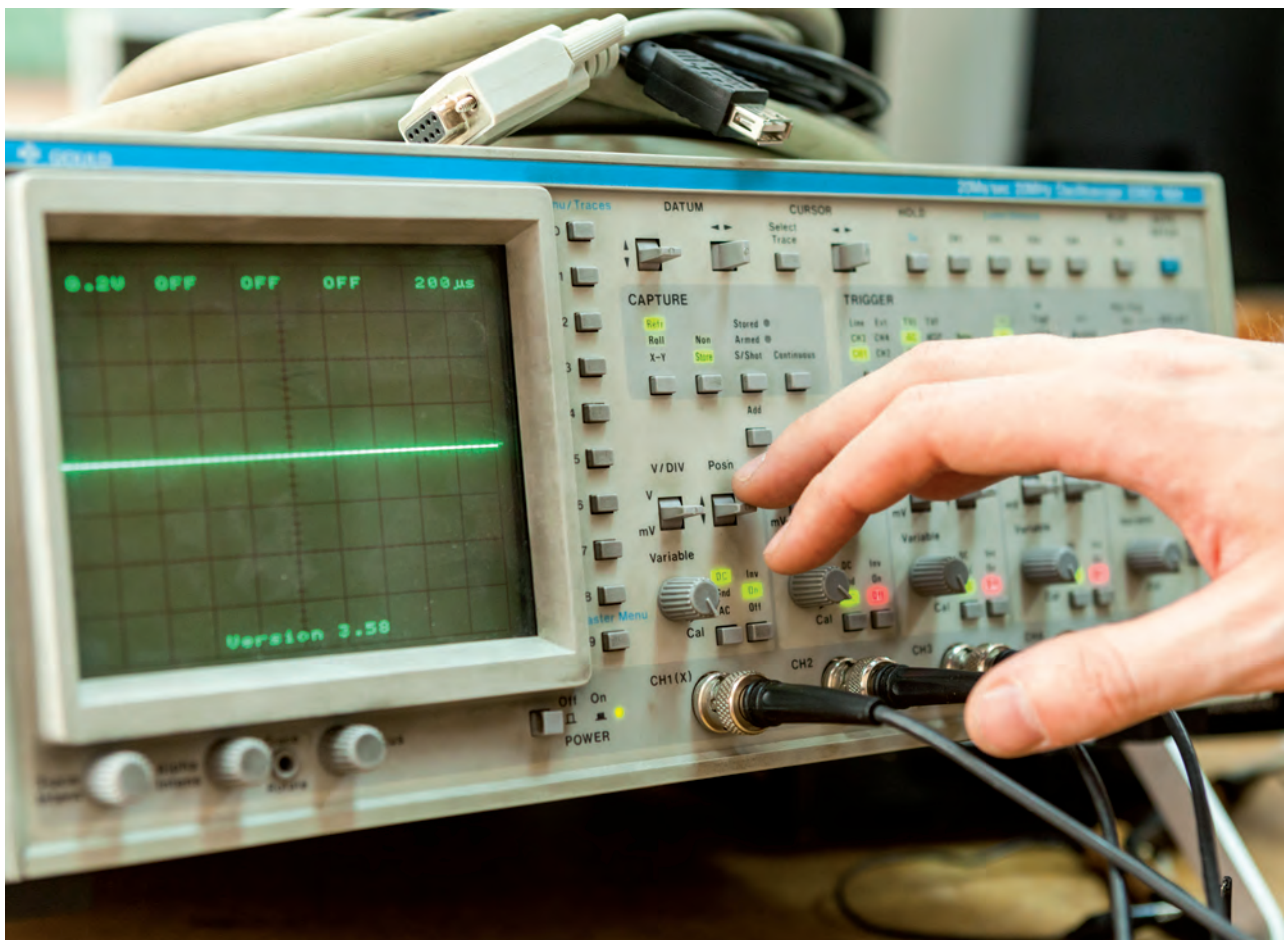
STUDY PROGRAMS

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Telecommunications and Informatics specialization provides knowledge and skills required for contribution to the design and implementation of networks, systems and services, especially identification, formulation and solution of intermediate engineering problems in the area of communication networks and information services. Besides general computing topics, information representation, logic and languages for specification and modelling are studied, as well as architecture of telecommunication networks and systems, and multimedia services. Elective courses cover concepts, techniques and tools related to local area networks, public mobile network, computer-telephony integration, network programming, basics of virtual environments and others, that will give qualifications and capabilities for development, production and usage of new information and communication technology.

Computer Science brings together scientific and engineering principles, theoretical analysis and computing experience to provide students with solid foundation of the discipline. The computer science module develops a high-level understanding of systems as a whole.This understanding encompasses an appreciation for the structure of computer sys-

tems and the processes involved in their construction and analysis. Students recognize many recurring themes such as abstraction, complexity, and evolutionary change and apply them to a broad range of applications as a team member in industry, utility sector and maintaining the skills as the field evolves. government institutions. Students of computer science are capable to understand and apply essential concepts, principles and practices in the context of well-defined scenarios.

Information processing - Information processing is an important ingredient of showing judgment in the selection and application modern multimedia systems. The study profile provides of tools and techniques. They also demonstrate the knowledge in hardware and software components for ability to work as an individual under guidance and processing, storage, coding, transfer, and analysis of various types of multimedia information (signals, speech, data, images, and video). Information processing has applications in communication networks, mobile ubiquitous systems, man-machine interaction, multimedia, medical informatics, security systems, biometrics, bioinformatics, and other areas of modern information society.

COMPUTING STUDY PROGRAM SCHEME

Semester	Course	ECTS points	Lecture hours per week	Lab hours per week
I	Mathematics 1	7	6+1	
	Fundamentals of Electrical Engineering	7	6	1
	Digital Logic	6	4	1
	Programming and Software Engineering	6	4	1
	Skills of Communication	3	2	
	Laboratory and Skills - Maths on the Computer	1		1
	Physical Education 1			2
		30	23	
II	Mathematics 2	7	6+1	
	Physics 1	6	5	1
	Algorithms and Data Structures	6	4	1
	Computer Architecture 1	6	4	1
	Management in Engineering	3	2	
	Laboratory and Skills - Autocad	2		2
	Physical Education 2			2
		30	22	
III	Mathematics 3C	5	4+1	
	Physics 2	6	5	1
	Electronics 1	7	5	1
	Operating Systems	7	5	1
	Quality Management	3	2	
	Laboratory and Skills - Matlab	2		2
	Physical Education 3			2
		30	22	
IV	Probability and Statistics	5	4	
	Introduction to Theoretical Computer Science	6	3+1	1
	Signals and Systems	6	4	1
	Databases	6	4	1
	Economics and Managerial Decision Making	4	3	
	Seminar	3	2	
	Physical Education 4			2
		30	21	
V	Software Design	8	4	4
	Communication Networks	4	3	1
	Information Theory	4	3	1
	Specialization course	4	3	1
	Sustainable Development and Environment	2	2	
	Software Project	8		
		30	15	
VI	Specialization course	4	3	1
	Specialization course	4	3	1
	Elective course	4	3	
	Elective course	4	3	
	Commercial Law	2	2	
	B.Sc. Thesis	12		
		30	14	

STUDY PROGRAMS

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3.2. Second cycle study programs

From the academic year 2008/2009 FER offers three study programs at the master lever. The study programs are:

- Electrical engineering and information technology
- Information and communication technology
- Computing

The common objectives of the three second cycle study programs are to educate students for a broad range of professional careers and provide the basis for life-long learning. Recognizing the changing professional environment that students will encounter, the programs aim to develop engineers who possess a strong foundation in mathematics, science and engineering and are able to link science and engineering principles to identify, formulate and solve complex engineering problems in professional practice and research and development contexts.

Upon enrolment, a student immediately chooses the study program and decides for a profile, which is a specialization within a chosen study program. All study programs at FER are taught according to the prerequisite system. For every profile, the following sets of courses are defined:

- Theoretical courses – the courses which comprise theory specific to one or more profiles (e.g. courses which could have the word theory in the title).
- Specialization courses – the courses which further specialise a student within a profile.
- Elective courses – all other courses in the fields of Electrical engineering, Information technology or Computing, or other fields within student's interest.
- Mathematics and science courses – courses offered at FER or other faculties within University of Zagreb, with mathematical and science content.
- Humanistic or social courses – courses offered at FER or other faculties within University of Zagreb, with humanistic or social content.

During the second cycle study program, a student must enrol at least:

- Theoretical courses – 25 ECTS points.
- Specialization courses – 20 ECTS points.
- Elective courses – 12 ECTS points.
- Mathematics and science courses – 8 ECTS points.
- Humanistic or social courses – 6 ECTS points.

In addition, a student must enrol two laboratories, which give practical knowledge specific to the chosen profile. Further, a student must successfully complete a seminar, where all participating students prepare and present individual presentations. Finally, a project must be completed, where students, in groups of 6 to 8, increase their project management, collaboration and team competences.

At the end, a graduation thesis must be completed and defended, which contributes with 30 ECTS points.

All courses will be graded through continuous assessment, consisting of homework, periodical tests, mid-term exams and the final exam. One of the main goals of this study-program reform is the switch from teaching to learning, so the students will

have around 16 lecture hours per week. All courses can be taught in English. The second cycle study ends when all mandatory courses are completed and 120 ECTS points are collected.

Next table contains the recommended study scheme and the list of courses. The students can choose other paths through the study.

▼ Second cycle study program - Electrical Engineering and Information Technology

Electrical engineering covers the application of physical laws about electromagnetic phenomena in development of products and services that provide a benefit to the mankind. Information technology, which uses computers, computer networks, communication systems and technology to sense, process, store and display the information, today has a significant impact on electrical engineering. Nowadays, it is almost impossible to come across an activity within electrical engineering that is not interconnected with information technology. Thus, these areas have been joined into the second cycle study program of Electrical engineering and information technology. This program enables a student to acquire the competencies to solve difficult engineering problems, to design complex systems, to act as a leader of a

SECOND CYCLE STUDY PROGRAM SCHEME

Semester	Course	ECTS points	Lecture hours per week	Lab hours per week
VII	Theoretical course	5	3	
	Theoretical course	5	3	
	Theoretical course	5	3	
	Mathematics and science	4	3	
	Specialization course	4	2	
	Humanistic or social course	2	2	
	Laboratory of the profile, 1	5		60
		30	16	60
VIII	Theoretical course	5	3	
	Theoretical course	5	3	
	Mathematics and science	4	3	
	Specialization course	4	2	
	Specialization course	4	2	
	Humanistic or social course	2	2	
	Seminar	3	2	
	Laboratory of the profile, 2	3		30
		30	17	30
IX	Specialization course	4	2	
	Specialization course	4	2	
	Elective course	4	2	
	Elective course	4	2	
	Elective course	4	2	
	Humanistic or social course	2	2	
	Project	8		
		30	12	
X	Graduation thesis	30		
		30		

team and to conduct research and development in one of five profiles.

Within the study program, a student immediately decides for a profile. The profile determines the list of theoretical and specialization courses to choose from.

Control Engineering and Automation as a multidisciplinary scientific and technological field comprises the following knowledge: determination of requirements and criteria for control systems design related to flow of matter, energy and information; research, development and implementation of methods for information processing and data acquisition in the control systems; research, development and implementation of methods for the system analysis, the system design and the system optimization; development, design and implementation of hardware and software for computer control of systems; research, development and design of control algorithms for robots and robotized systems in industry, services and households.

Electrical Engineering Systems and Technology encompasses a wide area of electrical engineering closely related to the application of novel electrical engineering and information technologies. The concept of the curriculum is based on a systematic approach to solving engineering and research tasks. The systematic approach comprises the knowledge and the achievements in electrotechnics, power electronics, digital technology, applied mechanics, electromechanical energy conversion, contemporary measurement techniques and means of transportation. The topics on electrical drives, mechatronic systems, modelling and construction of power electronic systems, design methodologies and diagnostics of electrical machines and devices, contemporary measurement systems, intelligent sensors and actuators are studied in detail. The multidisciplinary character of the profile includes the knowledge of applied computer systems for real-time operation, signal acquisition and processing, industrial communication networks, and system control via internet.

Electrical Power Engineering is a professional and scientific field of electrical engineering and power systems. It studies and promotes areas of power generation, transmission and distribution of electric energy as well as electric usage and energy management. By studying power systems engineering, students gain knowledge of fundamentals and applications of electrical power engineering in a wide range of topics: theory of power systems control; optimization methods applied to power systems; energy efficiency methods; reactive power control; electric facilities automation; reliability theory; expert systems; environmental protection; efficient use of energy and energy conservation; economic analysis; disturbances and transient phenomena in power systems; power system protection; 2 transmission and distribution networks network planning; development, stability, availability, reliability and operational safety of electric power system subsystems; mathematical modelling of power plants components and subsystems; deterministic and reliability analysis of operational safety; development modelling and analysis of environmental impact of electric power systems; establishment of open market environment, risk management and electrical energy trading; economy modelling, business and human resources management, microeconomics, marketing, etc. Besides education, research is a crucial factor determining the power systems engineering progress with emphasis on the development of new power system technologies.

Electronic and Computer Engineering gives competences in development, design and implementation of electronic systems based on analogue and digital circuits, computers and systems on chip, including software development. Application areas are electronic systems, measurement and instru-mentation, process control, communication and intelligent systems. The profile covers measurement and acquisition of physical quantities, transform to electrical signals, analogue and digital preprocessing, embedded system and networks for digital signal processing, transmission, analysis, storage and display of data. It gives strong emphasis on integration of multidisciplinary knowledge, as well as hardware, algorithms and software design to achieve complete solutions in a wide spectrum of applications.

Electronics deals with electronic devices and electronic circuits as the basic components of electronic products that are used in all areas of human activities, thereby having a very pronounced position in the modern society. The students in the Electronics study profile acquire theoretical and practical knowledge needed for the analysis, modelling, simulation, design and production of electronic circuits and systems. The students obtain the knowledge in the field of micro- and nanoelectronics, radiofrequency and microwave electronics, optoelectronics, power electronics, audioelectronics, electroacoustics, architectural acoustics, ultrasound, biomedicine, electronic measurement and testing, as well as other areas in electronics.

▼ **Second cycle study program - Information and Communication Technology**

Information and communication technology enables the transfer and utilization of all kinds of information, therefore presenting the most penetrating contemporary generic technology. As such, it is the foundation of economy and society in the 21st century. This technology generates changes in all spheres of the society. It is applicable in all branches
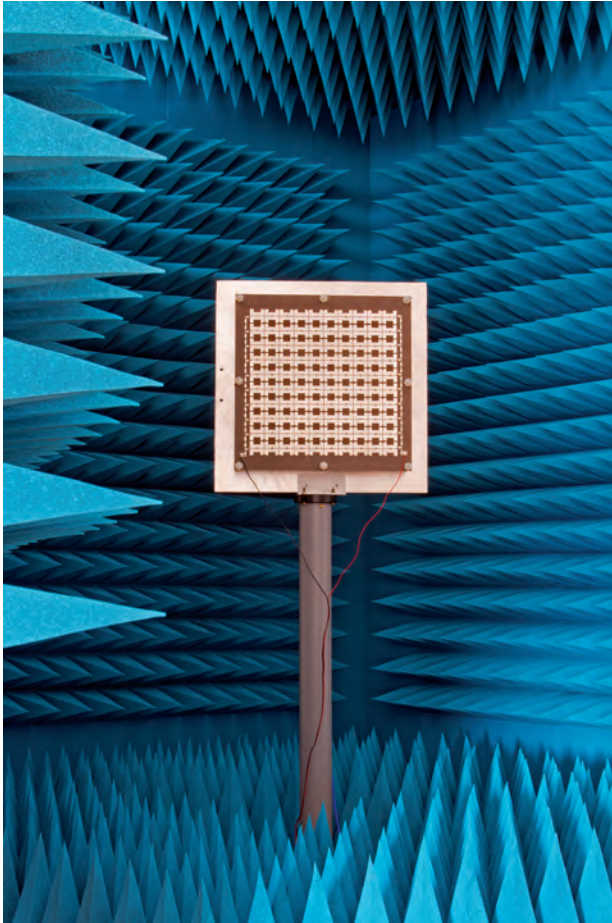
of economy and all areas of science, and it is the background for successful entrepreneurship, as well as for all social and governmental structures. This second cycle study program enables a student to acquire the competencies to solve difficult engineering problems, to design complex systems, to act as a leader of a team and to conduct research and development in one of three profiles. Within the study program, a student immediately decides for a profile. The profile determines the list of theoretical and specialization courses to choose from.

Information Processing (IP) is an important ingredient of modern information and communication systems. IP study profile includes hardware and software components for processing, storage, coding, transfer, and analysis of various types of information (signals, speech, data, images, video). Students gain knowledge in theory and applications of communications, compression techniques, information security, and real-time signal processing. Information processing has applications in communication networks, mobile ubiquitous systems, man-machine interaction, multimedia, medical informatics, security systems, biometrics, bioinformatics, and other areas of modern information society. IP study profile opens carrier paths into a wide spectrum of IT companies, industrial sector, financial and service sector, and

any other area where there is a need for processing, analysis, and transfer of information. Skills include design and development of algorithms, hardware and software systems, system testing, integration, and consulting.

Telecommunications and Informatics is based on information theory and information network theory, as well as switching algebra and automata theory. It is focused on the analysis and synthesis of multimedia information and communication in networks, as well as design and implementation of various communication systems and services. Models of local, access, and core networks are studied, including multi-service, intelligent, broadband networks and Internet, as well as planning and optimization of networks and information flows, and network management. Information transmission and routing, including photonic technology are studied, as well as information and communication services, manageable, and testable systems and networks structures with adequate performance. Knowledge is acquired in the areas of distributed systems, programming, specification and modelling languages, data processing and management in networked systems, telematic services, e-business, and systems with learning capability. Related to that communication protocols, multimedia communications, virtual reality and virtual environments, mobility in networks, mobile networks and software agents are studied. Software engineering is focused on telecommunication systems, while project management as well as research and development management are oriented towards telecom market. Acquired competencies are suitable for, but not limited to the following employment opportunities and positions: research and development of software products for networks and services in telecommunication industry; planning, implementation, testing and management of public fixed and mobile telecommunication networks, Internet and related services; design and operation of corporate and private networks and associated information systems and e-business systems with information rich contents; fundamental and applied research and high education.

Wireless Technologies comprise the scientific and professional area related to the principles of electromagnetic waves generation, transmission, propagation and reception in the area of radio- and optical frequencies; devices and software characteristics and design for the above mentioned purposes; wireless and optical networks and systems architecture which apply the methods of sound, picture and data processing and transmission; electromagnetic compatibility; wireless networks and systems planning and design (mobile communication networks, optical networks, broadcasting systems, terrestrial

and satellite communication systems, wireless access, metropolitan, local networks, navigation and radar systems. Students are educated to work in the telecommunication industry, with public mobile wireless networks operators, broadcasting companies, transmitting and communications service providers, companies with private networks, small and medium enterprise companies which design, install and maintain wireless systems, with government administration on frequency planning, regulations and radio spectrum monitoring, in education and research.

▼ Second cycle study program - Computing

The principal object of study in Computing is the computer as a universal data processing machine, together with the methods of its application in diverse areas. The holistic approach to hardware, software, and hardware-software dependencies is used. Computing encompasses the theory, methods of analysis and synthesis, design and construction, application and operation of computer systems. This second cycle study program enables a student to acquire the competencies to solve difficult engineering problems, to design complex systems, to act as a leader of a team and to conduct research and development in one of three profiles. Within the study program Computing, a student immediately decides for a profile. The profile determines the list of theoretical and specialization courses to choose from.

Software Engineering and Information Systems is a profile where the software development is studied in a systematic, controllable and efficient way. The program focuses on the analysis and evaluation, specification, design and development of software products. Students will learn about project management, quality assurance processes and standardization. They will be encouraged to work in teams and to express their creativity. Information systems are focused on using computer hardware, communication and software technology to fulfil the needs of information and to advance almost every aspect of human activities. Technical, mathematical and other interdisciplinary knowledge is applied to analysis and restructuring of systems that include a human being as a user and a key subject. Such systems might be business systems, production or governmental systems. Complex software systems are designed, developed and implemented to serve as the basis of all the activities within the enterprises and to enhance their competitiveness.

Computer Engineering program embodies research, design and implementation of computers, computer systems and related software. It includes in-depth knowledge of theory and practical aspects of the design and implementation of computers, computer based systems, mobile and embedded devices/computers, communication systems and other systems that incorporate computers as well as software design with emphasis on applications that require knowledge of the complete system. Computer engineering program provides system based approach to the design of computers, communication system and software as a whole. This program offers core, advanced and forefront knowledge required to creatively envision, conceptualize and design innovative, from simple to complex computers, computer based systems and applications running on those platforms.

Computer Science is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society. Computer science has scientific and mathematical, as well as practical, dimensions integrated into a distinct program study. Understanding of this integration transcends the implementation details of various components to encompass an appreciation for the complex structure of computer systems and their predictive behaviour. Computer science gives student competences for the most challenging tasks, from the infrastructural system programming to new application domains, as well as practical skills needed by the potential leaders of a group of programmers guiding them towards the most advanced problem solving paradigms.

3.3. Postgraduate study programs

Postgraduate studies at the Faculty of Electrical Engineering and Computing are organized as doctoral study and specialist studies.

Postgraduate doctoral study leads to Ph.D. academic degree in the scientific field of Electrical Engineering and the scientific field of Computing. The study is open to applicants who have com-

pleted graduate study (Dipl.-Ing. or M.Sc.) study at the Faculty of Electrical Engineering and Computing, or other electrical engineering and/or computing studies, with excellent or very good marks. The field and branch of graduate study do not limit these applicants in choosing the field of postgraduate study. Applicants will be expected to acquire additional knowledge on their own, if necessary. Applicants who have graduated at another relevant study with excellent or very good marks will be required to pass differential exams. Other university graduate studies relevant for admission to the postgraduate doctoral study are mathematics, physics and informatics.

Every applicant designs his/her programme of study by choosing the number of courses as determined by the postgraduate study plan. The mentor appointed to student should endorse the student's selection of courses. The final choice of courses and the appointment of supervisor are approved by the Faculty Council. The students complete postgraduate study by preparing and defending Ph.D. thesis.

By the academic year 2012/2013, 2283 candidates were awarded the Master of Science degree and 775 were awarded the Doctor of Science degree. Former Master of Science study that has been closed in the academic year 2004/2005, is in the academic year 2008/2009 replaced by the new second cycle study programs leading to the Master degree.

In the academic year 2006/2007 postgraduate specialist study in Transformers has been introduced. The essential of this study is the education of specialists for transformer production and usage in order to improve research, development, design, production and usage of transformers by inclusion of latest findings from different transformer-related areas.

In the academic year 2009/2010 multidisciplinary postgraduate specialist study in Electronic Communications Regulation has been introduced. Besides Faculty of Electrical Engineering and Computing of the University of Zagreb as hosting institution, in lectures/courses participates Faculty of Economics and Business and Faculty of Law of the University of Zagreb. The aim of the study is to gain knowledge related to economic, law and technical aspects of electronic communications regulation and to gain skills for applying regulatory framework and solving regulatory problems on the electronic communications market.

In the academic year 2010/2011 postgraduate specialist study in Information Security has been introduced. The objective of the study is to enable

students to gain knowledge in analytical methods and improve their technical and management skills in order to become leading experts in the field of information system security in business and government sector. The acquired knowledge and skills are comparable to those in internationally acknowledged standards in the field of education, research, project management and best practices in the area of information security.

In the academic year 2011/2012 postgraduate specialist study in Electrical Engineering Systems in Railways has been introduced. Competences that the student acquires are the familiarity with recent accomplishments related to the railway electrical systems and their application in development, project, production and use of electrical railways. Students will adopt knowledge and skills about electrical track vehicles and subsystems in locomotives and electrical trains, railway electrical system and railway safety-signalling and communication systems.

Number of postgraduate students by academic year:

	2011/2012	2012/2013
Ph.D. study - students	218	143
Ph.D. study - degree awarded	28	42
M.Sc. study - degree awarded	107	0
Specialist study in transformers - students	42	19
Specialist in transformers - degree awarded	4	4
Multidisciplinary postgraduate specialist study in electronic communications regulation - students	24	23
Multidisciplinary postgraduate specialist study in electronic communications regulation - degree awarded	3	7
Specialist study in information security - students	26	19
Specialist study in information security - degree awarded	0	1
Specialist study in electrical engineering systems in railways - students	24	21

STUDY PROGRAMS

3

4. Student Activities

SPORT ACTIVITIES

Among the faculties of the University of Zagreb, FER is traditionally recognised for its sporting tradition. FER promotes student sport, by providing facilities for sport and physical recreation and financial resources for both sport courses and competition teams. Whether they want to compete seriously or just for fun, bond in a team or work on their individual health and fitness goals, students have a wide range of sporting activities at their disposal. There are teams, tournaments and competitions at different skill levels, from student clubs to inter-university teams and the best athletes get the chance to represent the University of Zagreb in the international tournaments.

Every season FER participates in *Zagreb University Championship* where student teams from 33 different faculties of the University of Zagreb compete in 19 different sports. In 2011/2012 season FER took 1st place in cross country running (m), volleyball (m) and beach volleyball (w), 2nd place in futsal (m) and tennis (m) and 3rd place in table-tennis (m), badminton (m) and swimming (m). In the overall men's ranking FER took 2nd place. In 2012/2013 season FER took 1st place in cross country running (m), 2nd place in volleyball (m) and 3rd place in badminton (m) and squash (m). In the overall men's ranking FER took 3rd place.

FER also encourages and supports participation of its competition teams in international sport tournaments. In 2011/2012 season our athletes represented FER at *52nd International Electrical Engineering Students Gatherings - Elektrijada 2012* which was held in Kranevo, Bulgaria. In the multi-sport tournament at *Elektrijada 2012* FER took 1st place in the overall ranking. Our athletes won gold medals in chess and basketball (w), silver medals in basketball (m), volleyball (w), cross country running (m) and futsal (m) and bronze medals in handball (m) and futsal (w). In 2012/2013 season our athletes represented FER at two international sport tournaments: *53rd International Electrical Engineering Students Gatherings - Elektrijada 2013* which was held in Siofok, Hungary and *EuroBelgrade* which was held in Belgrade, Serbia. In the multi-sport tournament at the *Elektrijada 2013* FER again took 1st place in the overall ranking. Our athletes won gold

medals in cross country running (m), futsal (m), futsal (w), handball (m) and rowing (m), silver medals in basketball (w), table tennis (w), table tennis (m) and rowing (w) and bronze medals in chess and basketball (m). At the *EuroBelgrade* our athletes won silver medal in futsal (m) and bronze medal in waterpolo (m).

In 2011/2012 season our best athlete in beach volleyball represented the University of Zagreb at the *1st European Universities Games* which were held in Cordoba, Spain. In 2012/2013 season our best athlete in karate represented the University of Zagreb at the *6th European Universities Karate Championship* which was held in Budapest, Hungary. The same season our student Zvonimir Hölbling competed at the *2013 Mediterranean Games* (Mersin, Turkey) and won gold medal in men's doubles tournament making a historic success for Croatian badminton.

STUDENT UNION

Student union is a student association, elected by all students on Faculty, which protect students' interests, participate in Faculty boards and council work and represent students in high education system.

Union count 31 members of students on bachelor, master and postgraduate program. In the last period Student union organized tribunes, discussion groups and other events which help students to process important administrative information.

In 2011 Student Union founded *Science and Sport Competitions Committee (SSCC)* whose members are representatives of FER's student as-

sociations (BEST, EESTEC, eSTUDENT, SS FER, SUBOS), FER's Student council and FER's employees. The main goals of SSCC are:

- organization and administration of student sport and science competitions and their promotion in the Republic of Croatia and abroad
- organization and support of FER's students participation in science and sport competitions
- connecting FER to other higher education institutions in the Republic of Croatia and abroad through sports and science activities

Since its establishment, the Committee has successfully organized FER's students' attendance at the following international competitions: Eurkonostantia 2011 (Konstanz, Germany), EuroBelgrade 2011 (Belgrade, Serbia), Elektrijada 2012 (Kranevo, Bulgaria), EuroBelgrade 2012 (Belgrade, Serbia) and Elektrijada 2013 (Siofok, Hungary) where our students achieved outstanding results!

By organizing the general knowledge quiz and rowing competition, SSCC has also participated in the organization of *53rd International Electrical Engineering Students Gatherings - Elektrijada 2013*. *Elektrijada* is an international university competition among electrical engineering students in which students from Europe have successfully competed for the past fifty years. Every year thousand students from Croatia, Slovenia, Bosnia and Herzegovina, Poland, Czech Republic, Slovakia, Bulgaria, Serbia, Romania, Macedonia and Montenegro attends the *Elektrijada*. Due to the outstanding number of electrical engineering students, this is the biggest competition of its kind in the Europe. Students compete in science and sports, in teams and individually, to maximize their college's total score. Elektrijada's goal is to point out the best future engineers through the science competitions and to popularize university sport and encourage socialization and exchange

of experience among the students through the sport competitions.

In 2011/2012 season FER took 2nd place in science competition ranking, 1st place in sport competition ranking and 2nd place in the overall ranking. In 2012/2013 season FER took 1st place in science competition ranking, 1st place in sport competition ranking and 1st place in the overall ranking.

Presidents: 2012/2013 – Marko Gulin, M.Sc.
2013/2014 – Marko Gulin, M.Sc.

SS FER

SS FER is a voluntary student union consisting mainly of students from the Faculty of Electrical Engineering and Computing of the University of Zagreb, and its goal is organizing students' free time in a creative and educational manner. During past years, SS FER was involved in many different projects, workshops and events for the student community.

One of SS FER's main projects is the Club for Students of Electrical Engineering (KSET). Members of this club work intensively on promoting underground and urban culture and have hosted different kinds of artists from many different areas, such as music, theatre and photography, from around the world as well as from Croatia. The club is mostly famous for its concert program with around 100 concerts per year and 30 disco listening sessions. Also, in the past couple of years the club has hosted an impressive amount of festivals and organized many workshops and job fairs. Last "JobFair" was a two day event in May 2013. Through presentations by over 15 participants (mostly IT companies), a large number of students got information on job opportunities, possibilities of starting their own business or proceeding their education in scientific research. JobFair 2013 also got the support of the Croatian

Chamber of Economy and Croatian Employers' Association.

SS FER tries hard to provide students with some educational courses and workshops. Regarding sound management, the union organizes two courses annually: the Course on sound equipment and stage setup and Sound engineering workshop dealing with sound setup and operating the sound mixers.

Members of the photo section have also been organizing their photo course for years, since 2006, when the staff from the Faculty of Electrical Engineering and Computing of the University of Zagreb recognized the quality of their work and turned the course into a class offered to FER's students. Class held on FER called Photography course, which covers fundamentals of analogue and digital photography. Duration of the course is one semester. In the end students prepare their own exhibition that's held in KSET gallery. Photo section is organizing Digital photography workshop several times a year. Also, all active members host their own photography exhibitions which take place in KSET regularly.

Members of the Technical section organized several courses About Proper Use of Tools, with great emphasis on safety at work, open for all members of the SS FER. In wake of teaching our members how to use tools, we also created few worthy projects, such as Electronic Lock used on the doors of the Technical Section, and also our invaluable tools for etching printed circuit boards, a light source created on a basis of a standalone A4 format scanning machine, and a bathtub with etching solution flow control and temperature control.

The computing section is actively working on popularizing open source technologies and operating systems through two courses available to FER's students: Basic Use of Linux Operating System and Advanced Use of Linux Operating System. The members also maintain and upgrade the club's network and web system, gathering valuable hardware and software skills. It's an ideal "playground" where all interested members can study and implement less known, as well as standard technologies in networking, web development and system administration. The section also organizes a biannual Linux Installfest and holds many internal programming/networking courses, where older members talk and demonstrate the technologies that are actively used in the real world to the rest of the section, providing an invaluable insight in the current state of the industry.

Members of KSETs Video section are engaged in video production, from documenting KSETs rich live music program to filming creative and original videos and movies. Video section also filmed and documented various other projects, like Elektrijada2013, an international university competition among electrical engineering students in science

and sport.Much attention is given to amateur creativity and constant education of section members. Whole spectre of filming and production is covered with various projects, from idea, screenplay, editing and placement of the final product.

In conclusion we would just like to point out that we try as hard as possible to provide an entertaining, as well as an educational environment in science and art, and that any student interested in helping our cause is more than welcome to join.

IEEE

The IEEE is a non-profit organisation and the world's leading professional association for the advancement of technology. The IEEE name was originally an acronym for the Institute of Electrical and Electronics Engineers, Inc. Today, the organisation's scope of interest has expanded into so many related fields, that it is simply referred to by the letters I-E-E-E (pronounced Eye-triple-E). In 2009, IEEE celebrated its 125th Anniversary. To foster an interest in the engineering profession, the IEEE also serves student members in colleges and universities around the world.

The IEEE has:
- more than 425,000 members, including 116,000 students, in over 160 countries,
- over 330 sections in ten geographic regions worldwide,
- about 2,200 chapters that unite local members with similar technical interests,
- more than 2,300 student branches at colleges and universities in 80 countries,
- 45 societies and technical councils representing the wide range of technical interests,
- more than 1,300 conferences worldwide each year,
- more than 1,400 standards and projects under development

IEEE Student Branch at the University of Zagreb was founded in 1994 at the Faculty of Electrical Engineering and Computing. Currently it counts over 220 members. Student Branch office is located in the basement of the Faculty's C building.

Following IEEE's goal to advance global prosperity by fostering technological innovation, IEEE Student Branch Zagreb finds its mission to create a consciousness about possibilities in making careers in technology. IEEE Student Branch Zagreb is taking various activities to assure metamorphosis of a student into a qualified expert with a promising career.

Becoming a member, student gets combination of various resources for work, and an opportunity to network with colleagues and at the same time acquiring skills to participate on knowledge market. Students are being profiled as superior individuals with experience on different projects. We provide this seemingly small but significant advantage which can be major turnover in achieving personal goals.

One of the prime goals of the IEEE Student Branch Zagreb is creating and promoting a professional environment among students of electrical engineering, electronics, computer science and information science and nurturing friendships among students of these technical sectors. The Branch serves as a communication channel among students and employees at the University of Zagreb, and provides information vital to the future career of a student. The Branch promotes linking with the world of pro-

fessional technology within and outside institutions in which they are studying.

Since we are one of almost 2,200 IEEE student branches worldwide, we can say we are really promoting the global community of knowledge. Student Branch Zagreb has close and friendly relationships with many student branches around Europe and even some common projects.

To see what we have done so far, we are inviting you to visit www.ieee.hr/ieee. A short list of successfully completed projects is provided hereafter:

- numerous lectures (several Emotional Intelligence Seminars, series of Public Speech Workshops, Learning How to Learn, How to Develop New Products and Become an Entrepreneur, Scientific Research and Student Practice in EDF R&D...);
- participation at the IEEE Region 8 Student Branch and GOLD Congress 2012 in Madrid, Spain and at the IEEE Central European Student Branch Congress 2013 in Opole, Poland;
- connecting students with their first job by exchanging contacts and information about job offers through our portal and by organising the Styrian Job-Recruiting Day Croatia, in collaboration with other student organisations;
- organisation of several Student Transition and Elevation Partnership workshops and IEEE Elevate lectures in collaboration with the Croatia Section GOLD affinity group;
- organisation of the Croatian Student Branch and GOLD Congress in 2013 in the collaboration with the Croatia Section GOLD affinity group;
- organisation of movie nights (scientific movies) and annual IEEE Day;
- company visits and trips to National Energy Dispatch Centre, Hydro Power Plant Sklope, Nikola Tesla Memorial Centre, Institute for Nuclear Technology, Wind Farm Crno Brdo;
- participation in the 24h global programming challenge IEEEXtreme each year;
- actively helping IEEE Croatia Section in numerous activities such as Eurocon 2013 conference, Milestone event, traditional annual Gala Dinner.

eSTUDENT

eSTUDENT is one of the biggest and most active student associations in Croatia with over 400 members and more than 5000 project participants. Members of eSTUDENT are bright and ambitious students with interest in fields of social, formal and applied sciences. During the academic years 2011/2012 and 2012/2013, eSTUDENT organized more than 15 project competitions, dozens of lectures and workshops and cooperated with more than 50 renowned firms and organizations.

eSTUDENT's mission is to gather and network best students and offer them theoretical knowledge and practical skills through various projects, lectures and workshops in order to develop students' leadership abilities and encourage them to take a significant role in modern society. Furthermore, one of the most important goals of eSTUDENT is to connect its members with significant employers and help them find internships or jobs in their specific field of interest.

App Start Contest

App Start Contest is an educational student competition in which student teams make projects – program solutions for popular platforms of mobile devices. The contest was founded in 2007 on the Faculty of Electrical Engineering and Computing as Web Start Contest, a student competition in developing program solutions for the Web. In 2011/2012 the project changed its name into App Start Contest and started focusing on the mobile computing market.

Contest goals:

- Encouraging students to begin or continue to learn and develop software solutions for mobile platforms iOS, Android and Windows Phone;
- Educating students on how to start their own mobile startup business through lectures, workshops and mentoring and leading them through the whole development cycle of an IT-project;
- Connecting successful and talented students with the partner companies of the project;
- Enabling students to present their projects to potential investors.

Project in numbers:

- Almost 300 students from over 30 different faculties from Croatia participated;
- 89 teams applied, 21 of them were chosen in the semi-finals and 12 in the finals;

- The project had support from 13 partners from different fields (telecommunications, IT-solutions development);
- The total prize pool of 13,000 €;
- Over 850 interessants in this field is subscribed to the newsletter App Start Contest and over 1300 interessants follow it over the Facebook channel.

The organization team of the App Start Contest 2012 was awarded a special Rector's award and the project received official support from the Office of the President of the Republic of Croatia, as one of the most important projects in the student community.

Elektroboj

Elektroboj is an educational student competition in developing electronic circuits and program solutions for popular electronic platforms. The competition was founded with the intention of enabling and encouraging students to develop real circuits and devices by giving them professional and financial assistance. It was initiated and introduced at the Faculty of Electrical Engineering and Computing in the academic year 2012/2013 through several lectures and workshops. The competition will be held in 2013/2014 for the first time.

ŠUZA

eSTUDENT is one of the partners of the popularization of science program "ŠUZA – from school to science and the academic community". This is the new official popularization of science program of the University of Zagreb Faculty of Electrical Engineering and Computing. The main idea behind this program is to encourage young people to pursue a career in science. Through visits to schools, educational workshops for teachers and events at the Faculty their interest in STEM (Science, Technology, Engineering and Mathematics) fields is encouraged. The first activities of the Program were held in early 2013.

Lectures and workshops

eSTUDENT's FER branch organized a large number of lectures and workshops for students with academic and cultural content:

- "HR Conference" - a series of lectures and workshops held by human resources experts from several renowned companies, with the goal of preparing students for the job-finding process
- "The making of Serious Sam" - a lecture held by Croteam, the developers of one of the most popular video game series in the world
- "U better get that job!" - a series of workshops about employment
- "Half-month of culture" - a series of lectures by prominent artists, actors and sportsmen, held to uplift and fulfil the cultural sensitivities of students
- "How To Get What You Want: Lessons From Political Communication" - a lecture by Sam Potolicchio (Harvard and Georgetown University) about leadership and motivation

- A number of workshops for developing soft-skills (presentation skills, time management, interview behaviour, communication, CV writing and similar)
- "MULTIstudent" - a series of lectures about different professions and areas of expertise, with the aim encouraging interdisciplinary approaches among students

BEST

Board of European Students of Technology (BEST) is a student organisation present in over 30 countries in Europe, in almost 100 universities, and consists of over 4000 members who form an innovative, growing and powerful student network.

Local BEST group Zagreb was founded in 1999 and has evolved into a recognized and well respected student organisation with a solid base of 50 members, from various technical faculties, and an alumnae network consisting of 200 engineers. Our goals include providing students with complementary education, helping them connect with their future employers as well as raising awareness on important educational issues. We strive to help students to become more internationally involved through academic and non academic courses held across Europe.

During the last two years, BEST Zagreb organised over a dozen projects and hosted hundreds of foreign students in Zagreb. In the same time we have enabled over 100 Croatian students to attend

BEST engineering courses all over Europe, and over 100 programming students to attend our programming competition. We would like to point out some of our projects:

BEST Engineering Days - A four day event that gathers top companies in Croatia and local students with technical background. By informing themselves at the stands set up on the Faculty of Electrical Engineering and Computing in Zagreb, students can learn necessary information about the companies through promotional materials or through direct contact with company employees, getting from them solid and reliable answers to questions and useful advice. Also, through workshops and trainings, students learn how to write quality CVs for job applications, scholarships and competitions. Knowing the importance of proper etiquette in a business environment, we also hold trainings on communication with employers, professors and colleagues.

Local Engineering Competitions - There are two categories of competition during the Engineering days, in which we want to motivate students to utilise their skills and knowledge: Case Study, where they have to find a solution for a real technical problem, and Team Design, where they have to design a physical prototype of a given device. Students are divided into four member teams, and given one day for each task. Through these competitions, we both promote and develop teamwork in students which they will benefit from later, in a working environment. The winners of the competition go on to compete in regional and European BEST competitions, and we were the hosts for the 2012. European BEST Engineering Competition Final, where we hosted 100 engineering students who competed in this event.

BEST Engineering Course – an academic course lasting from between one and two weeks with 20-30 participants from all over Europe, and 20-30 participants from Croatia. The academic part covers a hot topic in engineering and is taught by local professors, for which all attendees are granted 1 ECTS point in their respective universities. In the past two years we have organised two courses, one on water technology and the other on sustainable energy, and we are preparing for another course in May, with the topic of materials. Apart from the academic part, participants were introduced to Croatian culture and natural heritage. Our courses are held at the Faculty of Electrical Engineering and Computing.

Cultural Exchanges and Regional Meetings – Cultural Exchanges are leisure events where two local BEST groups from Europe meet and experience other cultures, peoples and traditions. In the last 15 years we had almost a dozen cultural exchanges, with BEST groups from Russia, Italy, France, Spain, and so on. The Regional Meetings are organised between all local BEST groups from one region to learn from each other and where more experienced members transfer their knowledge to newer BEST members. BEST Zagreb organised a Regional Meeting in autumn 2011, where we hosted over 60 BEST members from 7 regional countries.

Best Code Challenge - a computing competition in today's most popular programming languages. Participants are students from University of Zagreb and beyond, and they are solving the given task from their homes in a two-week period. The main objective is to connect students with universities and companies. This project gathers all the best student programmers and companies, and it also promotes computer science between students.

EESTEC LC Zagreb

EESTEC (Electrical engineering students' association) is a non-political, non-profit organization of and for Electrical Engineering and Computer Science (EECS) students at universities, institutes and technical schools in Europe awarding an engineering degree. EESTEC has more than 3000 members in 28 European countries. The aim is to promote and develop international contacts and the exchange of ideas among the students of EECS. The association achieves its aim through improving technical knowledge of EECS students, introducing them to the industry and the educational system of other countries.

EESTEC LC (local committee) Zagreb was founded in 2007. Since then, this LC has organised 7 international workshops and **Android Competition "it's APP to you!"** in 2012 and 2013.

"Risky Business" (May 2012) - An international workshop during which the participants were taught about the principles of risk management. Through lectures and exercises, professors from the Faculty of Electrical Engineering and Computing in Zagreb and visiting lecturers educated participants about the risk management methods, strategies to manage threats and creating a risk management plan. Participants were involved in interactive exercises, and at the end of the lectures they tested their knowledge about the risk management through a short exam.

"Back in Time" (May 2013) - An international workshop during which the differences between the technologies used in the past and present were presented to the participants. Through lectures and exercises, professors from the Faculty of Electrical Engineering and Computing in Zagreb educated participants about the old principles of automatics, programming, power engineering and wireless technology, while associates and sponsors from the industry and business area presented the latest achievements of new technologies through interactive exercises.

LC Zagreb also organizes events at the local level. We have organized motivational team building weekends for our members (eco-village Gradunje in 2012 and 2013) and humanitarian fundraising event "Sweeten your day and fulfil someone's Christmas dream" (December 2011 and December 2012 with BEST). For more information please visit www.eestec-zg.hr

SUPEUS

SUPEUS (Student Organization for Promoting Energy Efficient and Sustainable Systems and Consulting) is a student organization that gathers students from eight different faculties of the University of Zagreb. We are promoting energy efficient systems, sustainable construction and renewable energy sources. Main activities through which this is done are seminars, quizzes, case studies and other informative and educational programs, aiming to connect students, universities and companies to brainstorm and work together. Our goal is to push the students forward and arm ourselves with ideas and then work on the realization of the best among them to finally improve the quality of our life and to

preserve our natural resources. SUPEUS was found-ed on 1st March, 2011, when the first meeting of the four founders was held. On 27th September, 2011, the organization started with its work, after registra-tion and establishing the statute. SUPEUS is now led by a group of ambitious students. Apart from stu-dents from technical faculties (The Faculty of Archi-tecture, Civil Engineering, Energy Engineering and Computing, Mechanical Engineering), students from The Faculty of Science –Environmental Science and The Faculty of Economics and Business are also involved in organization work. Over almost three years, SUPEUS, counting 60 members now, has successfully prepared several projects. Each project found approval from students, teachers and compa-nies. An example of such project is *SUPEUS Case Study*. Up to now we organized three *Case Stud-ies*, making it more interesting every year by using our previous experience. The concept of the *Case Study* is simple. Students are divided in teams and faced with real problems that they can come across later in their career. To be the ones who will offer the best solution and win the main prize, students need to work together, have a base theoretical back-ground in several fields, be savvy, fast and creative. In March, 2013. we released the first SUPEUS' mag-azine called *SUMA*. We consider *SUMA* as our big-gest project, since it combines all our activities and events and gives a summary of all current projects and plans for SUPEUS in future and other happen-ings in Croatia and world in energy field. *SUMA* was also a great opportunity for all students that wanted to publish papers and projects they have worked on during their studies, regardless of the membership in SUPEUS. We are preparing new articles on inter-esting subjects that we haven't presented in the first magazine, but the main topic being an analysis of possible employment of young engineers in Croatia, experiences and recommendations of companies, professors, former students and SUPEUS members who will witness how being a member of SUPEUS helped them in making connections that helped in

finding their jobs. It may not seem grand but we firmly believe in raising public awareness on certain issues and informing the students on recent scien-tific breakthroughs and current events that concern our work. An example of such a gathering that we organized would be our seminars on *"The future of comfortable living"* which without a doubt attracted a lot of attention and analyzed on of the most interest-ing and current topics of science today and also ap-pealed to a wider audience that exceeded the tech-nical enthusiasts and super-exceeded our expecta-tions. Two years in a row, *"The future of comfortable living"* brought together more than 400 students from 10 different faculties. In nearly all-day lectures by eminent experts in the fields of energy efficiency, re-newable energy and sustainable building, students were given an insight into the most important and most critical issues in these areas. Additionally, apart from the big projects, members expand their knowl-edge by attending internal seminars. Since internal seminars do not require special preparation, many of them were held. We are now proud of the strong support of the academic and business society that we gained. We can now say that we have partner companies that support us financially and offer part-time student jobs in fields of our studies SUPEUS is happy to find more ambitious students who have the will to expand their education in the way we also find interesting.

SUBOS

Croatian Academic Sport Association SUBOS is a voluntary student organization active on FER. Organization gathers students from all faculties of University of Zagreb. SUBOS is established in 2004 by three FER students and it become undisputedly most popular student sport organization in Republic of Croatia. In ten years, more than 3,000 students were active in this association. SUBOS organizes

practices in 10 different sports, team buildings, student parties, charity projects, summer and winter extreme weekends in the nature and other social and sport events focused toward students. In academic year 2011/2012 and 2012/2013 some of the major achievements in SUBOS were:

1. 30 training classes each week, ten months a year

2. Around 34,800 student/hour/trainings per year

3. Three new recreational classes were introduced

4. SUBOS bicycle team travel around whole Croatia on bicycles in 7 days, from Vukovar, over Zagreb to Dubrovnik

5. Three charity projects were successfully achieved (financial donations, blood donations and participation in bone marrow donation project)

6. Two summer extreme sport event were organized - three days of kayaking in Adriatic sea for 60 students

7. One winter extreme sport event was organized - three day mountaineering on Velebit for 110 students

8. Seven SUBOS parties were organized

9. Cooperation with professional rugby club Lokomotiva is established

10. Participation in organizing official championship of University of Zagreb

MISSION

Promotion of sport in academic society. Encouraging young people on healthy lifestyle. Promotion of excellence. Networking.

VISION

To be a first choice of students in University of Zagreb in terms of recreational sport activities and friendship.

5.
Departments

5.1. Department of Applied Physics

Faculty and Staff

▼ Professors

Dubravko Horvat – gravitation, cosmology and elementary particle structures and symmetries

Tomislav Petković – nuclear and experimental hypernuclear physics; philosophy and history of science and technology

Dubravko Pevec – reactor physics, nuclear engineering

Founded in 1945

Head of Department:
Asst. Prof. **Sanda Pleslić**, Ph.D.

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5.1.
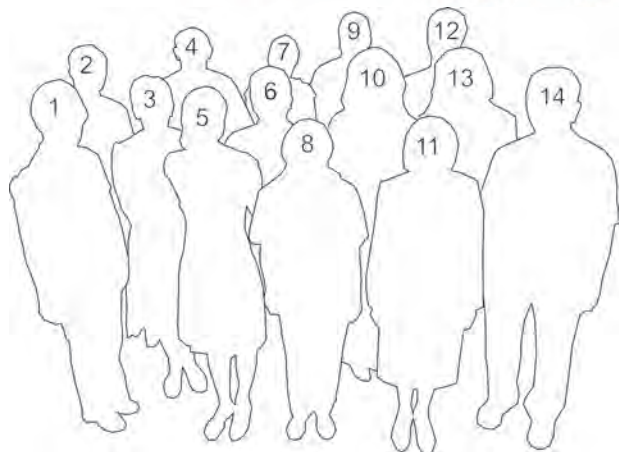
1 Snježana Božić   2 Vjeran Gomzi

3 Vesna Popović   4 Dubravko Pevec

5 Ana Holjak   6 Radomir Ječmenica

7 Anja Marunović   8 Danijela Grozdanić

9 Mario Matijević   10 Vesna Borjanović

11 Lahorija Bistričić   12 Saša Ilijić

13 Sanda Pleslić   14 Tomislav Petković

Associate Professors

Lahorija Bistričić – molecular and laser physics, spectroscopy of nanohybrid polymers

Vesna Borjanović – experimental solid state physics; investigations of nanostructured materials (quantum dots, nanorods, hybrid materials)

Assistant Professors

Saša Ilijić – high energy physics: gravitation and cosmology; stochastic dynamics of complex systems

Zoran Narančić – elementary particle structures and symmetries

Sanda Pleslić – atomic and plasma physics, material science, knowledge management

Krešimir Trontl – nuclear engineering, renewable energy sources, programming

Retired Professors

Vladimir Knapp – nuclear physics and engineering

Višnja Henč-Bartolić – atomic physics, lasers

Mile Baće – nuclear engineering and non-conventional energy sources

Senior Assistants

Anja Marunović

Mario Matijević

Affiliates

Danijela Grozdanić

Radomir Ječmenica

Administrative Staff

Ana Holjak

Snježana Božić

Laboratory Support

Vjeran Gomzi

First Cycle Study

▼ Mandatory Courses

- Physics 1
- Physics 2

▼ Elective Courses

- Computing Methods of Modern Physics
- Modern Methods of Physics for Electrical Engineering and Information Technology

▼ Courses for Advanced Students

- Electromechanics
- Modern Physics and Applications in Electrical Engineering

Second Cycle Study

▼ Mathematics and Science

- Fundamentals of Nuclear Physics
- Fundamentals of Plasma Physics
- Introduction to Nanoscience
- Laser Physics
- Physics of Materials
- Quantum Computers

▼ Recommended Elective Courses

- Materials in Electrical Products
- Radiation Effects and Radiation Protection

▼ Humanistic or Social Courses

- Introduction to Knowledge Management

▼ Specialization Courses

- Nuclear Fuel Cycles and Reactor Materials
- Renewable Resources and Advanced Technology

Postgraduate Doctoral Study

- Detectors and electronic instrumentation for particle physics
- Experimental techniques of nano- and materials sciences
- Laser physics and electro-optics
- New Energy Sources

Educational Activities

Lectures in general and modern physics: General physics and introduction to quantum mechanics. Electrical, optical, and magnetic properties of materials. Laser physics. Principles and applications of superconductivity. Introductory nano science, nuclear physics and plasma physics. Nuclear instrumentation and detectors for particles and radiation.

Lectures on the physical basis of new energy technologies. Selected topics in energy physics. Interactions and detection of nuclear radiation. Shielding and radiation protection. Nuclear fuel cycles and materials. Nuclear safety and regulation. New energy sources. Energy conversion and storage.

Introduction to theory and application of knowledge management for engineers.

- Nuclear Reactor Theory
- Pulsed plasma physics with applications
- Quantum mechanics - Selected Topics
- Selected Topics in Nuclear Physics and Nuclear Engineering

Research and Development

Gravitational physics: classical and quantum physics of gravitational field. Physics of compact structures: black holes, gravastars, neutron stars, quark and strange stars. Cosmological perturbations and stochastic inflation.

Modelling of advanced, inherently safe nuclear power reactors; Optimal fuel management of the standard PWR reactor; Advanced fuel cycles and long term nuclear energy strategies; Radiation shielding; Renewable energy resources and applications.

In the field of hypernuclear physics, a sophisticated experiment with a newly developed high-resolution kaon spectrometer and a scattered electron spectrometer with a novel configuration was performed in the Hall C at Jefferson Lab. The ground state of a neutron-rich hypernucleus, 7He-lambda, was observed for the first time with the (e, e'K$^+$) reaction with an energy resolution of about 0.6 MeV and published in Phys. Rev. Lett. **110** (2013). The resolution used is the best reported to date for hypernuclear reaction spectroscopy. Professor Tomislav Petković proposed

and co-organised with scholars of Greece, Romania, Serbia and Slovenia the symposium on R J Boscovich (code number S091), as the part of the great history of science, technology and medicine event of the 24th ICHSTM in Manchester, July 21-28, 2013. The symposium "The achievements of R J Bošković in the philosophy of nature, astronomy, technique and culture: historical resources and contemporary epistemic reflections" has assessed that Bošković is one of the best example of the European figures of science and culture in modern epoch, and coincides with accession of Croatia to the European Union on 1 July 2013. T. Petković presented the talk entitled as: "Bošković's achievements in natural philosophy in relation the development of modern particle physics". The project was supported by FER and Ministry of Culture of the Republic of Croatia.

In popular Croatian journal "Čovjek i svemir / Human and Universe", the same author published two epistemic essays in 2013. The first on the discovery of the Higgs boson at the LHC and Tevatron, and second on the Bohr's atomic model on the occasion of one hundred years anniversary of the Bohr's discovery, respectively.

Study of structure and vibrational dynamics of molecular systems (crystals, polymer films, nanohybrids) with application in different fields such as optoelectronics, shape-memory materials, conducting polymers and biotechnology.

Investigation of the new materials, with desired properties: nanostructured materials, quantum dots,

nanorods, and hybrid materials. Characterization of the material with different experimental techniques and developing the device structures based on new nano-materials.

Properties of laser-produced plasma from different materials have been investigated and compared. Plasma radiation produced by ablative capillary discharge has been investigated as a radiation source for EUV lithography. Polyvinylchloride with additives and polyacetal were used as materials for capillary production. Optimisation of working conditions was also performed.

Knowledge management as a hybrid discipline was investigated.

Study of structural and electronic properties of low dimensional systems: surfaces and ultra thin metallic films by scanning tunnelling microscopy (STM) and photoemission spectroscopy.

The investigation of structural changes occurring in thin amorphous silicon during thermal treatments by EPR, GIXRD and GISAXS.

▼ Projects

Classical and Quantum Theory of Nonlinear Fields and Structures (Project 036-0982930-3144, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Dubravko Horvat, 2007-2013)

Fuel Management of Standard and Advanced Nuclear Reactors (Project 036-0361590-1579, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Dubravko Pevec, 2007-2013)

Macrocyclic Ligands, Structural Changes of Solutions and Molecular Spectroscopy (Project 098-0982904-2927, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Goran Baranović, Institute Ruđer Bošković; Project collaborator: Lahorija Bistričić, 2007-2013)

Vibrational Dynamics and Structure of Multifunctional Polymer Systems (Project 125-1252971-2868, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Vesna Volovšek, Faculty of Chemical Engineering

and Technology, University of Zagreb; Project collaborator: Lahorija Bistričić, 2007-2013)

Ion Beam Interactions and Nanostructures (Project 098-1191005-2876, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Milko Jakšić, Institute Ruđer Bošković; Project collaborator: Vesna Borjanović, 2007-2013)

Electromagnetic Metamaterials and Nano-electromagnetics (Project 036-0361566-1571, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Silvio Hrabar, Project collaborator: Višnja Henč-Bartolić, 2007-2013)

International Links

Brookhaven National Laboratory (BNL), Upton, New York, USA

Gesellschaft für Reaktor Sicherheit (GRS), Garching, Germany

Institute of Historical Research / National Hellenic Research Foundation, Athens, Greece

International Atomic Energy Agency (IAEA), Vienna, Austria

International Centre for Theoretical Physics (ICTP), Trieste, Italy

Paul Scherer Institut, Villigen, Switzerland

Rheinland Westfallische Technische Hochschule Aachen, Aachen, Germany

Ruhr Universität Bochum, Institut für Experimentalphysik, Bochum, Germany

Thomas Jefferson National Accelerator Facility (Jefferson Lab), Newport News, Virginia, USA

Tohoku University, Department of Physics, Sendai, Japan

Universität Stuttgart, Institut für Kernenergetik und Energiesysteme, Stuttgart, Germany

University of Craiova, Faculty of Exact Sciences, Craiova, Romania

Institute for Theoretical Physics, Utrecht University, The Netherlands

Technical University of Munich (TUM), Germany

5.2. Department of Applied Mathematics

Faculty and Staff

▼ Professors

Neven Elezović – mathematical analysis

Mervan Pašić – differential equations

Mario Osvin Pavčević – combinatorial and discrete mathematics

Darko Žubrinić – nonlinear elliptic PDE-s, fractal analysis

Vesna Županović – dynamical systems

Founded in 1919

Head of Department:
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▼ Associate Professors

Andrea Aglić Aljinović – mathematical analysis

1 Ljiljana Frigelj   2 Josipa-Pina Milišić

3 Vesna Županović   4 Anamari Nakić

5 Neven Elezović   6 Ilko Brnetić

7 Luka Korkut   8 Tomislav Šikić

9 Mario Osvin Pavčević   10 Lenka Vukšić

11 Siniša Miličić   12 Lana Horvat Dmitrović

13 Mario Krnić   14 Domagoj Kovačević

15 Andrea Aglić Aljinović   16 Goran Radunović

17 Darko Žubrinić   18 Domagoj Vlah

Ilko Brnetić – mathematical analysis

Mario Krnić – mathematical analysis

▼ Assistant Professors

Lana Horvat Dmitrović – dynamical systems

Domagoj Kovačević – representation theory of Lie groups

Josipa Pina Milišić – mathematical modelling, nonlinear PDEs

Tomislav Šikić – representation theory of affine Lie algebras

Igor Velčić – theory of elasticity, nonlinear analysis

▼ Retired Professors

Davor Butković – mathematical analysis

Vladimir Ćepulić – finite groups, finite mathematics

Ivan Ivanšić – topology

Petar Javor – algebra

Luka Korkut – partial differential equations

Ljubo Marangunić – finite mathematics, mathematical analysis

▼ Senior Assistants

Tomislav Burić

Marijana Grebliči

Siniša Miličić

Anamari Nakić

Maja Resman

Domagoj Vlah

Ana Žgaljić Keko

▼ Research Assistants

Goran Radunović

Lenka Vukšić

▼ Administrative Staff

Ljiljana Frigelj

Department of Applied Mathematics is the oldest one at the Faculty of Electrical Engineering and Computing, founded in 1919. Members of the Department are working in various fields of

mathematics. Some of our past professors had been originally trained in electrical engineering. Such was the case for example with the academician Danilo Blanuša, a past dean of the Faculty, whose results concerning isometric imbeddings of hyperbolic spaces into Euclidean spaces obtained international acclaim (cited among others by John Nash), as well as his correction of Max Planck's formulae from relativistic phenomenological thermodynamics, and his graph now called Blanuša's graph or Blanuša's snark (adopted as the logo of the Croatian Mathematical Society). Above the main entrance of the Department there is a nice rectangular marble plaque with an inscription cited from Plato's school: *Medeis ageometretos eisito* (in Greek), that is, «Those who do not know geometry cannot enter». For a more detailed information about the history of the Department of Applied Mathematics you are invited to consult a survey article written by professor Ivan Ivanšić, available at the web address www.zpm.fer.hr/~darko/zavod_pov (in Croatian).

In 2009, when the Department of Applied Mathematics celebrated 90 years of existence, a new professional mathematical journal *Differential Equations and Applications* (DEA) has been successfully launched in Croatia upon the initiative of Professor Neven Elezović, managing editor of the journal. It is published at the pace of four issues yearly by the Element Publishing House in Zagreb and the Department of Applied Mathematics of the Faculty of

Electrical Engineering and Computing. Among three editors in chief of DEA is Professor Mervan Pašić, along with Professors Mats Gyllenberg from Finland and Jean-Michel Rakotoson from France. You are invited to visit the web pages of DEA at the following address: dea.ele-math.com

Educational Activities

Basic calculus. Vector analysis. Linear algebra. Differential equations. Functions of a complex variable. Fourier series. Laplace transform. Discrete mathematics. Graph theory. Numerical methods in applied mathematics. Probability and stochastic processes. Croatian and international mathematical competitions.

First Cycle Study

▼ Mandatory Courses

- Mathematics 1
- Mathematics 2
- Mathematics 3 - C
- Mathematics 3 - EE
- Probability and Statistics

- Laboratory and Skills – Maths on the computer

▼ Effective Courses

- Mathematical Modeling using Computer

▼ Courses for Advanced Students

- DisCont mathematics 1
- DisCont mathematics 2

Second Cycle Study

▼ Mathematics and Science

- Complex Analysis
- Computational Mathematics
- Differential Equations and Stability Theory
- Discrete Mathematics
- Extremal Combinatorics
- Financial Mathematics
- Fourier Analysis
- Graph Theory
- Introduction to Mathematical Chaos Theory for Engineers
- Linear Algebra

- Mathematical Logic and Computability
- Stochastic Processes

▼ Skills

- Chinese language 1
- Chinese language 2

Postgraduate Doctoral Study

- Applied Functional Analysis
- Combinatorial Algorithms
- Differential Equations and Dynamical Systems
- Discrete Stochastic Processes
- Integral and Discrete Transformations with Wavelet Theory
- Mathematical Methods in Control Theory
- Mathematics of Codes
- Nonlinear Optimization
- Stochastic Processes and Filters

Research and Development

Mathematical structures in mathematical models and numerical algorithms. Construction of combinatorial structures. Combinatorial and subspace designs with applications to coding theory. Finite geometry. Group theory. Nonlinear and quasi-linear elliptic equations. Ordinary differential equations. Dynamical systems. Fractal analysis. Inequalities in analysis and applications. Representation theory.

▼ Projects

Combinatorial designs and finite geometry (Project 036-0372785-2964, Ministry of Science, Education and Sports, Principal investigator: Mario Osvin Pavčević, 2007-2013)
Estimates of sums, integrals and integral transformations (Project 036-1170889-1054, Ministry of Science, Education and Sports, Principal investigator: Neven Elezović, 2007-2013)
Nonlinear analysis of differential equations and dynamical systems (Project 036-0361621-1291, Ministry of Science, Education and Sports, Principal investigator: Mervan Pašić, 2007-2013)
Analyse Fractale de l'application de Poincaré aux voisinages des polycycles Programme (PHC COGITO 2011 Project No. 24710UJ, Principal investigators: Vesna Županović and Pavao Mardešić, 2011-2012)

Random Network Coding and Designs over GF(q) (COST Action IC1104, European Science Foundation, vice-chair: Mario Osvin Pavčević, member: Anamari Nakić, 2012-2016)
Fractal analysis of Poincare maps, Abelian integrals and normal forms of dynamical systems, Principal investigator: Vesna Županović, 2013-)

International Links

Technical University of Vienna, Austria

Ghent University, Belgium

Hasselt University, Belgium

University of Hong Kong, China

University of Qufu, China

The University of Pau and Pays de l'Adour, France

University of Burgundy, Dijon, France

University of Pierre and Marie Curie - Paris 6, France

University of Poitiers, France

Technical University Munich, Germany

University of Bayreuth, Germany

University College Dublin, Ireland

Eshime University, Japan

Okayama University of Science, Japan

University of Gifu, Japan

University of Hiroshima, Japan

Center for Applied Mathematics and Theoretical Physics University of Maribor, Slovenia

Mathematical Department, Institute for Low Temperatures Physics and Engineering, Academy of Sciences, Kharkov, Ukraine

Taras Shevchenko National University of Kyiv, Kiev, Ukraine

American Mathematical Society, Providence, USA

California State Polytechnic University, Ponoma, USA

University of Oklahoma, Norman, USA

University of California, Riverside, USA

5.3. Department of Applied Computing

Faculty and Staff

▼ Professors

Mirta Baranović – databases, information systems, data warehousing, business intelligence, semantic web

Krešimir Fertalj – information systems, software engineering, project management

Damir Kalpić – information systems, operational research

Vedran Mornar – information systems, programming paradigms, e-learning

Founded in 2005
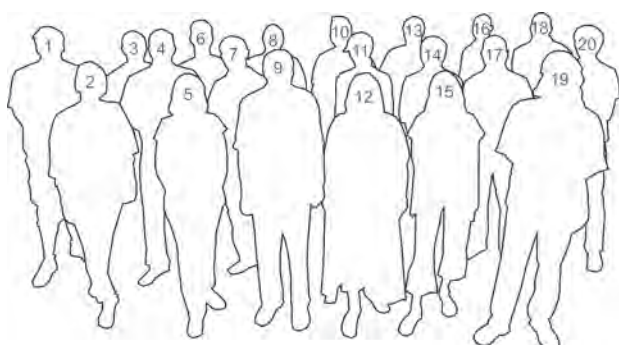
Head of Department:
Prof. **Mirta Baranović**, Ph.D.

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Web: www.zpr.fer.hr

1 Fran Tonković   2 Marija Katić
3 Boris Vrdoljak   4 Nikica Hlupić
5 Jasenka Anzil   6 Igor Mekterović
7 Krešimir Križanović   8 Ivica Botički
9 Damir Kalpić   10 Petar Djerasimović
11 Sonja Majstorović   12 Mirta Baranović
13 Tomislav Jagušt   14 Boris Milašinović
15 Ljiljana Brkić   16 Gordan Gledec
17 Tomislav Rajnović   18 Mario Brčić
19 Krešimir Fertalj   20 Nikša Stanović

Associate Professors

Gordan Gledec – networks and Internet, web technologies

Nikica Hlupić – system identification and optimization, algorithm design

Boris Vrdoljak – database systems

Assistant Professors

Ivica Botički – technology enhanced learning, mobile learning, information systems

Ljiljana Brkić – databases, information systems, business intelligence

Igor Mekterović – databases, information systems, business intelligence

Boris Milašinović – information systems, software engineering

Slaven Zakošek – database systems

Retired Professors

Marijan Đurek – computer ergonomics, computer forensics

Senior Assistants

Mirjana Domazet-Lošo

Marija Katić

Ivana Nižetić Kosović

Assistants

Jasenka Anzil

Research Assistants

Mario Brčić

Ivan Budišćak

Petar Djerasimović

Department Associates

Tomislav Jagušt

Krešimir Križanović

Danijel Mlinarić

Tomislav Rajnović

Nikša Stanović

Fran Tonković

Administrative Staff

Sonja Majstorović

Educational Activities

Programming, Software engineering, Programming paradigms and languages, Algorithms and data structures, Object-oriented programming, Object oriented design, Databases, Data Warehousing, Business Intelligence, Spatio-temporal databases, Operational research, Information systems design, Information systems security, Communication protocols, www technologies, Human factors in

computing, Electronic business, Internet security, Risk analysis, Numerical methods, System Identification and Optimization, Computer supported education, Project management.

First Cycle Study

▼ Mandatory Courses

- Algorithms and Data Structures
- Databases
- Development of Software Applications
- Programming and Software Engineering
- Programming Paradigms and Languages
- Software Design Projects

▼ Elective Courses

- Human Factors in Computing

▼ Skills

- Competitive Programming

Second Cycle Study

▼ Mandatory Courses

- Laboratory of Software Engineering and Information Systems 1
- Laboratory of Software Engineering and Information Systems 2

▼ Theoretical Courses

- Advanced Algorithms and Data Structures
- Advanced Databases
  Data Management
- Database Systems
- Development of Information Systems
- Object-oriented Design

▼ Specialization Courses

- Bioinformatics
- Business Intelligence
- E-Business Technologies
- Geospatial Databases
- Internet Security

- Operations Research
- Project Management
- Protection and Security of Information Systems

▼ Skills

- Competitive Programming

Postgraduate Doctoral Study

- Algorithms in Bioinformatics
- Application of Numerical Methods
- Communication Protocols - Selected Topics
- Computer Supported Education
- Data Warehouse Design
- Databases
- Electronic Business
- Information Systems Management
- Operational Research
- Quantitative Methods in Risk Management
- Selected Topics in WWW Technologies & Applications
- Software Development Methods and Techniques
- Spatio-temporal Databases and Data Streams
- Statistical Modelling and Identification

Research and Development

Distance learning software has been developed further, to support continuous assessment of students' knowledge. Software for student administration has been upgraded to comply with the Bologna process. Participation in control and auditing of a computerisation project aimed to establish the central server for primary health care in Croatia has been under way. Research concerning e-Education encompasses Computer supported education, Collaborative computer-supported learning, Blended learning, Mobile learning and administrative applications for courses and faculty. Genetic algorithms have been developed for menu planning. Forecasting methods were analysed and recommended for a major bank and a major retailer. Algorithms for integration testing in the data warehouse environment were developed and evaluated. Models and algorithms that address spatial distribution of biodiversity at any taxonomic rank are being developed. Software platform for processing and analysis of time-lapse movies was developed including a novel tracking algorithm and a visualization tool. Further research is performed in the area of moving objects, considering spatio-temporal analysis and development of novel positioning techniques and location-based applications. Model for dynamic evolution of aspect-oriented software and algorithms that support such an evolution have been developed.

Methods for ontology matching have been developed. A prototype of the semantic web portal, integrating semantic data from various sources, has been developed. Semantic data source, SISVU (Semantic ISVU) has been published and integrated within the Linked Data Cloud project. Consulting has started regarding establishment of customer relationship management for the major network of marinas in the Adriatic. Planning of workforce engagement is expected to begin for the major telecommunication operator.

National information system for application and enrolment to high-schools has been developed, where the data of all potential Croatian elementary school students' are gathered, as well as the criteria for the rankings for the enrolment in every high-school in the country. Students create their lists of preferences which they are able to modify during the entire process. According to those lists and the pre-set criteria, ranking lists are optimally created and students electronically enrol the appropriate high-school.

National information system for application to HEI has been developed, where general idea is similar to National information system for application and enrolment to high-schools, but which also provides complete organizational support for the State Matura, including the tracking and grading of the exams and the presentation of the exam results.

▼ Projects

Optimisation and risk management in information systems (Project 036-0361983-3137, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Damir Kalpić, 2007-2013)

Sustainable development of information systems (Project 036-0361983-2022, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Krešimir Fertalj, 2007-2013)

Semantic integration of heterogeneous data sources (Project 036-0361983-2012, Ministry of Science, Education and Sports, Republic of Croatia, Project leader: Mirta Baranović, 2007-2013)

Computer supported education (Project 036-0361983-2019, Ministry of Science, Education and Sports, Republic of Croatia, Project leader: Vedran Mornar, 2007-2013)

Geospatial Sensors and Moving Objects Databases (Project 036-0361983-2020, Ministry of Science, Education and Sports, Republic of Croatia, Project leader: Zdravko Galić, 2007-2013)

Information System for Higher Education in Croatia - ISVU (Ministry of Science, Education and Sports, Republic of Croatia, Project leader: Mirta Baranović, 2000-2011)

Research of movement of moving objects (Project 036-VIF2013-016, University of Zagreb, Principal investigator: Krešimir Fertalj, 2013-2014)

Computer supported education (Project 036-VIF2013-023, University of Zagreb, Principal investigator: Vedran Mornar, 2013-2014)

International Links

Humboldt Universität, Berlin, Germany

Information Resources Management Association (IRMA), Hershey, PA, USA

Deutsche Telekom AG, University of Applied Sciences, Leipzig, Germany

University of Mostar, Bosnia and Herzegovina

University of Tuzla, Tuzla, Bosnia and Herzegovina

National Institute of Education, Nanyang Technological University, Singapore

Chinese American Scholars Association (CASA), New York, USA

Vrije University Brussels, Belgium

Max Planck Institute for Evolutionary Biology, Plön, Germany

Purdue University, West Lafayette, IN, USA

5.4. Department of Electrical Engineering Fundamentals and Measurements

Faculty and Staff

▼ Professors

Sead Berberović – numerical field calculations, CAD

Damir Ilić – precise electromagnetic measurements, calibration of standards, virtual instruments, measurement technique
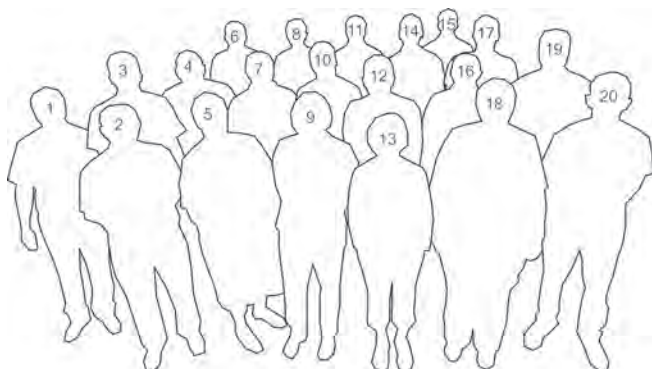
Founded in 1924

Head of Department:
Prof. **Željko Štih**, Ph.D.

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1 Sead Berberović   2 Stjepan Bobeta
3 Luka Humski   4 Zoran Skočir
5 Ruža Vukelić   6 Frano Škopljanac-Mačina
7 Mirko Randić   8 Martin Dadić
9 Jasenka Haladin   10 Petar Mostarac
11 Roman Malarić   12 Damir Jurić
13 Marija Čukelj   14 Bojan Trkulja
15 Davor Kotur   16 Željko Štih
17 Tomislav Župan   18 Sanja Ferković Živković
19 Damir Ilić   20 Ivan Leniček

Petar Knežević – telematic services, performance of computer systems

Roman Malarić – automated data acquisition systems, electromagnetic measurements, calibration of standards

Armin Pavić – EM fields measurement and protection, computer-aided learning

Zoran Skočir – database design, information system development, networked economy, electronic business

Željko Štih – computational electromagnetics, engineering management

▼ Associate Professors

Bruno Blašković – model checking, formal description methods, protocol synthesis

Martin Dadić – computational and applied electromagnetics

Šandor Dembitz – natural language processing, expert systems

Ivan Leniček – precise electromagnetic measurements, calibration of standards

▼ Assistant Professors

Marko Banek – database design, electronic business, ontology engineering, natural language processing
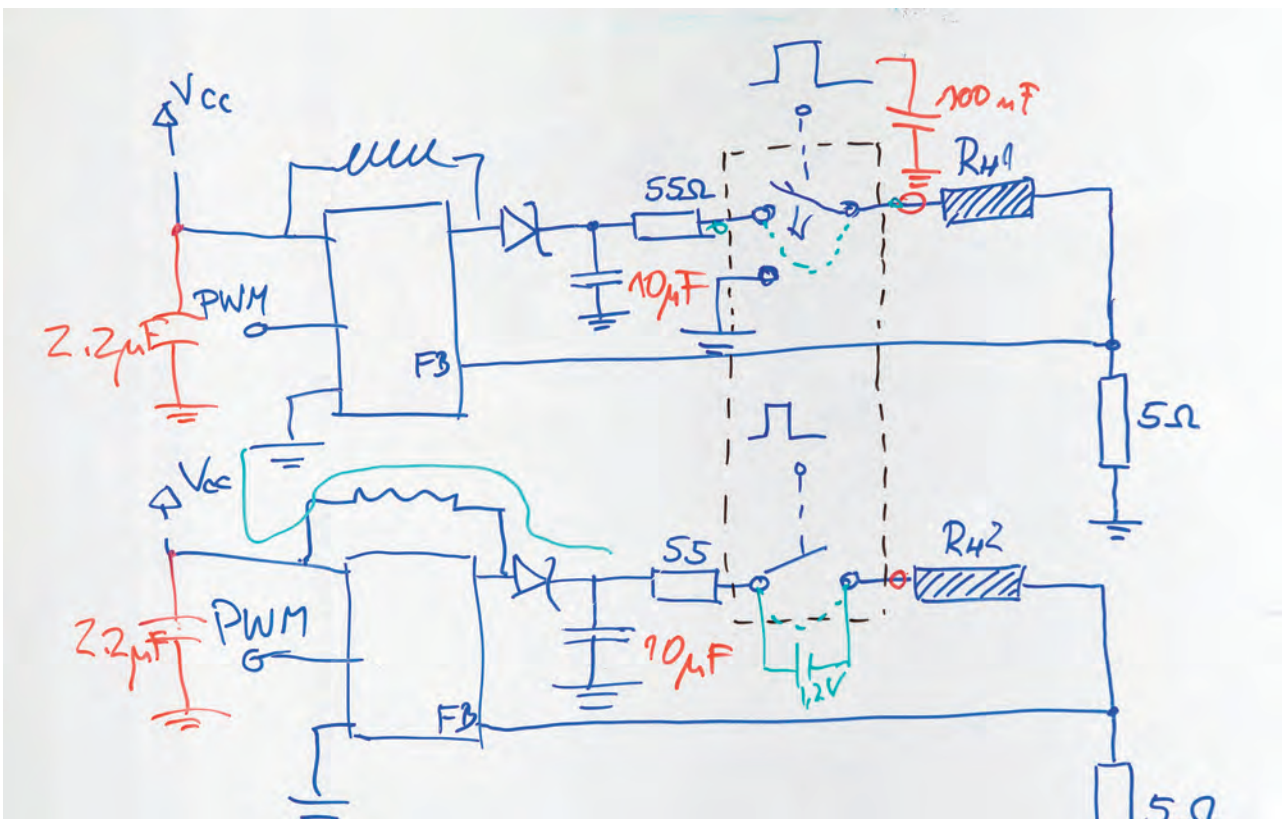
Luka Ferković – precise measurement of high AC and DC current, non conventional measuring transducers

Marko Jurčević – automated data acquisition systems, electromagnetic measurements, remote (Internet-enabled) calibration of standards, graphical programming languages

Damir Pintar – service-oriented computing, data mining, predictive and descriptive data analysis

Mirko Randić – distributed object-oriented software design, network and system management

Bojan Trkulja – computational electromagnetics, boundary element methods

▼ Retired Professors

Božidar Ferković – precise measurements of electromagnetic quantities

Zijad Haznadar – electromagnetic fields, numerical analysis

Dušan Vujević – precise measurement of voltage and magnetic quantities

▼ Senior Assistants

Hrvoje Hegeduš

Petar Mostarac

Mihaela Vranić

▼ Research Assistants

Kristina Ferković

Tomislav Župan

▼ Department Associates

Luka Humski

▼ Associates

Frano Škopljanac-Mačina

▼ Laboratory Support

Dražen Franolić

Davor Kotur

Ivica Kunšt

▼ Administrative Staff

Sanja Ferković Živković

Jasenka Haladin

Educational Activities

Fundamentals of electrical engineering - theory and practice. Electrostatic and electromagnetic phenomena. Basic circuits and field theory. Electrical and non-electrical measurements, elements, methods, instruments and laboratory equipment. Metrology and absolute electromagnetic measurements. Measurement error theory, measurement technique, analysis of the measurement results. Measuring systems and virtual instruments. Metrology infrastructure, calibration and testing services. Quality management and laboratory accreditation. Telemetric data acquisition systems and automated measurement systems. Process testing and industrial measurements of magnetic material properties, isolation and earthing. Electromagnetic field theory. Electromechanics. Electromagnetic waves and wave propagation. Numerical methods and electromagnetic field calculation. Elements of design theory and design processing. Computational electromagnetic compatibility. Electromagnetic pollution. Logic and formal methods for software testing and verification. Data processing. Data management. Databases. Data Warehousing. Data mining. E-Business. Business Intelligence.

First Cycle Study

▼ Mandatory Courses

- Databases
- Economics and Managerial Decision Making
- Electromagnetic Fields
- Fundamentals of Electrical Engineering
- Information, Logic and Languages
- Management in Engineering
- Quality Management

Elective Courses

- Methods of Measurement
- Metrology Fundamentals

Courses for Advanced Students

- Electromechanics

Skills

- Advanced LabVIEW
- Introduction into Fault finding
- LabVIEW

Second Cycle Study

Mandatory Courses

- Laboratory of Electrical Engineering Systems and Technology 2

Theoretical Courses

- Data Management
- Formal Methods in System Design
- Measurement Theory

Specialization Courses

- E-Business Technologies
- Measurement Technique
- Measurements in Technology Systems
- Network and Service Management

Recommended Elective Courses

Computational Electromagnetism
Electrotechnical Measurements
Natural Language Processing

Skills

Advanced LabVIEW

Postgraduate Doctoral Study

- Analysis and Synthesis of Real-Time Systems
- Computational Electromagnetic Compatibility
- Computer Aided Analysis in Electromagnetic Theory
- Computer Aided Design
- Data Warehouse Design
- Digital Measuring Instruments and Measuring Systems
- Distributed Information Systems
- Electrical Measurement of Nonelectric Quantities
- Electromagnetic Pollution
- Intelligent Control and Automata Games
- International Measurement Traceability
- Measurements in Electric-power Networks
- Metrology and Precise Measurements
- Quality Management and Metrology
- Selected Topics on Data Processing
- Telecommunication Networks Management
- Validation of Laboratory Measurement Methods and Software

Research and Development

Development and permanent improvement of precise measurements of electromagnetic quantities in Croatia. Internationally accredited Primary Electromagnetic Laboratory. Development of standards, measuring devices, instruments and procedures of high accuracy. Maintenance and comparison of voltage, resistance and capacitance standards. Interlaboratory comparison of quantum JAVS voltage standard. Automation of measuring procedures. Research and development of telemetric data acquisition systems, especially in collecting data from electric power plants and system, and transmitting them through public telephone network to the central monitoring station. Measurement of the quality of electrical energy in the Croatian distribution system. Methods of calibration of high-class wattmeters and

power-meters. Organisation of metrology, certification and standardisation services in Croatia harmonised with WECC, ILAC and other requirements. Research in the area of numerical calculation of electromagnetic fields, development of software packages for numerical field calculation applicable to electromagnetic compatibility problems as well as to analysis of human exposure to low-frequency electromagnetic fields. Research and development of ship's shaft generator. EM field influence of power lines on surrounding metallic objects. Computation, measurement, and analysis of EM fields for various sources of electromagnetic pollution. Application of complex numerical computation of electromagnetic fields to design of electrical apparatus and machines in order to achieve better quality and market competitiveness. Application of software packages in the development of new designs of electromagnetic devices, to be incorporated into usual design and developing procedures. The development of the methodology and the tools for analysis of electromagnetic environment of power engineering systems and for protection of undesired electromagnetic fields. Initiation of further development and new approach to the integral solution of the problem relating to protection, control and management in the electric-power supply systems. Laboratory for Electromagnetic Fields. Measurement of electromagnetic pollution. Development of the magnetic field National Standard. Object-relational database design, data mining, information system development, data warehousing design, networked economy, applications for electronic business.

▼ Projects

Development of conditions for realization of the national magnetic field standard (Project 036-0363081-1652, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Armin Pavić, 2007-2013).

Internet enabled calibrations and measurement (Project 036-0363081-1648, Ministry of Science, Education and Sports, Republic of Croatia, Principal Investigator: Roman Malarić, 2007-2013).

Measurement of electromagnetic quantities at the level of standards (Project 0036-0363081-1650, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Damir Ilić, 2007-2013).

Networked economy (Project 0036-0362027-1638, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Zoran Skočir, 2007-2013).

Numerical calculation of electromagnetic fields in transformers (Project 0036-0362321-2326, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Željko Štih, 2007-2013).

Remote laboratory (Project 0036-0363081-1653, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Mladen Boršić, 2007-2009, Petar Knežević 2009-2013).

Business Intelligence and Electronic Commerce (Agrokor, Project coordinators: Mirko Laušić, Mate Krpan, Ivo Pejaković, Ignac Lovrek, Zoran Skočir, Project leader: Zoran Skočir, 2005-2012).

Creation of the third cycle studies-doctoral studies in metrology - D.S.M. (TEMPUS JEP project; Project coordinator: Ljupčo Arsov, Macedonia; Croatian partner: Roman Malarić; 2010-2013).

Extracting electric energy from human body for supplying autonomous biomedical devices and new PVDF transducer optimization (Bilateral project; International partner: Aimé Lay-Ekuakille, Italy; Croatian partner: Roman Malarić; 2010-2012).

Cooperation between University of Gavle and University of Zagreb (Bilateral project; International partner: University of Gavle, Sweden; Croatian partner: Roman Malarić; 2013-2015).

Development of promotional store-level demand forecasting models for the retail sector (Agrokor, Project coordinators: Mate Krpan, Ivo Pejaković, Tomislav Jukić, Ignac Lovrek, Bojana Dalbelo-Bašić, Zoran Skočir, Project leader: Zoran Skočir, 2013-2014).

Data model analysis for business intelligence and data transfer measurements (Equidem, Project leaders: Borivoj Modlic, Zoran Skočir, 2012-2013).

International Links

Bureau International des poids et Mesures, Pavillon de Breteuil, Sevres, France

Mechanical & Manufacturing Engineering, De Monfort University, Leicester, United Kingdom

National Institute of Standards and Technology, Gaithersburg, Maryland, USA

National Physical Laboratory, Middlessex, Teddington, United Kingdom

Physikalisch Technische Bundesanstalt, Braunschweig, Germany

Saga University, Faculty of Science and Engineering, Saga, Japan

Technische Universität Graz, Institut für Grundlagen und Theorie der Elektrotechnik, Graz, Austria

University of Tokyo, Faculty of Engineering, Nuclear Engineering Research Laboratory, Tokyo, Japan

5.5. Department of Electric Machines, Drives and Automation

Faculty and Staff

▼ Professors

Ivan Gašparac – electrical machines, industrial plants

Željko Jakopović – power electronics, semiconductor power devices

Fetah Kolonić – control of drives, mechatronic systems

Zlatko Maljković – electrical machines

Founded in 1925
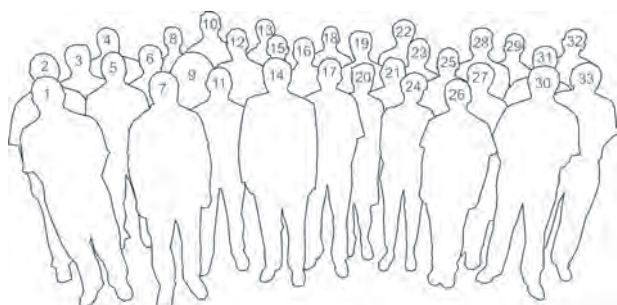
Head of Department:
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1 Fetah Kolonić   2 Damir Sumina   3 Viktor Šunde
4 Mario Vražić   5 Ali Sinan Çabuk
6 Stjepan Stipetić   7 Zlatko Hanić   8 Tino Jerčić
9 Martina Kutija   10 Ivan Mrčela   11 Goran Rovišan
12 Marinko Kovačić   13 Damir Žarko
14 Zlatko Maljković   15 Marinko Miletić
16 Krešimir Ćosić   17 Ivan Gašparac   18 Siniša Popović
19 Drago Ban   20 Spomenka Perkušić
21 Branka Rihtarić   22 Igor Erceg   23 Marko Horvat
24 Snježana Krleža   25 Bernard Kovač
26 Šandor Ileš   27 Zdenko Štifter
28 Branimir Dropuljić   29 Marijan Martinović
30 Željko Jakopović   31 Davor Kukolja
32 Jadranko Matuško   33 Zvonko Benčić

Associate Professors

Jadranko Matuško - control of mechatronic systems

Viktor Šunde – power electronics, semiconductor power devices

Mario Vražić – electrical machines, industrial plants

Damir Žarko – electrical machines and drives

Assistant Professors

Igor Erceg – control of electrical machines, industrial automation

Damir Sumina – control of electrical machines and drives

Nikola Švigir – technical mechanics

Retired Professors

Drago Ban – electrical machines and drives

Zvonko Benčić – power electronics, semiconductor power devices

Krešimir Ćosić – interactive simulation systems, strategic planning

Ivan Ilić – retired, professor emeritus, electrical machines and drives

Senior Assistants

Davor Kukolja

Assistants

Zlatko Hanić

Šandor Ileš

Marinko Kovačić

Martina Kutija

Goran Rovišan

Research Assistants

Branimir Dropuljić

Marko Horvat

Ivan Mrčela

Tanja Poljugan

Stjepan Stipetić

Department Associates

Tino Jerčić

Bernard Kovač

Marijan Martinović

Siniša Popović

Danko Sirotić

▼ Affiliates

Vitomir Blagojević

▼ Laboratory Support

Marinko Miletić

Zdenko Štifter

▼ Administrative Staff

Snježana Krleža

Spomenka Perkušić

Educational Activities

Fundamentals of electrical machinery. Direct current and electronically commutated motors, induction and synchronous machines. Small and special electric machines. Transformers. General theory of electromechanical conversion. Design in electromechanical engineering. Power electronics and electrical drives, control of electrical machines and drives. Mechatronic systems. Testing and diagnostics of electrical machines and drives. Applied mechanics in electrical engineering. Electric switches. Switching arrangements. Industrial plants and automation of industrial plants. Electrical traction. Electric vehicle drive and energy distribution. Interactive and real-time simulation systems based on virtual reality: simulator based training and selection, numerical methods, 3D modelling and visualization, multimedia stimuli generation, emotional state estimation.

Research and development of methods for the analysis, design and testing of electrical machines, transformers and other electrical devices, and for their implementation in various industrial, electrical, transportation and other technical systems. Modelling, simulation and identification of parameters of electrical machines and power electronics converters. Analysis of small and special machines (step motors, linear motors, electronically commutated motors) for general and special purpose. Electrical motor drives in normal and specific working conditions. Design, testing and commissioning. Reconstruction, retrofit and modernisation of high power electrical machines and drives in electrical, industrial, mining and other plants. Research, development, design and implementation of different power electronic converters. Research, development and application of the methods for automatic control of AC and DC electrical drives in industry, mining, transport, shipbuilding and elsewhere. Design, modelling and application of mechatronic systems. Reconstruction and modernisation of controlled electrical drives, automation of electrical drives and protection systems, especially in rolling mills, mining and other similar industrial plants. Design

and modernisation of industrial and electrical plants. Diagnostics of electrical motors and drives.
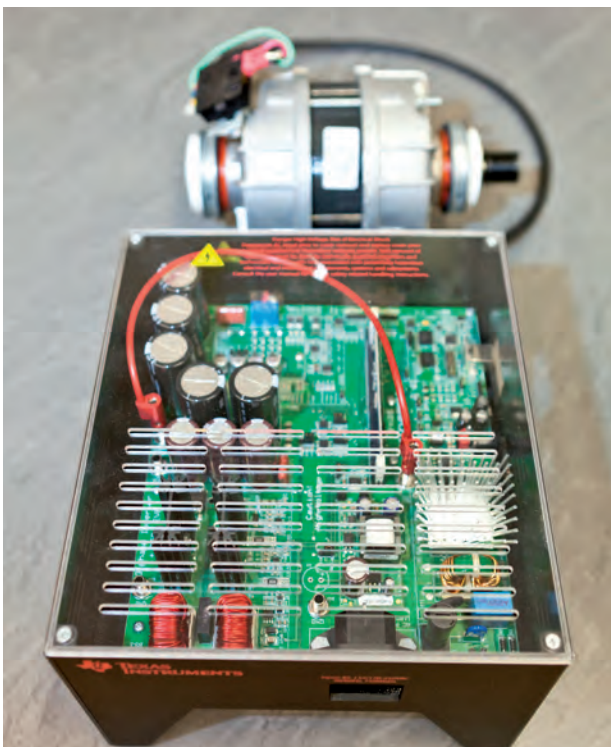
First Cycle Study

▼ Mandatory Courses

- Electromechanical and Electrical Conversion
- Electromechanical Systems
- Laboratory and Skills - Autocad
- Laboratory and Skills - Matlab
- Physical Education 1

▼ Elective Courses

- Electrical Actuators
- Electrical Machines Control Practicum

- Fundamentals of Electrical Drives
- Fundamentals of Mechatronics
- Power Electronics Practicum

▼ Skills

- Laboratory and Skills - Application of CAD Software in Technical Design

Second Cycle Study

▼ Mandatory Courses

- Laboratory of Control Engineering and Automation 1
- Laboratory of Electrical Engineering Systems and Technology 1
- Laboratory of Electrical Engineering Systems and Technology 2

▼ Theoretical Courses

- Control of Electrical Drives
- Electrical Machines and Transformers Theory
- Industrial System Dynamics
- Power Electronics

▼ Specialization Courses

- Control of Power Converters
- Design and Automatization of Industrial Plants
- Design of Electric Machinery
- Diagnostic and Monitoring of Machines and Drives
- Electric Drives
- Mechatronic Systems
- Switching and Protection Devices
- Synchronous Machines and Excitation Systems

▼ Recommended Elective Courses

- Defense Systems and Technologies
- Development of Electrical Products
- Intelligent Control Systems
- Interactive Simulation Systems
- Materials in Electrical Products
- Technical Mechanics

Postgraduate Doctoral Study

- Automated Testing of Electrical Machines

- Contemporary Methods for Design of Electrical Equipment
- Control of Electromechanical Systems
- Control Systems of Electrical Drives
- Disturbances and Protection of Synchronous Machines
- Dynamics of Alternative Current Machines
- Electric Traction
- Industrial Plants
- Intelligent Systems in Industrial Plants
- Interactive Simulation Systems - Selected Topics
- Power Electronics Systems
- Special Electrical Drives
- Synergistic Integration in Mechatronics Systems
- Theory of Power Circuit Breakers
- Transformers

Research and Development

Electrical machines: Finite Element Method based analysis of synchronous generators, both hydrogenerators and turbogenerators, as well as transformers have been introduced. New advances in computing technology (hardware and software) have enabled more accurate determination of magnetic field distribution and basic machine parameters. The numerical tools are used for design of new generators and refurbishment of the existing ones. A method for accurate calculation and analysis of turbogenerator electromagnetic parameters has been developed. An analytical method based on conformal mapping has been developed for fast and reliable calculation of magnetic field and torque in surface permanent-magnet motors. Computerised on-line diagnostics for determining the state of induction motor cage rotor was investigated and applied in a large number of industrial facilities. The computerised method for on-site testing of low-voltage and high-voltage motor insulation systems has been developed and applied in power plants, chemical plants and cement industry.

Control of AC electrical drives: Research and development of digital control systems for AC electrical drives and synchronous generator excitation. Intelligent control systems and their applications in various plants. Development of a new DSP control system for electrical machines. Sensorless speed control system for slip-ring AC motor has been developed. Actual speed information is realised via rotor voltage frequency estimation (RVFE). Using line frequency as a reference, the fundamental component of the rotor frequency gives information on the slip of the motor, which in turn yields information on the speed in a digital form. The measurement of line currents and voltages for the estimation of the actual motor torque has also been realised. This torque estimation technique has replaced the mechanical torque sensor.

Power electronics: Introducing the new concept of teaching Power electronics. Development of multimedia laboratory for Power electronics enabling integration of different teaching methodologies. Evaluation of simple power semiconductor thermal model applied in a commercial circuit simulator. The obtained results corrected the existing electrothermal model. The transient thermal impedance measurement method for MOS-gated power semiconductors has been developed and tested, enabling fast and accurate on-site measurement.

Industry automation: Research and development of PROFIBUS (Industrial communication network) application in automated systems for testing of electrical machines. Coupling of an intelligent automation with soft computing related to industrial site applications. Design and build systems, which exhibit high level of intelligence, support sufficient user application flexibility related to cost effective product. Introduction of engineering tools, which represent a holistic approach to control engineering, covering all disciplines and activities required to the process automation system. Presentation and introduction of different types of modern high-level PLC programming languages. These languages are function-block-based and have been specially developed for industrial automation process control. Study of different types of application projects represented by a hierarchical and multifaceted engineering database, which contains all the data needed to fully describe the design and function of the plant. Information about selected database, which stores data without redundancy, i.e. without duplication, despite the fact that data items may have multiple usages. General information about high-speed communication links used as a backbone for the process automation control system. Study of a Fieldbus Foundation system architecture, which provides a framework for industrial application as a distributed system composed of digital devices and control/monitoring equipment. Research and development of mechatronic systems and electric vehicle systems.
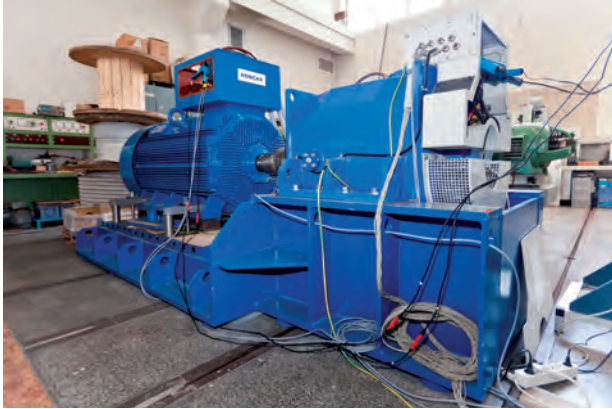
Interactive simulation: Training simulators for complex missions and tasks, based on virtual reality and 3D modeling. Generic technology for multimedia generation of stimuli with potential applications in training of emotional and cognitive control under stressful conditions.

Projects

Permanent Magnet Machine Technology for Boosting the Energy Efficiency in Traction and Marine Applications (MAGEF - IPA Project, Principal investigator: Damir Žarko, 2013-2015)

Adaptive Control of Scenarios in VR Therapy of PTSD (Project 036-0000000-2029, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Krešimir Ćosić, 2007-2013)

Control of Complex Electromechanical Systems for Manipulations in Transport (Project 036-0363078-1629, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Fetah Kolonić, 2007-2013)

Refurbishment and Operation of Hydro-generators (Project 036-0361616-1617, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Zlatko Maljković; 2007-2013)

Research Methodology for Determination PQ Diagram of a Synchronous Generator (Project 036-0361616-1618 Ministry of Science and Technology, Republic of Croatia, Principal investigator: Ivan Gašparac; 2007-2013)

Control of the Power Unit With Respect to the Demands of Electrical Power System (Project 036-0361621-1626, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Gorislav Erceg; 2007-2013)

Optimization of Electric Motors and Drives for Special Conditions of Exploitation (Project 036-0361616-1619, Ministry of Science and Technology, Republic of Croatia, Principal investigators: Drago Ban; 2007-2013)

Power Converters with Enhanced Efficiency as Interface Between Renewable Energy Source and Grid (Project 036-0362978-2314, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Željko Jakopović; 2007-2013)

Converters for Tram and Electrical Drive in Train (Project 036-0362978-1574 Ministry of Science and Technology, Republic of Croatia, Principal investigator: Viktor Šunde; 2007-2013)

International Links

ABB - Industrial Systems AB, Sweden

Budapest Technical University, Budapest, Hungary

Fakulta elektrotechniky a informatiky Slovenskej Technickej Univerzity v Bratislave, Slovakia

Technische Universität München, Institute of Electrical Drives, München, Germany

University "St. Kiril & Metodij", Faculty of Electrical Engineering, Skopje, Macedonia

University of Connecticut, Department of Mechanical Engineering, Connecticut, USA

Univerza v Ljubljani, Fakulteta za elektrotehniko, Ljubljana, Slovenia

Univerza v Mariboru, Fakulteta za elektrotehniko, raèunalništvo i informatiko, Maribor, Slovenia

University of Leoben, Department of Electrical Engineering, Leoben, Austria

University of Maribor, Faculty of Energy Technology, Krško, Slovenia

Univerza v Mariboru, Fakulteta za energetiko, Krško, Slovenia

5.6. Department of Energy and Power Systems

Faculty and Staff

▼ Professors

Nikola Čavlina – nuclear power plant safety and control

Nenad Debrecin – nuclear power plants, renewable energy sources, energy efficiency

Slavko Krajcar – electrical facility design, distribution networks, energy market design
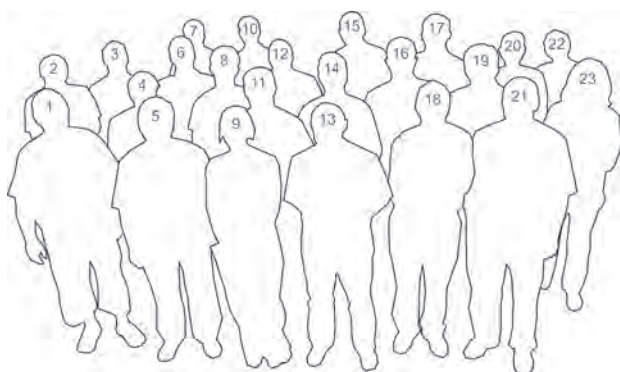
Founded in 1934

Head of Department:
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Ante Marušić – power system protection and local control

Vladimir Mikuličić – energy conversion, electrical power system reliability

1 Ivica Berislavić   2 Viktor Milardić
3 Perica Ilak   4 Kristina Baranašić
5 Ante Marušić   6 Milan Amižić   7 Matija Zidar
8 Tomislav Capuder   9 Vesna Bukarica
10 Frano Tomašević   11 Igor Kuzle   12 Juraj Havelka
13 Davor Škrlec   14 Vladimir Mikuličić
15 Nikola Čavlina   16 Marko Delimar   17 Davor Rašeta
18 Davor Grgić   19 Radoslav Zelić   20 Siniša Šadek
21 Željko Tomšić   22 Tomislav Fancev   23 Vesna Benčik

Ivica Pavić – transmission networks, power system analysis and control

Davor Škrlec – electrical distribution systems, geographical information systems

Sejid Tešnjak – electric power system, electric power system regulation and dynamics

Tomislav Tomiša – power system automation and control

Ivo Uglešić – high voltage engineering

▼ Associate Professors

Marko Delimar – power system analysis, operation and control

Davor Grgić – nuclear power plants, reactor safety

Igor Kuzle – power system dynamics and control, equipment maintenance, electricity markets

Viktor Milardić – high voltage engineering

Zdenko Šimić – renewable energy sources, programming

Željko Tomšić – Energy Sustainable Development; Energy markets generation system planning, energy management

▼ Assistant Professors

Juraj Havelka – relay protection for power systems; SCADA system design for power facilities

▼ Retired Professors

Danilo Feretić – nuclear power plants, reactor safety, energy and environment

Zdravko Hebel – transmission networks, power system analysis

▼ Research Assistants

Kristina Baranašić

Tomislav Capuder

Perica Ilak

Boško Milešević

Hrvoje Pandžić

Ivan Rajšl

Frano Tomašević

Matija Zidar

▼ Department Associates

Vesna Benčik

Tomislav Fancev

Bojan Franc

Ninoslav Holjevac

Siniša Šadek

Miroslav Šturlan

Laboratory Support

Ivica Berislavić

Božidar Filipović Grčić

Davor Klarin

Radoslav Zelić

Administrative Staff

Jasna Hemen

Neda Šimara

Educational Activities

Electric power engineering. Energy conversion technologies. Fluid mechanics. Heat transfer. Power system planning and construction. Operation, control and dynamics of the power system. Power system protection, automation and control. Open market of electric energy. Ancillary services. Maintenance of power system devices. Power facilities. Distribution networks planning and design. Low-voltage distribution networks and consumer installations. Power system analysis. High voltage engineering. Nuclear physics reactor theory. Nuclear and thermal power plants. Fuel cycles and reactors materials. Engineering reliability and safety. Energy and environment. Geographic information systems. Energy systems economics. Energy efficiency. Energy and environment management. Renewable energy sources.

First Cycle Study

Mandatory Courses

- Economics and Managerial Decision Making
- Electric Facilities
- Energy Technology
- Management in Engineering
- Sustainable Development and Environment
- Transmission and Distribution of Electric Power

Elective Courses

- Electric Facilities Design
- Electromagnetic Transients and Electromagnetic Compatibility
- Energy Efficiency Audit and Energy Management Programme
- Low-voltage Power Systems
- Power Plants

- Process Measurements and Diagnostic in Power Plants
- Technical Standardization and Legislative

▼ Skills

- Advanced LabVIEW
- LabVIEW

Second Cycle Study

▼ Mandatory Courses

- Laboratory of Electrical Power Engineering 1
- Laboratory of Electrical Power Engineering 2

▼ Theoretical Courses

- Economics of Energy
- Energy Conversion
- High Voltage Engineering
- Power System Dynamics and Control
- Power Systems Analysis

▼ Specialization Courses

- Distribution Networks and Distribution Generation
- Electric Facilities Automation
- Electric Power Market
- Electric Power Network Operation and Control
- Electric Power Networks
- Electric Power System Operation and Planning
- Electric Traction Power Supply
- Energy Management and Energy Efficiency
- Energy-Economy Models for Developing of Energy Systems
- Mass and Heat Transfer

- Nuclear Engineering
- Nuclear Safety
- Numerical Methods in Electric Power Systems
- Overhead Lines and Cables
- Overvoltage Protection
- Power System Modeling and Simulation
- Power System Protection
- Power System Supervision and Remote Control
- Reliability and Availability Assessment Methods
- Renewable Resources and Advanced Technology
- Risk Assessment
- Special Protection Systems
- Switching and Protection Devices

▼ Recommended Elective Courses

- Electrical Lighting
- Electrotechnical Measurements
- Energy, Environment and Sustainable Development
- Geoinformation Systems
- Power Quality
- Power System Maintenance
- Risk Management

▼ Skills

- Advanced LabVIEW

Postgraduate Doctoral Study

- Availability Evaluation of Electric Power System Subsystems
- Control Techniques in Electrical Engineering
- Disturbances and Protection of Synchronous Machines
- Diagnostics in Electric Power Elements Maintenance
- Dynamics of Power Plants Operation
- Electric Railways
- Environmental Impact of Electric Power Systems
- Flexible Power Transmission
- Geoinformation Systems
- High-voltage Network Analysis
- Innovative Nuclear Systems for Sustainable Development
- Intelligent Systems in Electric Power Engineering
- Long-Term Electricity Planning under Uncertainty

- Modeling of Electricity Market
- Nuclear Power Plant Safety Analyses
- Optimization Principles of the Electric Power Networks
- Overhead Lines and Cables
- Overvoltages in Power System
- Power Distribution System
- Power Network Calculations
- Power System Operation
- Power System Relaying
- Probabilistic Assessment of Technological Risk
- Quality of Electric Power Supply
- Risk Analysis
- Testing and Measurement Method in High Voltage Engineering

Research and Development

Power Systems Engineering: The research is focused to development of both fundamental knowledge and applications of electrical power engineering. Studies on scientific projects include collaboration with industry, national institutions, electric utilities, and many foreign universities. The research is generally directed to increasing the availability and the reliability of a power system with an emphasis on the adjustment to the open market environment. Specific goals include: improving models and methodologies for power system analysis, operation and control; development, production and application of models and methodologies for power systems planning, maintenance and development; application of soft-computing (artificial intelligence, meta-heuristics, etc.), information technologies (web-oriented technologies, geographic information systems, enterprise IT solutions, etc.) and operational research in improving processes of planning, development, exploitation and control of power systems; investigation on applications for coordinated control of power system devices and exploring the power system stability, security and economic operation; integration of intelligent devices and agents in energy management systems and distribution management systems equipment and software; advanced modelling of dynamics, disturbances and transient phenomena in transmission and distribution networks (in particular regarding distributed generation); advances in fault detection, restoration and outage management. At time of global changes in the energy sector, with emphasis on sustainable development, and in view of Croatia's application for joining EU, significant efforts are devoted to elimination of technical and administrative inadequacies in relation to EU legislation and directives. In particular, this implies liberalization efforts, utilities restructuring, facilities revitalization, improved legislation and adoption of new standards.

Power Technologies: General objective of the research is to develop methodologies for reliable assessment of nuclear power plants operational safety and for quantitative assessment of the environmental impact of applicable energy technologies (electric power producing plants and their technology chains), as a base for estimating optimal long-term development strategy of the Croatian power system. Research work includes new strategies of energy sector and power system development for Republic of Croatia; preparing medium and long-term electricity generation expansion plan for power system; comparison of energy, economic and environmental characteristics of different options for electric power generation; studies for rational use of energy and energy savings, assuming a centralized structure of the electricity market. Research work also includes renewable energy sources and its role in Croatian power sector, as well as electricity production considering cap on CO_2 emissions. Recent research covers development of new models for power system generation optimization and planning under uncertainties of the open electricity market. The goal of that research is to create analytical and software tools which will enable a successful transition to liberalized electricity market in Croatia and ensure healthy and efficient power system operation in compliance with environmental requirements. In the nuclear energy field the specific analysis and calculations of transients and consequences of potential accidents in NPP Krško have recently been updated with some 3D models and extended to severe power plant accidents.

▼ Projects

Flexible Electric Vehicle Charging Infrastructure - FLEX-CHEV (ERA-NET; Igor Kuzle; 2014-2015)

Emergent phenomena testbed simulator for improving SCADA performance in power system security management (NATO project; Zdenko Šimić; 2010-2013)

Financial Risk Evaluation, Using IAEA FINPLAN Tool, for Financing New Large Energy

Project (Coordinated Research Contract IAEA 17848; Željko Tomšić; 2013-2017)

Intelligent information system for monitoring and verification of energy management in cities - ISEMIC (SEE-ERA.NET Plus; Željko Tomšić; 2010-2012)

Control of Electric Power Systems in the Open Market Environment (MZOS Project: 036-0361557-1561, Sejid Tešnjak; 2007-2013)

Development of Electricity Market Analysis Tools (MZOS Project: 036-0361590-1591, Slavko Krajcar; 2007-2013)

Development of power quality measuring and analyzing system (MZOS Project: 036-0361557-1562, Tomislav Tomiša; 2007-2013)

Energy Security and Climate Change (MZOS Project: 036-0361590-1586, Nenad Debrecin; 2007-2013)

Fulfilment of Environmental Requirements in High Voltage System (MZOS Project: 036-0361590-1578, Ivo Uglešić; 2007-2013)

Nuclear power plants for sustainable energy generation (MZOS Project: 036-0361590-1589, Danilo Feretić; 2007-2013)

Planning and Operation of Active Distribution Networks and Microgrids (MZOS Project: 036-0361590-1587, Davor Škrlec; 2007-2013)

Embedding Renewable Energy Sources into an Active Distribution Network (Bilateral project; Marko Delimar; Vladimir Katić, University of Novi Sad; 2010-2011)

Sustainable Energy and Environment in the Western Balkan (Founded by the Norwegian Ministry of Foreign Affairs, researchers: Nenad Debrecin and Slavko Krajcar, 2011-2014)

International Links

Gesellschaft für Reaktor Sicherheit (GRS), Garsching, Germany

Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany

International Atomic Energy Agency (IAEA), Vienna, Austria

Ruhr Universität Bochum, Fakultät für Maschinenbau, Bochum, Germany

Ruhr Universität Bochum, Institut für Energietechnik, Bochum, Germany

Technische Universität Graz, Institut für Hochspannungstechnik, Graz, Austria

The Netherlands Agency for Energy and Environment (NOVEM), Sittard, The Netherlands

Aalborg University, Denmark

Narvik University College, Norway

UNIDO, Wien, Austria

University of Pisa, Pisa, Italy

World Bank, Washington, USA

Électricité de France (EDF), Paris, France

Doshisha University, Kyoto, Japan

University of Leuven (KU Leuven), Leuven, Belgium

ETP SmartGrids - European Technology Platform for Electricity Networks of the Future, Brussels, Belgium

IEEE, New York, NY, USA

IEEE Corporate Activities, Piscataway, NJ, USA

IEEE Power & Energy Society, Piscataway, NJ, USA

IEEE Industry Applications Society, Piscataway, NJ, USA

University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

5.7. Department of Telecommunications

Faculty and Staff

▼ Professors

Alen Bažant – data communications, local area networks, broadband access networks and technologies

Dragan Jevtić – computer telephony, Petri and neural nets, knowlegde based systems and services, intelligent agents
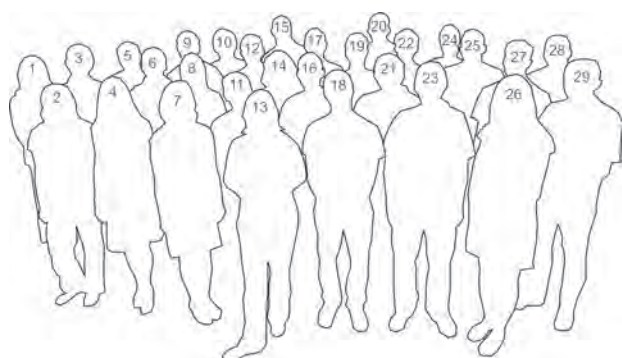
Founded in 1951

Head of Department:
Prof. **Maja Matijašević**, Ph.D.

Phone: + 385 1 6129 810
Fax: + 385 1 6129 832
E-mail: tel@fer.hr
Web: www.tel.fer.hr

Mladen Kos – network optimisation, performance analysis

Ignac Lovrek – telecommunication system architecture, call/service modelling and processing, mobile agents and multi-agent systems

1 Željka Car   2 Gordana Ožvald   3 Hrvoje Maračić
4 Lea Skorin-Kapov   5 Mario Kušek   6 Pavle Skočir
7 Marija Furdek   8 Iva Bojić   9 Gordan Ježić
10 Ignac Lovrek   11 Aleksandar Antonić
12 Krunoslav Ivešić   13 Jasna Slavinić
14 Maja Matijašević   15 Igor S. Pandžić
16 Jurica Babić   17 Miljenko Mikuc   18 Valter Vasić
19 Marina Ivić   20 Tomislav Grgić   21 Branko Mikac
22 Ivan Slivar   23 Miroslav Frljak
24 Aleksandra Čereković   25 Šimo Brtan
26 Ivana Rašan Sladoljev   27 Darko Štriga
28 Marin Vuković   29 Dragan Jevtić

Maja Matijašević – converged IP-based networks, multimedia communication, quality of service

Branko Mikac – reliability, transmission systems

Igor S. Pandžić – virtual characters, virtual environments, multimedia

▼ Associate Professors

Željka Car – software engineering, software process modelling and simulation, project management

Gordan Ježić – agent technology, mobile networks and services, mobile computation

Mario Kušek – mobile service programming, mobile software agents, software development, machine to machine (M2M) communication, self-organizing systems

Miljenko Mikuc – logical design, application of formal methods in telecommunication system design, network simulation systems

Ivana Podnar Žarko - large-scale distributed systems, real-time data stream processing, information retrieval and recommender systems

▼ Assistant Professors

Željko Ilić – high-performance digital transmission, medium access control protocols for broadband access networks, information theory

Vedran Podobnik – social networks, multi-agent systems, electronic markets

Krešimir Pripužić – distributed information systems, information retrieval and filtering, data stream processing

Lea Skorin-Kapov – quality of experience of multimedia services, signaling and resource allocation in next generation networks

▼ Retired Professors

Marijan Kunštić – information, logic and languages, switching systems

Vjekoslav Sinković – information theory, information networks

Mladen Tkalić – automata theory, logical design

▼ Senior Assistants

Iva Bojić

Aleksandra Čereković

Ognjen Dobrijević

Marija Furdek

Tomislav Grgić

Mirko Sužnjević

▼ Research Assistants

Matija Džanko

Krunoslav Ivešić

Damjan Katušić

Nenad Markuš

Valter Vasić

▼ Department Associates

Aleksandar Antonić

Jurica Babić

Miroslav Frljak

Marina Ivić

Hrvoje Maračić

Martina Marjanović

Vjekoslav Ranogajec

Ivana Rašan Sladoljev

Kristijan Rožanković

Denis Salopek

Pavle Skočir

Ivan Slivar

Petar Stojanac

Ivan Šemajnski

Darko Štriga

Marin Vuković
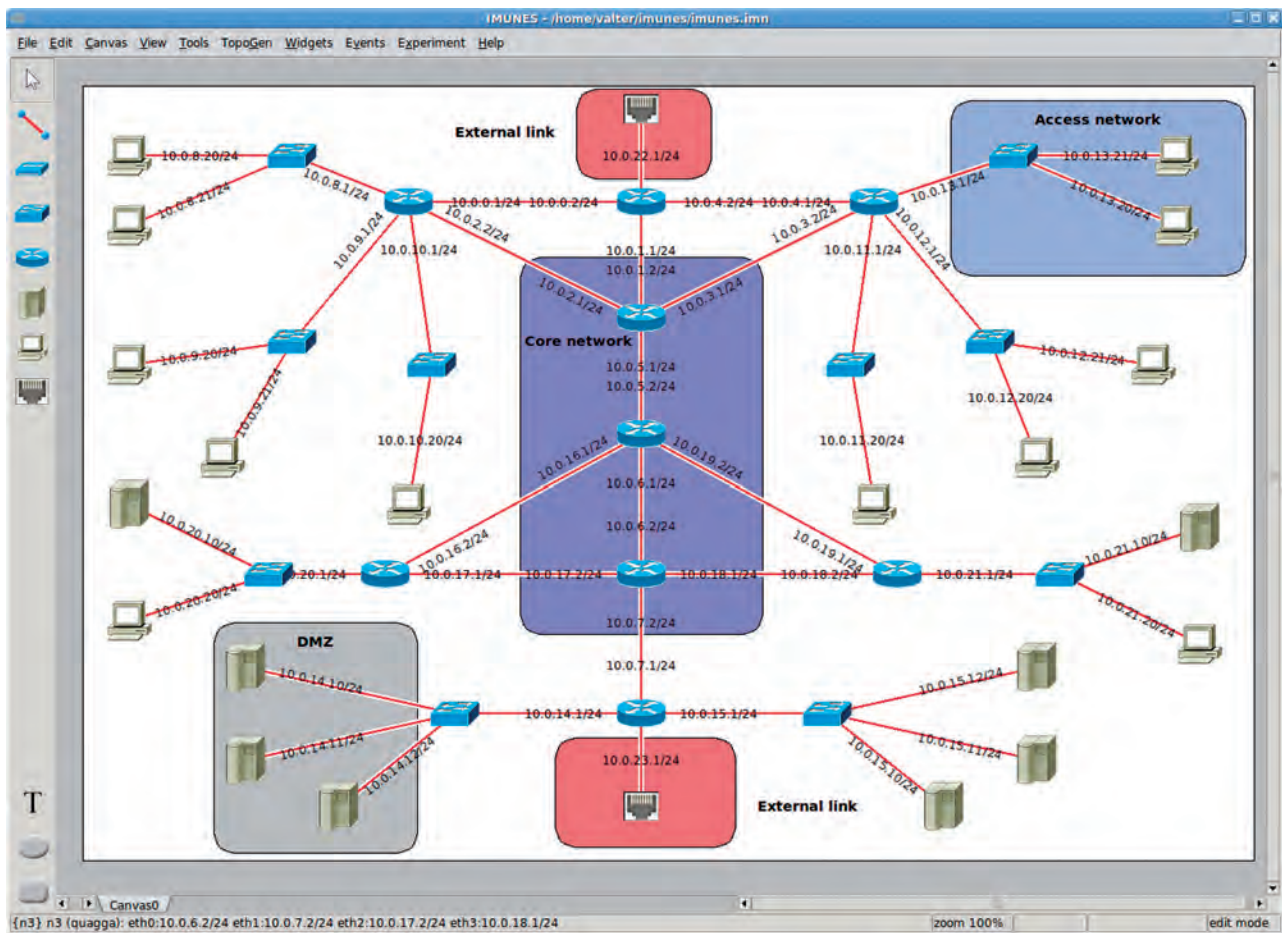
Laboratory Support

Marko Zec

Administrative Staff

Jasna Slavinić

Educational Activities

Information theory and information networks. Automata theory and logical design. Telecommunication networks, Internet. Languages and algorithms. Teletraffic theory. Digital transmission and switching, all-optical networks. Data communications. Local and access networks. Communication protocols. Hardware and software architectures of telecommunication systems, processors and programming languages. Mobile agents and multi-agent systems. Formal methods and techniques. Network planning, control and management. Information and telematic services. Broadband and intelligent networks. Multimedia communications, virtual reality. Mobility. System reliability. Performance evaluation and network optimisation, quality of service. Software processes. Project management.
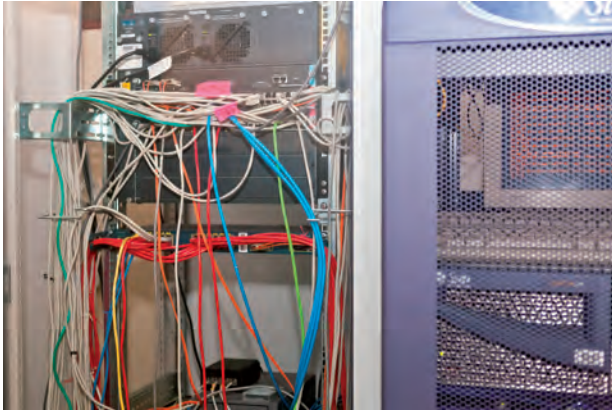
First Cycle Study

Mandatory Courses

- Communication Networks
- Digital Logic
- Information Theory
- Information, Logic and Languages
- Management in Engineering

Specialization Courses

- Multimedia Services
- Telecommunication Systems and Networks

Elective Courses

- Computer-Telephony Integration
- Introduction to Virtual Environments
- Local Area Networks
- Network Programming
- Public Mobile Network

- Mobility in Networks
- Network and Service Management
- Photonic Communication Technologies
- Project Management
- Telecommunication Software Development
- Virtual Environments

▼ Recommended Elective Courses

- Heuristic Optimization Methods

▼ Skills

- Service and Application Development for Operating System Android
- Web Start Contest

Postgraduate Doctoral Study

- 3D virtual characters
- Analysis of Information Processes
- Broadband Networks
- Communication Protocols-Selected Topics
- Communications in Virtual Environments
- Concurrent Systems
- Formalisms in Telecommunications
- Intelligent Control and Automata Games
- Methods and Models in Automata Theory
- Network Availability
- Open Network Architectures
- Optical Transmission Network
- Optimization Methods for Telecommunications
- Petri Nets and Distributed Systems
- Selected Topics in Distributed Systems
- Selected Topics in WWW Technologies & Applications
- Software Agents for Electronic Market
- Software Processes
- Telecommunication Networks Management
- Mobile Telecommunications Market

Research and Development

Information and communication technology. Information flows and teletraffic, analytical models and simulation of information sources and flows in broadband networks. Information channel capacity in multi-user wireless systems. Performance analyses of access network technologies. Network modelling and optimisation, network planning, performance evaluation, high-speed network dynamics. Queuing network theory and applications. Logic, relation

▼ Skills

- Service and Application Development for Operating System Android
- Web Start Contest

Second Cycle Study

▼ Mandatory Courses

- Information Networks
- Laboratory of Information Processing 2
- Laboratory of Telecommunications and Informatics 1
- Laboratory of Telecommunications and Informatics 2
- Laboratory of Software Engineering and Information Systems 1

▼ Theoretical Courses

- Communication Protocols
- Distributed Systems
- Multimedia Communications
- Photonic Telecommunication Networks
- Telecommunication Network Reliability
- Teletraffic Theory

▼ Specialization Courses

- Concurrent Programming
- Content Networking
- Data Transmission
- Forecasting and Marketing of Telecommunication Services
- High Speed Communication Networks
- Internet Security
- Learning Automata
- Mobile Software Agents

between information, knowledge and communication. Learning automata theory and applications. Software design: models, methods, languages and tools for telecommunications. Call and service conceptual modelling, concurrent programming and distributed processing. Communication and signalling protocols, formal specification and verification. Reliability and availability of telecommunication systems and network, reliability models of all-optical transmission network and its components. Comparative analysis of different protection/restoration scenarios. Fault testing and diagnosis, maintenance of telecommunication systems. Integrated communication systems, computer telephony integration. Multimedia and virtual reality, virtual characters. Mobility of users and services, mobile agents and multi-agent systems. Internet services and applications, e-business technology. Network evolution.

▼ Projects

Open Source blueprint for large scale self-organizing cloud environments for IoT applications (EU FP7 Project; Ivana Podnar Žarko; 2013-2014)

ICT Competence Network for Innovative Services for Persons with Complex Communication Needs (ICT-AAC - IPA Project; Vedran Podobnik; 2013-2015)

Intercultural Engineering Knowledge Transfer in Engineering for a Sustainable Global ICT Community (Erasmus LLP Project: SUSCOMTEC; Ignac Lovrek, 2012-2014)

Wireless Networking for Moving Objects (COST Action IC0906 - Cooperation in Science and Technology, European Commission, MC member: Maja Matijašević, 2010-2014)

Agreement Technologies (COST Action IC0801 - Cooperation in Science and Technology, European Commission, MC members: Gordan Ježić and Mario Kušek, 2008-2012)

Data Traffic Monitoring and Analysis: Theory, Techniques, Tools and Applications for the Future Networks (COST Action IC0703 - Cooperation in Science and Technology, European Commission, MC member: Maja Matijašević, 2008-2012)

Intelligent Monitoring, Control And Security Of Critical Infrastructure Systems (COST Action IC0806 - Cooperation in Science and Technology, European Commission, MC member: Nina Skorin-Kapov, 2009-2013)

European Network on Quality of Experience in Multimedia Systems and Services (COST Action IC1003 - Cooperation in Science and Technology, European Commission, MC member: Lea Skorin-Kapov, 2010-2014)

Computational Social Choice (COST Action IC1205 - Cooperation in Science and Technology,

European Commission, MC members: Krešimir Pripužić and Vedran Podobnik, 2012-2016)

Services and Applications in the Future Internet: Ensuring Quality and Energy Efficiency (Bilateral Slovenia-Croatian Project; Lea Skorin-Kapov, 2012-2013)

Energy Efficient M2M Device Communication (The Telecommunications Research Center Vienna (FTW), Austria; Mario Kušek, 2013-2014)

Technologies for simulating and animating human faces on the computer (Visage Technologies AB and FER; Igor S. Pandžić; 2004-2012)

Content Delivery and Mobility of Users and Services in New Generation Networks (Project 036-0362027-1639, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Maja Matijašević, 2007-2013)

Embodied Conversational Agents as Interface for Networked and Mobile Services (Project 036-0362027-2028, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Igor S. Pandžić, 2007-2013)

Knowledge-Based Network and Service Management (Project 036-0362027-1640, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Dragan Jevtić, 2007-2013)

Performance Analysis and Design of Broadband Networks (Project 036-0362027-1641, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Alen Bažant, 2007-2013)

WWW.HR - Croatian Home Page (CARnet - Croatian Academic and Research Network, Project leader until 10/2011: Gordan Gledec; Project leader since 11/2011: Marin Vuković)

Ericsson customized IMUNES (E-IMUNES) (Ericsson Nikola Tesla d.d. Zagreb, Project leader: Miljenko Mikuc, 2011-2013)

Machine-to-Machine communication challenges (M2MCC) (Ericsson Nikola Tesla, Zagreb; Gordan Ježić, 2011-2013)

Policy Based Resource Control for complex IP networks (PBRC) (Ericsson Nikola Tesla, Zagreb; Maja Matijašević, 2010-2013)

Looking into the Future (Croatian Post and Electronic Communications Agency (HAKOM), Gordan Ježić, 2011-2013)

iOS based applications: MobileX (Ericsson Nikola Tesla, Zagreb; Mario Kušek, 2013)

International Links

AIT – Athens Information Technology, Greece

The Boeing Company, Anaheim, California, USA

Center for Advanced Computer Studies, University of Louisiana at Lafayette, USA

Center for Global Computing, École Polytechnique Fédérale de Lausanne, Switzerland

Department of Intelligence Science and Technology, Kyoto University, Japan

Department of Telecommunications, Budapest University of Technology and Economics, Hungary

DERI - Digital Enterprise Research Institute, Galway, Ireland

Distributed Information Systems Laboratory, École Polytechnique Fédérale de Lausanne, Switzerland

Fakulteta za elektrotehniko, računalništvo in informatiko, Univerza v Mariboru, Slovenia

Fakulteta za elektrotehniko, Univerza v Ljubljani, Slovenia

Fakulteta za računalništvo in informatiko, Univerza v Ljubljani, Slovenia

FreeBSD Foundation, Boulder, Colorado, USA

FTW - Forschungszentrum Telekommunikation Wien, Vienna, Austria

Institut für informationssysteme, Technische Universität Wien, Austria

Institut für Angewandte Informationsverarbeitung und Kommunikationstechnologie, Technische Universität Graz, Austria

Institut für Breitbandkomunikation, Technische Universität Graz, Austria

Institute of Telecommunications, Technische Universität Wien, Austria

Instituto de Telecomunicações, Aveiro, Portugal

International Computer Science Institute, University of California, Berkeley, USA

ISCOM - Istituto Superiore delle Comunicazioni e delle Tecnologie dell'Informazione, Rome, Italy

Karlstad University, Sweden

KES International, UK

Knowledge-Based Intelligent Engineering Systems Centre, University of South Australia, Adelaide, Australia

KTH - Kungliga Tekniska Högskolan, Stockholm, Sweden

Linköping University, Sweden

Mälardalen University, Västerås, Sweden

Technische Universität Braunschweig, Germany

Universidad Politécnica de Cartagena, Spain

University of Applied Sciences, Leipzig, Germany

University of Bristol, UK

University of Denver, USA

University of Oslo, Norway

Universität Wien, Austria

Visage Technologies, Linköping, Sweden

5.8. Department of Electronic Systems and Information Processing

Faculty and Staff
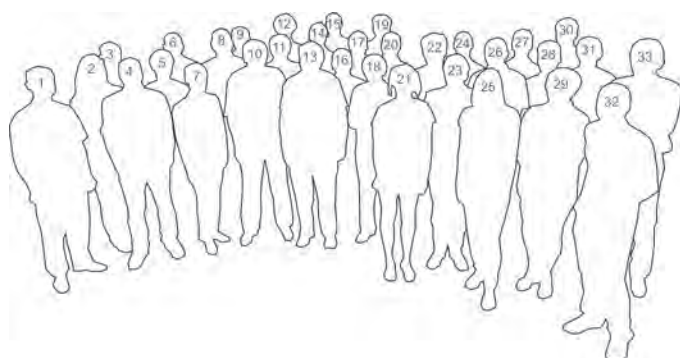
▼ Professors

Vedran Bilas – electronic instrumentation and measurements, biomedical engineering

Mario Cifrek – electronic instrumentation and measurements, biomedical engineering

Founded in 1943

Head of Department:
Prof. **Damir Seršić**, Ph.D.

Phone: +385 1 6129 911
Fax: +385 1 6129 652
E-mail: zesoi@fer.hr
Web: www.zesoi.fer.hr

1 Mario Cifrek   2 Vana Jeličić   3 Igor Lacković
4 Dinko Oletić   5 Neda Tomaš   6 Tomislav Petković
7 Željka Lučev Vasić   8 Darko Vasić   9 Davorin Ambruš
10 Branko Jeren   11 Zvonko Kostanjčar   12 Marijan Kuri
13 Vladimir Naglić   14 Marko Subašić   15 Marko Butorac
16 Ratko Magjarević   17 Tomislav Pribanić

18 Hrvoje Babić   19 Mile Šikić   20 Vedran Bilas
21 Ana Sović   22 Mladen Vučić   23 Davor Petrinović
24 Tihomir Marjanović   25 Vedrana Baličević
26 Damir Seršić   27 Nikola Banić   28 Hrvoje Kalinić
29 Vesna Kezdorf   30 Hrvoje Džapo   31 Juraj Petrović
32 Luka Celić   33 Neven Mijat

Branko Jeren – network and system theory, signal processing

Sven Lončarić – signal and image processing, computer vision, intelligent systems

Ratko Magjarević – electronic and computerised instrumentation, biomedical engineering, minimally invasive methods and devices

Neven Mijat – electrical network, system theory and signal processing

Davor Petrinović – digital signal and speech analysis and processing

Damir Seršić – digital signal and image processing

Mladen Vučić – analogue and digital signal processing, digital system design

▼ Associate Professors

Dražen Jurišić – analog signal processing and filtering

Igor Lacković – electronic instrumentation and measurements, biomedical engineering

▼ Assistant Professors

Hrvoje Džapo – electronic instrumentation and measurements, embedded systems

Zvonko Kostanjčar – complex systems, computational finance

Tomislav Pribanić – computer vision, image processing and analysis, motion analysis

Marko Subašić – digital image processing and analysis, image segmentation

Mile Šikić – bioinformatics and computational biology

Darko Vasić – electronic instrumentation and measurements, signal processing

▼ Retired Professors

Hrvoje Babić – member of the Croatian Academy of Science and Arts

Stanko Tonković – professor emeritus

Vladimir Naglić – distinguished professor

Zoran Stare

▼ Senior Assistants

Hrvoje Kalinić
Tihomir Marjanović
Ana Sović

▼ Research Assistants

Vedrana Baličević
Marko Butorac
Luka Celić
Vana Jeličić
Željka Lučev Vasić
Dinko Oletić
Juraj Petrović

▼ Department Associates

Davorin Ambruš
Nikola Banić
Dominik Džaja
Marijana Fraculj
Ivan Harbaš
Darko Jurić
Ivan Matec
Ivica Medved
Goran Molnar
Predrag Pale
Tomislav Petković
Pavle Prentašić
Kristian Skračić
Goran Šeketa
Goran Živković

▼ Laboratory Support

Marijan Kuri

▼ Administrative Staff

Jasmina Zorko
Neda Tomaš

Educational Activities

Electronic measurement and instrumentation. Measurement systems. Transducers and sensors. Smart sensor systems. Electronic equipment design. Computerized instrumentation. Biomedical engineering and electronics. Biomedical informatics. Computers in medicine. ICT in health care and medicine. Signal and systems theory. Network theory. Digital signal processing. Digital speech processing. Systems for signal processing. Linear and nonlinear electric networks. Telemetry systems. Electrical filters. Numerical methods in electric network and systems design. Embedded system design. Advanced tools for digital system design. Data multimedia transmission and computer networks. Digital image processing. Neural networks. Random processes in systems. Entrepreneurship for engineers. Bioinformatics.

First Cycle Study

▼ Mandatory Courses

- Electrical Circuits
- Embedded Systems
- Fundamentals of Electronic Measurements and Instrumentation
- Information Processing
- Management in Engineering
- Multimedia Technologies
- Signals and Systems

▼ Specialization Courses

- Electronic Equipment Design

▼ Elective Courses

- Computer Aided Design of Electronic Systems

Second Cycle Study

▼ Mandatory Courses

- Laboratory of Electronic and Computer Engineering 1
- Laboratory of Electronic and Computer Engineering 2
- Laboratory of Electronics 1
- Laboratory of Information Processing 1
- Laboratory of Information Processing 2

▼ Theoretical Courses

- Analog and Mixed Signal Processing
- Digital Signal Processing
- Electronic Instrumentation
- Random Processes in Systems
- Signal Processing in Communications

▼ Specialization Courses

- Advanced Digital Signal Processing Methods
- Bioinformatics
- Biomedical Signals and Systems
- Digital Image Processing and Analysis
- Digital Signal Processing Software Design
- Digital Speech Processing
- Electronic Measurements and Components
- Embedded System Design
- Measurement and Process Control Systems
- Networked Sensor Systems
- Neural Networks
- Programming Industrial Embedded Systems
- Sensor Technology
- Tools for Digital Design

▼ Recommended Elective Courses

- Biomedical Informatics
- Biomedical Instrumentation
- Computer Modeling of Physiological Systems
- Electronic Equipment Power Supplies

▼ Humanistic or Social Courses

- Entrepreneurship and Export in High-technologies

Postgraduate Doctoral Study

- Biomechanical and Neurophysiological Mechanisms
- Biomedical Imaging Instrumentation
- Biomonitoring Systems
- Blind Signal Separation and Independent Component Analysis
- Digital Image Analysis
- Digital Signal Processing and Applicating
- Digital Signal Processor Architectures
- Electrical Filters - Selected Topics
- Electrical Filters in Power Systems
- Electrical Instrumentation in Environmental Protection
- Measuring Amplifiers
- Selected Topics in Digital Image Processing

- Signal Theory
- Smart Sensor Networks
- Synthesis of Systems based on Optimization Methods
- Systems for Measurement Nonelectrical Values
- Use of Computers in Medicine

Research and Development

Analogue and digital signal processing in different fields. Digital multi-channel instrumentation systems. Intelligent electronic instrumentation. Pulsed eddy current non-destructive measurement. Distributed systems for analog and mixed signal processing. Design of analog active filters with low sensitivity, low power, low noise and tuneability of filter parameters. Embedded systems. Digital system design. Speech processing. Adaptive, time-variant and non-linear systems. Sparse representations. Multidimensional signal processing. Digital image processing. Computer vision. Pattern recognition. Intelligent systems for 3-D medical image analysis.3-D volume visualisation. Virtual reality and applications in medicine, geography, and education. Information systems and technologies. Complex systems. Computational finance. Computer networks and multimedia. Numerical methods in electrical network and filter design. Bioinformatics. Computational biology. Protein-protein interactions. Biomedical instrumentation design. Bioelectric signal analysis. Bioelectrical impedance measurement and modelling. Bioelectromagnetics. Biomonitoring.

Non-invasive and minimally invasive measurement methods and instrumentation in medicine. Electrical stimulation and cardiac pacing. Human motion and gait analysis. Diffuse infrared biotelemetry. Health technology assessment. Standardisation and safety of electromedical equipment.

▼ Projects

Virtual Physiological Human (EU FP7 Network of Excellence, FER - General Member; Sven Lončarić; 2008-2012)

Advanced Solutions for Supporting Cardiac Patients in rehabilitation (EU FP7 Project; Ratko Magjarević; 2012-2014)

VISTA - Computer Vision Innovations for Safe Traffic (EU IPA Project; Sven Lončarić; 2013-2015)

Intelligent systems for measurement of difficult-to-measure variables (Project 036-0362979-1625, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Vedran Bilas; 2007-2013)

Complex System Modelling (Project 036-0362979-1987, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Branko Jeren; 2007-2013)

Intelligent Methods for Image Processing and Analysis (Project 036-0362979-1989, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Sven Lončarić; 2007-2013)

Systems for Analog and Mixed Signal Processing (Project 036-0362979-2316, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Neven Mijat; 2007-2013)

Noninvasive Measurements and Procedures in Biomedicine (Project 036-0362979-1554, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Stanko Tonković; 2007-2013)

Design and Implementation of Efficient Methods for Digital Signal Processing (Project 036-0362979-2217, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Mladen Vučić; 2007-2013)

Algebraic methods for detection of characteristic segments of bioelectric signals (Bilateral Project; Ratko Magjarević; 2011-2012)

Research of Intrabody Communication for Body Area Networks (Bilateral Project; Mario Cifrek; 2011-2013)

Integrated Systems for Analog and Mixed Signal Processing - Active-RC Filter for ADSL Communication Systems (Bilateral Project; Dražen Jurišić; 2013-2015)

European network for development of electroporation-based technologies and treatments (COST Project; Ratko Magjarević; 2012-2016)

Curricula Reformation and Harmonization in the field of Biomedical Engineering (TEMPUS IV; Ratko Magjarević; 2009-2012)

System for measurement of oxygen and hydrogen produced by metabolism of single-cell photosynthetic organisms (BICRO-PoC, Mario Cifrek, 2011)

Software for early detection of diabetic retinopathy (BICRO-PoC, Sven Lončarić, 2012-2013)

Intelligent room with online reservation system for Callidus Domus Ltd (BICRO-PoC, Ratko Magjarević, 2010-2012)

Self-stabilizing vehicle on one wheel (BICRO-PoC, Damir Seršić, 2011)

Software for detection and recognition of (BICRO-PoC, Marko Subašić, 2011)

Center of Excellence for Computer Vision (University of Zagreb Development Fund, Sven Lončarić, 2012)

WiFi Nurse Call Terminal (Sagena d.o.o., Hrvoje Džapo, 2011-2013)
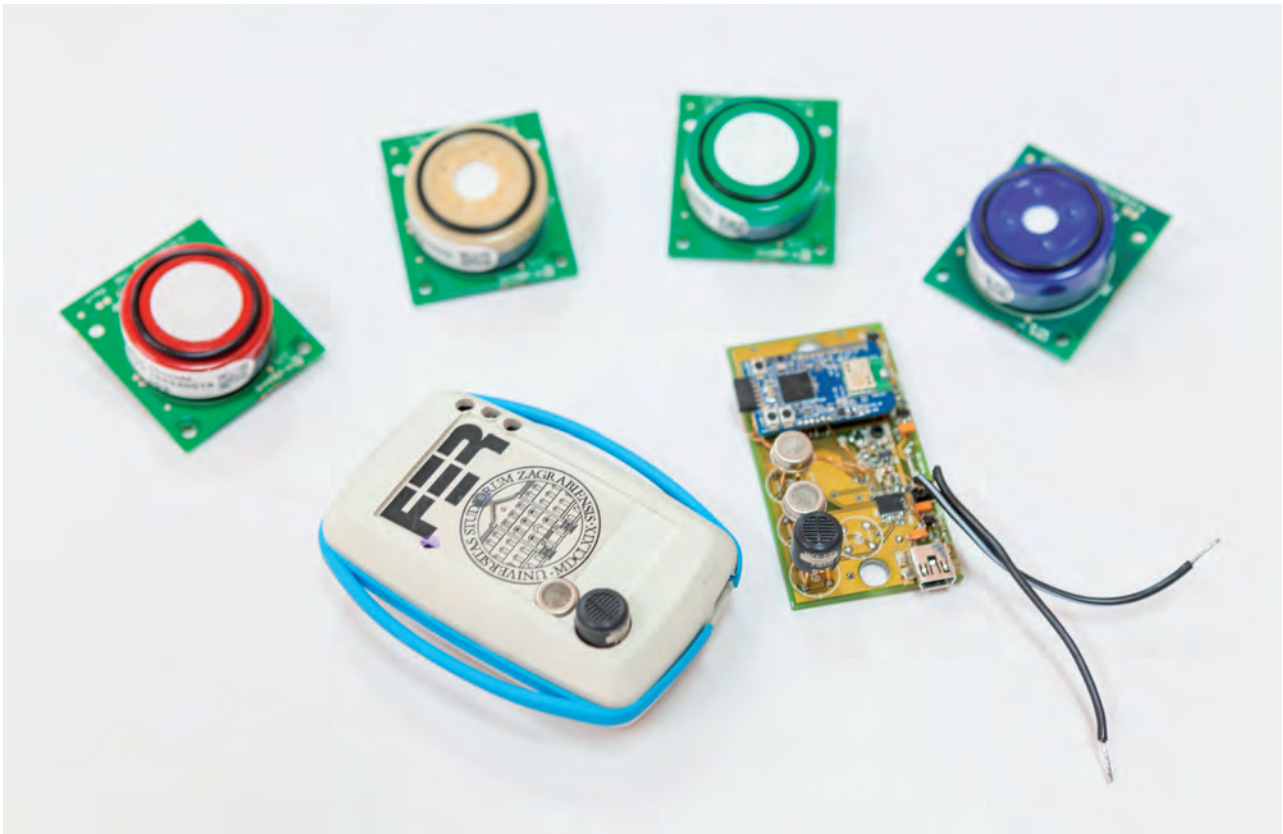
Research and development of an innovative system for identification with biometric data (Equidem d.o.o., Ratko Magjarević, 2012-2014)

Personalized intelligent mobile health system OZIMS (SDinformatika d.o.o., Ratko Magjarević, 2011-2013)

Construction of structured light system using Teledyne DALSA cameras (Teledyne DALSA, Tomislav Pribanić, 2012)

Methods and Systems for Automated Visual Inspection (Elektrokontakt, Sven Lončarić, 2010-2014)

Biomonitoring of physiological functions and environment in management of asthma (RECRO-NET, Vedran Bilas, 2010-2013)

International Links

Bar-Ilan University, Ramat-Gan, Israel
Colorado State University, Fort Collins, USA
Eidgenössische Technische Hochschule (ETH), Zürich, Switzerland

Fuzhou University, Fuzhou, China
Polytechnic University of Madrid, Spain
Pompeu Fabra University, Barcelona, Spain
Pontificia Universidad Javeriana, Bogota, Colombia
Royal Institute of Technology, Stockholm, Sweden
Star Bioinformatics Institute, Singapore
Tampere University of Technology, Tampere, Finland
TechnischeUniversität Graz, Graz, Austria
The Chinese University of Hong Kong, China
Universite de Reims Champagne Ardenne, UFR des Sciences ExactesetNaturelles, France
University of California, Berkeley, USA
University of California, Los Angeles, USA
University of California, Santa Barbara, USA
University of Cincinnati, Cincinnati, USA
University of Girona, Spain
University of Macau, Macau, China
University of Patras, Greece
University of Szeged, Szeged, Hungary
University of Technology and Economics, Budapest, Hungary
Univerza v Ljubljani, Ljubljana, Slovenia

5.9. Department of Control and Computer Engineering

Faculty and Staff

▼ Professors

Danko Basch – programming language design, modelling and simulation of computer architectures, hardware description languages

Stjepan Bogdan – discrete event systems, flexible manufacturing automation, intelligent control, supervisory control, multi-agent formation control, Unmanned Aerial Vehicles

Founded in 1954

Head of Department:
Assoc. Prof. **Hrvoje Mlinarić**, Ph.D.

Phone: + 385 1 6129 795
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E-mail: zari@fer.hr
Web: www.fer.hr/zari
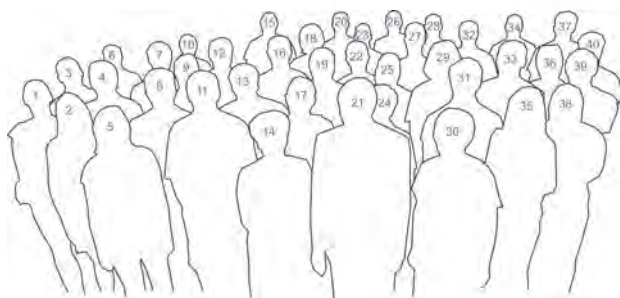
1 Marija Đakulović   2 Tihana Sesar   3 Alan Mutka
4 Nikola Mišković   5 Tamara Petrović   6 Mario Bukal
7 Đula Nađ   8 Mario Žagar   9 Nikola Stilinović
10 Ivana Palunko   11 Zoran Vukić   12 Antonio Vasilijević
13 Goran Vasiljević   14 Blanka Gott   15 Frane Petric

16 Ivan Petrović   17 Željkica Šikuten   18 Vlaho Petrović
19 Damir Josić   20 Igor Cvišić   21 Nedjeljko Perić
22 Tomislav Pavlović   23 Daniel Hofman
24 Zrinka Plodinec   25 Tamara Hadjina   26 Martin Žagar
27 Ivan Maurović   28 Josip Knezović   29 Mato Baotić
30 Mirjana Stjepanović   31 Mladen Đalto   32 Robi Turnar
33 Srećko Jurić-Kavelj   34 Antonio Starčić
35 Anita Martinčević   36 Kristina Radoš Cvišić
37 Domagoj Herceg   38 Ivana Bosnić
39 Danko Basch   40 Igor Čavrak

Mario Kovač – computer architectures, multimedia algorithms and architectures, large scale information systems, medical information systems, smart card applications

Zdenko Kovačić – intelligent and adaptive control, industrial and mobile robotics, artificial intelligence-based control, electrical drives and servo systems, virtual reality-based systems

Nedjeljko Perić – estimation and system identification, advanced control strategies, plant and process automation, servo drives and servo systems, control of renewable energy sources

Ivan Petrović – advanced control, optimal estimation, autonomous mobile robots, networked robotic systems, intelligent space

Zoran Vukić – adaptive and robust control, fault tolerant and intelligent control, non-linear and stochastic control, guidance and control of marine vehicles

Mario Žagar – microcomputer architectures, real-time microcomputer systems, distributed computing (ubiquitous, pervasive) and distributed measurements/control, design automation, open computing, e-learning
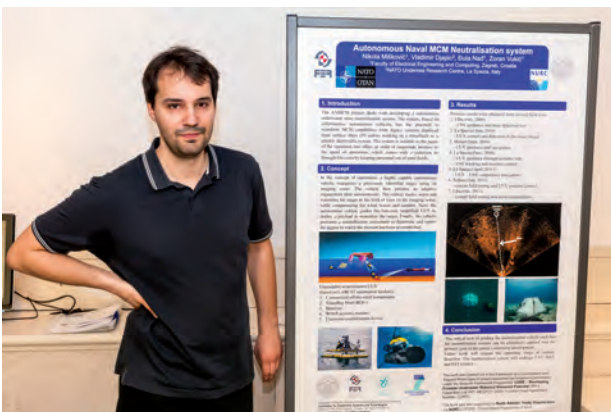
Associate Professors

Željko Ban – modeling and simulation, intelligent and model reference adaptive control, optimization of control algorithm parameters, control of the fuel cell and photo voltaic based energy sources, alarm systems

Mato Baotić – mathematical programming, hybrid systems, optimal control, model predictive control

Hrvoje Mlinarić – computer architectures, embedded system design, programmable logic, system on chip

Mario Vašak – predictive control, renewable energy systems control, energy-efficient buildings control, energy management systems

Assistant Professors

Igor Čavrak – distributed intelligent systems, pervasive computing, software engineering

Josip Knezović – Computer architecture, high-level compilation for embedded systems, multimedia processing, homogeneous and heterogeneous parallel computers

Nikola Mišković – nonlinear control systems; guidance, navigation and control of marine vehicles; marine systems and technologies

Retired Professors

Gabro Smiljanić – computer architectures, real-time microcomputer systems, modelling and simulation

Ljubomir Kuljača – Nonlinear control, ship automation, application of control theory to marine vessels

Senior Assistants

Marija Đakulović

Andrej Kitanov

Damjan Miklić

Martin Žagar

Research Assistants

Ivana Bosnić

Igor Cvišić

Karlo Griparić

Marko Gulin

Tamara Hadjina

Tomislav Haus

Domagoj Herceg

Daniel Hofman

Nikola Hure

Luka Lednicki

Vinko Lešić

Ivan Marković

Ivan Maurović

Alan Mutka

Matko Orsag

Tomislav Pavlović

Tamara Petrović

Vlaho Petrović

Vedrana Spudić

▼ Department Associates

Goran Banjac

Mario Bukal

Josip Ćesić

Mladen Đalto

Igor Horvat

Edin Kočo

Josipa Kuzmić

Kruno Lenac

Anita Martinčević

Đula Nađ

Branimir Novoselnik

Ivana Palunko

Frano Petric

Kristina Radoš Cvišić

Vasko Sazdovski

Tihana Sesar

Antonio Starčić

Nikola Stilinović

Mirjana Stjepanović

Domagoj Tolić

Robi Turnar

Antonio Vasilijević

Goran Vasiljević

### ▼ Laboratory Support

Damir Josić

▼ Administrative Staff

Blanka Gott

Snježana Poljak

Educational Activities

Theory of automatic control. Non-linear and optimal control. Adaptive and robust control. System identification and state estimation. Computer controlled systems. Neural and fuzzy control. Predictive control. Process identification. Mathematical modelling and simulation. Fault tolerant systems. Process automation. Servo systems. Robotics and flexible manufacturing systems. Service robotics. Ship automation. Security and alarm systems. Intelligent measurement in control systems. Digital computer and advanced computer concepts. Microcomputers. Real-time operation of digital computers. Computer architecture. Computer networks. Computer aided design. Multimedia systems and applications. Embedded and smart card systems.
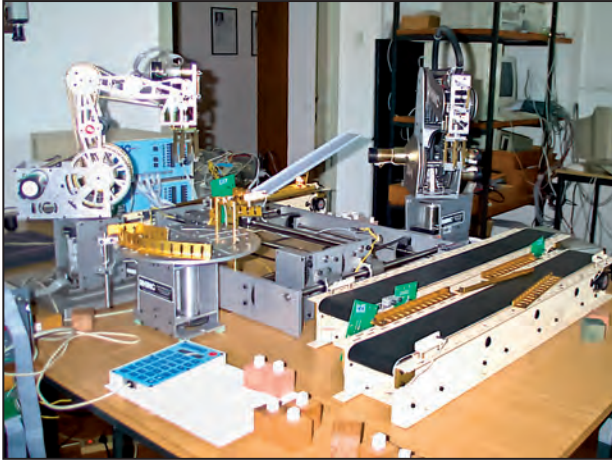
Computer programming languages and operating systems. Software engineering. Open systems. Open computing. E-learning. Wireless sensor networks.

First Cycle Study

▼ Mandatory Courses

- Automatic Control
- Computer Architecture 1
- Computer-Controlled Systems
- Control System Elements
- Embedded Systems
- Laboratory and Skills - Matlab
- Multimedia Technologies
- Open Computing

▼ Elective Courses

- Alarm Systems
- Automation Practicum
- Fundamentals of Intelligent Control Systems
- Robotics Practicum

Second Cycle Study

▼ Mandatory Courses

- Laboratory of Computer Engineering 1
- Laboratory of Control Engineering and Automation 1
- Laboratory of Control Engineering and Automation 2

▼ Theoretical Course

- Computers and Processes
- Control of Electrical Drives
- Estimation Theory
- Fundamentals of Robotics
- Linear Control Systems Design
- Multimedia Architecture and Systems
- Nonlinear Control Systems

▼ Specialization Courses

- Adaptive and Robust Control
- Discrete Event Systems
- Distributed Software Development
- Mobile Robotics
- Process Automation
- System Level Integration
- Systems Modeling and Simulation

▼ Recommended Elective Courses

- Guidance and Control of Marine Vehicles
- Intelligent Control Systems
- Manufacturing Systems Design
- Robotic Systems Control

Postgraduate Doctoral Study

- Adaptive and Robust Control - Selected topics
- Applied Estimation Techniques
- Control of Autonomous Systems
- Control of Electromechanical Systems
- Control of Renewable Energy Sources
- Control of Robotized Plants
- Discrete Event Control Systems
- Model Predictive and Optimal Control
- Modeling and Simulation - Selected Topics
- Multimedia Computer Systems
- Nonlinear Control Systems
- Software Processes
- The Reference Model Adaptive Control Methods
- Ubiquitous Computing

Research and Development

Optimal, adaptive and robust control strategies and their applications to control complex technical systems. Application of fuzzy logic, neural networks and genetic algorithms in the control systems. System identification and optimal estimation. Automation of

systems with discrete events and flexible manufacturing systems. Modelling and control of hybrid systems. Supervisory control (e.g. multi-AGV systems, wireless sensor networks). Virtual reality and Internet-based remote motion control. Failure detection, isolation and accommodation in marine vehicles and power plant systems. Integration of communication and control systems in plant automation. Intelligent measurement systems, multi-sensor fusion. Vision based control. Navigation and control of mobile autonomous sensory-based systems. Distributed control systems for rail vehicles. Public lighting systems. Control of renewable energy systems: wind turbines wind farms, solar energy systems, generator systems based on the oceanic tidal and wave energy. Control of fuel cells with applications in power and transport systems. Secondary regulation of frequency and power exchange in power systems. Development of embedded systems, application-specific computer architectures, and microprocessor architecture design. Research in pervasive, ubiquitous computing, Immune systems in wireless sensor networks. Research of multimedia system architectures and algorithms for parallel processor architectures. Data compression. Visual data processing in medical applications. Smart card and information systems based on smart card technology. Development of hardware description languages for digital system design. Development of computer-aided design tools. Methods for modelling and simulation of computer systems. Data encryption methods and applications. Object-oriented distributed systems. Remote data acquisition and measurement systems. Electronic commerce – electronic payment systems. Fast volume rendering and compression. Medical information systems. Telemedicine. Cooperation with EU partners in setting up EU standards for European Education Connectivity Solution. SearchMe, interactive database of products and services of ICT industry- easy search of business partners in Croatian region – prerequisite for clustering of industry SME's. Collaborative internationalisation of software engineering in Croatia. Software engineering competence centres. E-learning and rich content. Development of advanced e-learning services to integrate content and increase its availability.

▼ Projects

ACROSS - Centre of Research Excellence for Advanced Cooperative Systems (EU FP7 SSA project, SP4-Capacities, Project No.: 285939, Project Coordinator: Ivan Petrović, 2011-2015)

EC-SAFEMOBIL - Estimation and Control for Safe Wireless High Mobility Cooperative Industrial Systems (EU FP7 IP project, ICT, Project No.: 288082, FER Project leader: Zdenko Kovačić, 2011-2015)

ThermalMapper - Thermal 3D Modeling of Indoor Environments for Saving Energy (SEE-ERA.net PLUS, FER Project leader: Ivan Petrović, 2010-2012)

MONGS - Monitoring of Wind Turbine Generator Systems (SEE-ERA.net PLUS, FER Project leader: Mario Vašak, 2010-2012)

AEOLUS - Distributed control of large-scale offshore wind farms (EU FP7 Cooperation, STREP project, FP7-ICT-2007-2, Project No.: 224548, FER Project leader: Nedjeljko Perić, 2008-2011)

CURE - Developing the Croatian underwater robotics research potential (EU FP7 Research Potential, Support Action project, FP7-ICT-2007-2, Project No.: 229553, Project coordinator: Zoran Vukić, 2009-2012)

HYCON2 - Highly-complex and networked control systems (EU FP7 Project; Zoran Vukić, 2010-2014)

EECS - European education connectivity solution (EU FP7 Co-operative Research, Research for SMEs, Project No.: 232324, FER Project leader: Mario Kovač, 2009-2011)

CART - Cooperative Autonomous Robotic Towing system (EU FP7 Project; Zoran Vukić, 2011-2013)

UrbanWater - Intelligent Urban Water Management System (EU FP7 Project; Mario Vašak, 2012-2015)

ASSISI - Animal and Robot Societies Self-organise and Integrate by Social Interaction (EU FP7 Project; Stjepan Bogdan, 2013-2018)

EUROFLEETS2 - New Operational Steps Towards an Alliance of European Research Fleets (EU FP7 Project; Zoran Vukić; 2013-2017)

UReady4OS - Autonomous underwater vehicles ready for preparedness for oil spills (EU ECHO project: Zoran Vukić, 2014-2016)

BtS – Breaking the surface (Office of Naval Research Global project; Zoran Vukić, 2012-2014)

DYMASOS - Dynamic Management of Physically Coupled Systems of Systems (EU FP7 Project; Mato Baotić; 2013-2016)

CADDY - Cognitive autonomous diving buddy (EU FP7 Project; Nikola Mišković; 2014-2016)

Will4Wind - Weather Intelligence for Wind Energy (IPA Project; Mario Vašak; 2013-2015)

Enhancement of Research, Development and Technology Transfer Capacities in Energy Management Systems for Buildings (ENHEMS-Buildings - IPA Project; Mario Vašak; 2013-2015)

Centre of Excellence for Structural Health (CEEStructHealth - IPA Project; Mario Vašak; 2013-2015)

Electronic differential for small electric car (HRZZ project - Croatian Science Foundation, Project leader: Stjepan Bogdan, 2010-2012)

Advanced control and estimation strategies in complex systems (project 036-0361621-3012, Ministry of Science Education and Sports, Republic of Croatia, Principal investigator: Nedjeljko Perić, 2007-2013)

Architectures of integrated computer and communication systems and services (project 036-0361959-1971, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Mario Kovač, 2007-2013)

Control of mobile robots and vehicles in unknown and dynamic environments (project 036-0363078-3018, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Ivan Petrović, 2007-2013)

Control system of the fuel cells energy source with the cogeneration (project 036-1201837-3020, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Željko Ban, 2007-2013)

Design and implementation of special purpose programming languages (project 036-0361959-1979, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Danko Basch, 2007-2013)

Integrated control of robotic systems in complex environments (project 036-0363078-3017, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Zdenko Kovačić, 2007-2013)

RoboMarSec - Underwater robotics in sub-sea protection and maritime security (project 036-0362975-2999, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Zoran Vukić, 2007-2010)

Software engineering in ubiquitous computing (project 036-0361959-1965, Ministry of Science,

Education and Sports, Republic of Croatia, Principal investigator: Mario Žagar; 2007-2013)

Task planning & scheduling in robotic and autonomous systems (project 036-0363078-3016, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Stjepan Bogdan, 2007-2013)

Human-in-the-loop Control of Multi-agent Aerial Systems Under Intermittent Communication (Bilateral project with AFRL USA; Stjepan Bogdan, 2013-2015)

DSD - Distributed software development (Swedish-Croatian bilateral project, Mälardalen University, School of Innovation, Design and Engineering, and University of Zagreb Faculty of Electrical Engineering and Computing, Project leaders: Ivica Crnković, Mario Žagar, 2003-present)

DICES - Distributed component-based embedded software systems (Unity through Knowledge Fund, Research Cooperability Programme, UKF 1A Grant Agreement No. 03/07, Project leaders: Ivica Crnković, Mario Žagar, 2008-2011)

Multi criteria wind turbine control (National Foundation for Science, Croatia, and Končar Electrical Industries Inc. Zagreb, Croatia, Partnership in basic research, Principal investigator: Nedjeljko Perić, 2008-2011)

Competence center for software engineering in open systems (establishment funded through EU Tempus project Collaborative internationalisation of software engineering in Croatia, Center head: Mario Žagar, 2009-present

e-Learning now! : Development of advanced e-learning services to integrate available content (e-Učenje sad!, iProjekt, Ministry of science education and sports, Republic of Croatia, Project leader: Mario Žagar, 2008-2009)

System architecture of a new national student smart card in Croatia (Project by Ministry of Science, Education and Sports, Republic of Croatia, Project leader: Mario Kovač, 2005-2010)

Autonomous Surface Platform for Diver Tracking and Navigation (BICRO PoC Project, 2012-2013)

International Links

The University of Texas, The Automation and Robotics Research Institute, Arlington, USA

The University of New Mexico, MARSHES Lab, Albuquerque, USA

The Virginia Polytechnic Institute and State University, The Bradley Department of electrical Engineering, Blacksburg, USA

Eidgenössische Techniche Hochschule Zürich (ETH), Institut für Automatik, and Autonomous Systems Lab, Switzerland

Technische Universität München, Institut für Automatisierungstechnik und Autonome Systeme, Munich, Germany

Anglia Polytechnic University, Department of Design and Technology, Cambridge, United Kingdom

Technical University of Crete - A.B.E.A. - Anatoli S.A., Chania, Greece

Budapest University of Technology and Economics, The department of Mechatronics, Optics and Engineering Informatics, Budapest, Hungary

University of Tokyo, Institute of Industrial Sciences, Tokyo, Japan

University of Paderborn, Paderborn, Germany

United Technologies Research Center (UTRC) Hartford, Connecticut, USA

Aalborg University, The Faculties of Engineering, Science and Medicine, Denmark

Lund University, Department of Automatic Control, Lund Institute of Technology, Sweden

Industrial Systems and Control, Glasgow, Scotland, United Kingdom

Energy research Centre of the Netherlands (ECN), Vestas Wind Systems, Denmark

China University of Mining&Technology, College of Information and Electrical Engineerig, Xuzhou, China

Universität Rostock, Fachbereich Elektrotechnik, Institut für Automatisierungstechnik, Rostock, Germany

Univerza v Mariboru, Fakulteta za elektrotehniko, računalništvo in informatiko, Maribor, Slovenia

Univerza v Ljubljani, Fakulteta za elektrotehniko, Ljubljana, Slovenia

Sveučilište u Mostaru, Fakultet strojarstva i računarstva, Mostar, Bosnia and Herzegovina

Mälardalen University (MdH), Department of Computer Science and Engineering, Västerås, Sweden

Ford Motor Company, Scientific Research Laboratory, Dearborn, Michigan, USA

IFAC – International Federation of Automatic Control

Technische Universität Wien (Vienna University of Technology), Faculty of Electrical Engineering and Information Technology, Vienna, Austria

University of Montenegro, Faculty of Electrical Engineering, Podgorica, Montenegro

Wroclaw University of Technology, Institute of Electrical Machines, Drives and Measurements, Wroclaw, Poland

China University of Mining and Technology, School of Chemical Engineering and Technology, Xuzhou, China

United Technologies Research Center, East Hartford, Connecticut, USA

Aalborg University, Department of Electronic Systems, Aaalborg, Denmark

Lund University, Faculty of Engineering, Department of Automatic Control, Lund, Sweden

Industrial Systems and Control Ltd., Glasgow, Scotland, UK

Energy research Centre of the Netherlands, Petten, the Netherlands

Vestas Wind Systems A/S, Denmark

University of Tokyo, Institute of Industrial Science, Tokyo, Japan

Aurora Trust, Key Largo, Florida, USA

NATO Undersea Research Centre, La Spezia, Italy

Office of Naval Research Global, London,UK

Consiglio Nazionale delle Ricerche - Istituto di Studi sui Sistemi Intelligenti per l'Automazione, Genova, Italy

University of Limerick, Mobile Marine Robotics Research Centre, Limerick, Ireland

Instituto Superior Tecnico, Institute for Systems and Robotics, Dynamical Systems and Ocean, Robotics Lab, Lisboa, Portugal

University of Girona, Girona, Spain

Università politecnica delle Marche, Ancona, Italy

Albert-Ludwigs-Universität Freiburg, Institut für Informatik, Autonome Intelligente Systeme, Germany

Kungliga Tekniska Högskolan (The Royal Institute of Technology), Centre for Autonomous Systems, Stockholm, Sweden

Technical University of Crete, Machine Tools Lab and Intelligent Systems and Robotics Lab, Chania, Greece

Eindhoven University of Technology, Department of Electrical Engineering – Control Systems, the Netherlands

Politecnico di Bari, Dipartimento di Elettrotecnica ed Elettronica, Italy

Politecnico di Milano, Dipartimento di Ingegneria Aerospaziale, Italy

University of Seville, Dpto. Ingeniería de Sistemas y Automática, Spain

Shanghai Jiao Tong University, Shanghai, China

JACOBS University Bremen, Germany

5.10. Department of Electroacoustics
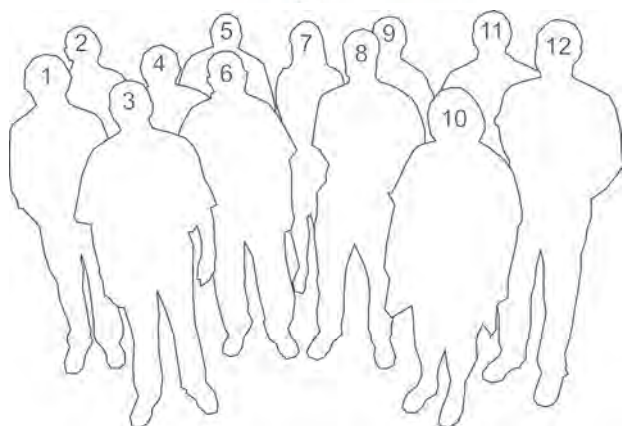
Faculty and Staff

▼ Professors

Hrvoje Domitrović – audio technique, sound reinforcement, loudspeakers, acoustical designing, sound recording and editing, broadcasting systems, audio in multimedia

Founded in 1954

Head of Department:
Prof. **Siniša Fajt**, Ph.D.

Phone:	+ 385 1 6129 640
Fax:	+ 385 1 6129 680
E-mail:	predstojnik.zea@fer.hr
Web:	www.zea.fer.hr

1 Darko Gašparović   2 Miljenko Krhen
3 Bojan Ivančević   4 Siniša Fajt
5 Hrvoje Domitrović   6 Branko Somek
7 Sanja Grubeša   8 Marko Horvat
9 Antonio Petošić   10 Ljubica Konjević
11 Kristian Jambrošić   12 Ivan Đurek

Bojan Ivančević – electroacoustics, general acoustics, psychoacoustics, digital audiotechnique, ultrasound, hydroacoustics, architectural acoustics

Associate Professors

Ivan Đurek – audio equipment, transducers, audio signal processing

Siniša Fajt – electroacoustics, digital sound processing, speech and hearing, acoustical measurements, architectural acoustics, professional audio technique

Kristian Jambrošić – architectural acoustics, psychoacoustics, acoustic measurements, electroacoustics

Assistant Professors

Antonio Petošić – electromechanical characterization of ultrasound systems used in medicine and industry, nonlinear time series analysis, numerical modelling in acoustics

Retired Professors

Ivan Jelenčić – acoustics, electroacoustics, radiocommunications-receivers

Branko Somek – acoustics, electroacoustics, audiotechnics

Senior Assistants

Sanja Grubeša

Mia Suhanek

Assistants

Karlo Filipan

Miljenko Krhen

Department Associates

Marko Horvat

Laboratory Support

Darko Gašparović

Administrative Staff

Ljubica Konjević

Educational Activities

Acoustics: physical acoustics, hearing acoustics, speech and musical acoustics, speech recognition,

architectural and building acoustics, control of noise and vibrations, infrasound and ultrasound in industry and medicine, prediction and measurement of noise pollution, audiology and audiometry, analysis and synthesis of speech and music, acoustical measurements.

Electroacoustics: electro-mechano-acoustical analogies, microphones, loudspeakers and enclosures, headphones, analogue and digital sound recording and reproduction, sound reinforcement in closed and open spaces, audio and data signal processing, sound systems, audio measurements.

Multimedia communications: digital audio broadcasting, radio receiver techniques, communication receivers and measurements, surround sound, multichannel recording and reproduction, movie and TV sound, Internet audio, broadband transmission of sound with GSM, sound broadcasting systems and facilities.

First Cycle Study

▼ Specialization Courses

- Audiotechnics
- Electroacoustics

▼ Elective Courses

- Audio and Computers
- Sound and Environment
- Transmission of Audio

▼ Skills

- Basics of Sound Recording and Processing

Second Cycle Study

▼ Mandatory Courses

- Laboratory of Electronics 1

▼ Theoretical Courses

- Audiosystems

▼ Specialization Courses

- Analysis and Processing of Audio Information
- Digital Audio Technique
- Sound Quality in Broadcasting

Recommended Elective Courses

- Communication Acoustics
- Professional Audio Devices
- Room Acoustics
- Sound Reinforcement
- Speech and Musical Acoustic
- Ultrasound in Technique and Medicine

Skills

- Basics of Sound Recording and Processing

Postgraduate Doctoral Study

- Acoustical Design
- Audio Forensics
- Audiocommunications
- Electroacoustical measurements
- Electroacoustical Transducers and Systems
- Hearing Acoustics
- Noise and Vibration
- Receiver Technics in Digital Transmission
- Sound in Architecture
- Sound in Multimedia Systems
- Ultrasonic Systems

Research and Development

Investigation of problems in acoustics, electroacoustics and audiotechnics. Physical and physiological acoustics, surface acoustics waves, acoustical optics, hearing, speech intelligibility, audiology and audiometry, radiation of sound, architectural acoustics, problems of noise and noise control, hydroacoustics, ultrasound applications in medicine, pharmacy and industry, control rooms, sound studios and public address systems. Techniques of high fidelity, sound reproduction systems, analogue and digital processing of sound, audio amplifiers. Problems of communication, consumer receivers and receiver system planning. Digital audio signal processing in radiocommunications. Digital audio transmission and receiving. Engineering of components, equipment and systems in audio and radio receivers and radio broadcasting. Psychoacoustical models of the hearing process and their application in the recording, transmission, editing and reproducing of audio signal. Sound processing in multimedia. Development and measurement of acoustical components, equipment and spaces. Measurement and estimation of sound quality.

Projects

COST Action TU0901: Integrating and Harmonizing Sound Insulation Aspects in

Sustainable Urban Housing Constructions (FER project partner: Marko Horvat, 2009-2013)

Analysis and synthesis of ultrasound field for application on tissue (Project 036-1080231-1646, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Bojan Ivančević, 2007-2013)

Estimation, monitoring and noise control (Project 036-0361630-1633, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Hrvoje Domitrović, 2007-2013)

Acoustic characteristics of composite elements in civil engineering (Project 036-0821504-2319, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Kristian Jambrošić, 2007-2013)

Soundscape of European Cities and Landscapes - COST TD0804 (MC Members: Kristian Jambrošić, Hrvoje Domitrović, 2008-2012)

International Links

Acoustical Society of America (ASA), New York, USA

Acoustics and Thermal Physics Section, KU Leuven, Belgium

Akustik Buero Oldenburg, Germany

Audio Engineering Society (AES), New York, USA

Austrian Acoustics Association (AAA), Vienna, Austria

DEGA, University of Oldenburg, Germany

Department of Electronic Systems, Aalborg University, Denmark

Erich-Thienhaus-Institut, Hochschule für Musik Detmold, Germany

European Acoustical Society (EAA), Madrid, Spain

Institut für technische Akustik der RWTH, Aachen, Germany

Institut für allg. Elektrotehnik und Akustik, Bochum, Germany

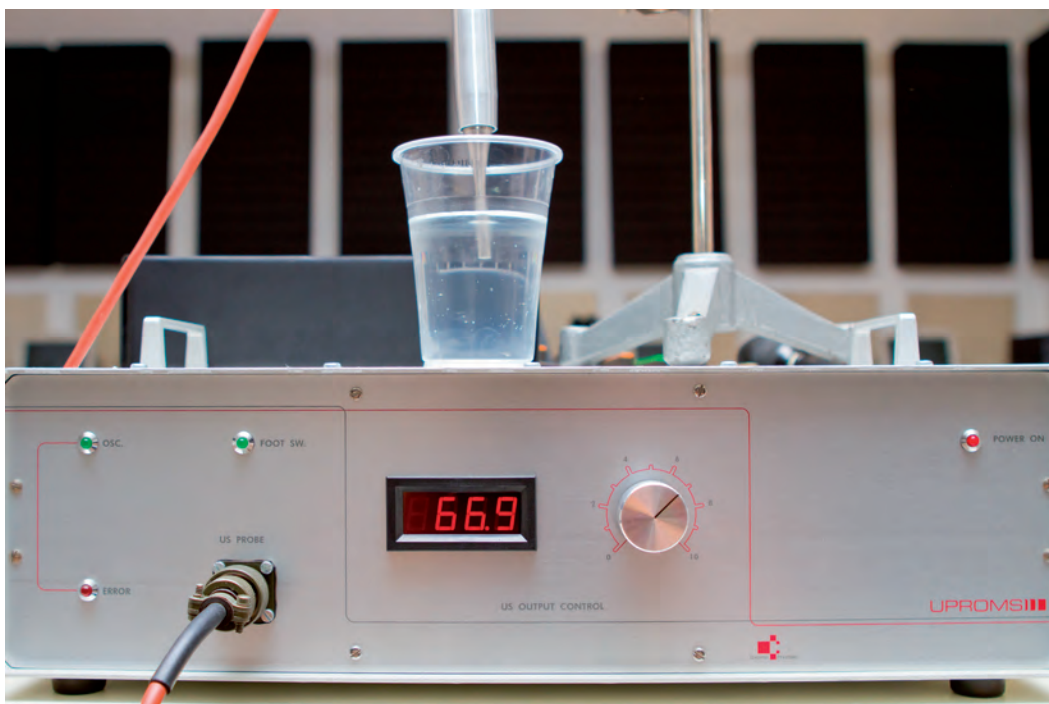Institut für Allgemeine Physik, TU Vienna, Austria

International Institute for Acoustics and Vibration (IIAV), USA

IT University of Goteborg, Sweden

Queen Mary University, London, UK

Research Group Acoustics, INTEC, Ghent University, Belgium

Slovenian Acoustical Society (SAS), Ljubljana, Slovenia

DEPARTMENT OF ELECTROACOUSTICS

5.10.

5.11. Department of Electronics, Microelectronics, Computer and Intelligent Systems

Faculty and Staff

▼ Professors

Adrijan Barić – modelling of electronic devices, design and modelling of integrated circuits, passive components and interconnect, electromagnetic compatibility
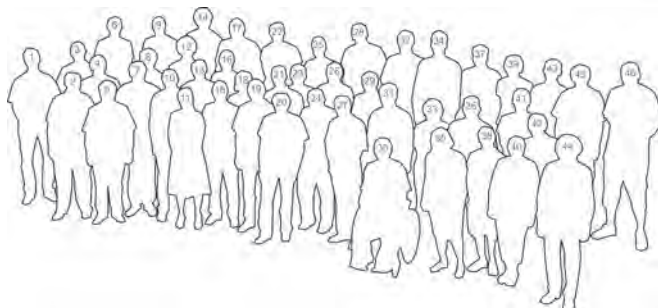
Founded in 1943

Head of Department: Assoc. Prof. **Marin Golub**, Ph.D.

Phone:	+ 385 1 6129 935
Fax:	+ 385 1 6129 653
E-mail:	zemris@fer.hr
Web:	www.zemris.fer.hr

1 Tomislav Suligoj   2 Siniša Srbljić   3 Siniša Šegvić
4 Tihomir Knežević   5 Željko Butković   6 Domagoj Jakobović
7 Igor Krois   8 Josip Bačmaga   9 Ivan Filković
10 Marin Golub   11 Željka Mihajlović   12 Tvrtko Mandić
13 Marko Koričić   14 Ivan Krešo   15 Vlado Glavinić
16 Mario Križan   17 Mirko Poljak   18 Marija Marčetić
19 Nikola Bogunović   20 Slobodan Ribarić   21 Alan Jović
22 Josip Žilak   23 Tomislav Hrkać   24 Leo Budin

25 Sanja Žonja   26 Marko Čupić   27 Petar Biljanović
28 Goran Delač   29 Leonardo Jelenković
30 Ivan Budiselić   31 Goran Glavaš   32 Zvonimir Pavlić
33 Mladen Karan   34 Artur Šilić   35 Dubravka Bernat
36 Dejan Škvorc   37 Marin Šilić   38 Marijo Maračić
39 Klemo Vladimir   40 Đurđica Dandić
41 Darijan Marčetić   42 Zoran Kalafatić
43 Danko Ivošević   44 Adrijan Barić   45 Branko Filipčić
46 Markan Lopar

Nikola Bogunović - formal methods in system design, model based design, model based reasoning, knowledge based systems, knowledge discovery

Željko Butković – electronic devices and circuits, microelectronic analog and digital circuits, CAD in microelectronics

Bojana Dalbelo Bašić – artificial intelligence, machine learning, data and text mining, natural language processing, information retrieval

Vlado Glavinić – e-learning and m-learning systems, human-computer interaction, mobile applications and interfaces, Semantic Web.

Željka Mihajlović – computer graphics, visualization, animation, virtual reality

Slobodan Ribarić – computer architecture, digital system design, pattern recognition, biometrics, computer vision, artificial intelligence, intelligent systems, autonomy oriented computing

Siniša Srbljić – Consumerization of innovation; Consumer computing; Socially intelligent computing; Programming language translation; Theory of computing.

▼ Associate Professors

Marin Golub – operating systems, computer security, evolutionary computation

Domagoj Jakobović – evolutionary computation, parallel and distributed computation

Zoran Kalafatić – computer vision, pattern recognition

Vlado Sruk – software and hardware reliability, design methodologies, embedded systems and information technology, storage systems

Tomislav Suligoj – advanced electron devices, semiconductor fabrication technology, simulation modeling and characterization, solid state circuit design

Siniša Šegvić – computer vision, autonomous navigation, software design, computer architecture

▼ Assistant Professors

Ante Đerek – computer network security, privacy, foundations of cryptography

Stjepan Groš – computer networks and internet, operating systems, security

Tomislav Hrkać – computer architecture, computer vision, intelligent systems

Leonardo Jelenković – operating systems, embedded operating systems

Marko Koričić – advanced semiconductor devices and structures; integration of bipolar and CMOS technologies; characterization and numerical simulation of electron devices

Igor Krois – analog design

Dejan Škvorc – service-oriented computing, mobile computing, geolocation-specific web services

Jan Šnajder – natural language processing, text mining, information retrieval

▼ Retired Professors

Petar Biljanović – electronic devices, solid state circuits, microelectronics

Leo Budin – operating systems, computational methods in science and engineering, real time systems

Julijana Divković-Pukšec - electronic devices, solid state circuits, VLSI physical design

Uroš Peruško – digital systems, memory structures, computer systems reliability

Joško Radej – digital systems, computational engineering

▼ Senior Assistants

Vladimir Čeperić

Marko Čupić

Danko Ivošević

Alan Jović

Tvrtko Mandić

Darijan Marčetić

Mirko Poljak

Miroslav Popović

Marin Šilić

Sanja Žonja

▼ Assistants

Raul Blečić

Tihomir Knežević

Zvonimir Pavlić

Klemo Vladimir

▼ Research Assistants

Niko Bako

Ivan Budiselić

Goran Delač

Goran Glavaš

Jurica Kundrata

Artur Šilić

Josip Žilak

▼ Department Associates

Josip Bačmaga

Damjan Bandić

Toni Benussi

Karla Brkić

Ivan Filković

Nikolina Frid

Mladen Karan

Ivan Krešo

Markan Lopar

▼ Laboratory Support

Branko Filipčić

Zvonimir Jakopović

▼ Administrative Staff

Dubravka Bernat

Biljana Geratović Reich

Educational Activities

Electronic devices. Analogue electronics. Microelectronic technology, devices and circuits. Microelectronic standard circuits, ASIC and SoC design. Computer-based circuit analysis. Integrated circuit physical design and verification.

Digital logic design. Computer and communication networks. Internet technologies. E-learning and m-learning. Mobile applications. Web computing. Service-oriented architectures. Network security. Semantic Web. Computer graphics. Visualization. Programming language translation. Theory of computing. Parallel programming. Software and hardware reliability. Embedded systems. Storage systems.

First Cycle Study

▼ Mandatory Courses

- Artificial Intelligence
- Communication Networks
- Computer Architecture 2
- Digital Logic
- Electronics 1
- Electronics 2
- Interactive Computer Graphics
- Introduction to Theoretical Computer Science
- Operating Systems
- Programming Language Translation
- Software Design

DEPARTMENT OF ELECTRONICS, MICROELECTRONICS, COMPUTER AND INTELLIGENT SYSTEMS

5.11.

Elective Courses

- Artificial Intelligence
- Design Patterns in Software Design
- Introduction to Pattern Recognition
- Scripting Languages

Skills

- Advanced Use of Linux Operating System
- Basic Use of Linux Operating System
- Introduction to Java Programming Language
- Introduction to the Scala programming language
- PHP Application Development Basics
- Programming in Haskell
- Solving Optimization Problems Using Evolutionary Computation Algorithms in Java

Second Cycle Study

Mandatory Courses

- Laboratory of Computer Engineering 2
- Laboratory of Computer Science 1
- Laboratory of Computer Science 2
- Laboratory of Electronics 2

- Laboratory of Software Engineering and Information Systems 2

Theoretical Courses

- Advanced Operating Systems
- Computer Aided Analysis and Design
- Computer Systems Reliability
- Digital Microelectronic Circuits
- Digital System Design
- Distributed Systems
- Formal Methods in System Design
- Machine Learning
- Pattern Recognition
- Real-Time Systems

Specialization Courses

- Advanced Computer Networks
- Analog and Mixed-signal Integrated Circuits
- Computer Animation
- Computer Graphics
- Computer Vision
- Expert Systems
- Fuzzy, Evolutionary and Neuro-computing
- Human-Computer Interaction
- Intelligent Multiagent Systems
- Memory Systems
- Microelectronic Devices
- Networked Systems Middleware
- Operating Systems for Embedded Computers
- Parallel Programming
- Service-Oriented Computing
- System Level Integration
- Text Analysis and Retrieval

Recommended Elective Courses

- CAD Procedures in Physical Integrated Circuit Design
- Design of Radio-frequency and Microwave Integrated Circuits
- Electronic Equipment Power Supplies
- VLSI Technology

Skills

- Basic Use of Linux Operating System
- Introduction to Java Programming Language
- Introduction to the Scala Programming Language
- Java and Open Source Technologies in the Enterprise Environment

- PHP Application Development Basics
- Programming in Haskell
- Solving Optimization Problems Using Evolutionary Computation Algorithms in Java

Postgraduate Doctoral Study

- Advanced and Intelligent Networking Technologies
- Algorithms in Embedded Computer Systems
- Biometric-based Security Systems
- Computer and Robot Vision
- Computer Graphics
- Computer System Security
- Distributed Computing Systems
- Dynamic Scene Analysis
- High Speed Integrated Circuits
- Human Computer Interaction
- Knowledge Discovery in Data Sets
- Knowledge Representation in Information Systems
- Microelectronics Circuit Design
- Microelectronics for Computing and Communication Systems
- Models for Representing Images and Video
- Multiprocessors and Parallel Systems
- Processes in Computer Systems
- Programming Language Translation in Distributed Systems
- Reliability and Fault-tolerance of Computer Systems
- Scheduling Algorithms
- Selected Topics in Natural language Processing
- Statistical Methods for Data Mining
- Storage Systems
- Visualization

Research and Development

Electronics and microelectronics:

Semiconductor material applications in non-standard fields. New semiconductor heating elements and temperature sensors. Modern homojunction and heterojunction transistor structures. New horizontal current bipolar transistor (HCBT). Development of semiconductor device models. Modelling of passive devices. Development of simulation methods and their application in microelectronics. Development of topology design methods for VLSI/ULSI circuits. Analysis and design of bipolar, CMOS, BiCMOS and GaAs analogue and digital integrated circuits. Physical layout and verification of microprocessor integrated circuits. On chip DC and RF measurements.

Computing:

Digital system design. Computer systems hardware and software co-design and development. Formal methods in the design of computing systems. Software and hardware reliability. Embedded systems. Real-time systems.

Distributed systems, clusters and grids. Dependable systems design and development. Computer systems and network security. Computer graphics, animation and visualization. Human-computer interaction.

Internet computing. Web and cloud computing. Widget-oriented and service-oriented architectures. Consumer programming. Autonomy-oriented computing. Multi-agent systems. Semantic Web and ontologies. Mapping data to ontologies. Office automation. Electronic document management systems. Mobile applications and interaction.

Intelligent information systems. Crowdsourcing and collective intelligence. Evolutionary computation. Expert and other knowledge based systems. Data, text and signal mining. Machine learning. Pattern recognition. Computer vision. Biometrics-based identification. De-identification for privacy protection. E-learning, m-learning and u-learning.

▼ Projects

IMOLA - Intelligent light Management for OLED on foil Applications (EU FP7 STREP project, ICT, FER project partner: Adrijan Barić, 2011-2014)

E2LP - Embedded Computer Engineering Learning Platform (EU FP7 Project; Vlado Stuk; 2012-2015)

MASTIF - Mapping and Assessing the State of Traffic Infrastructure (HRZZ project - Croatian Science Foundation, Project leader: Siniša Šegvić, 2008-2011)

BILDET - Model based traffic sign detection (Bilateral Croatian-Austrian project, Croatian partner: Siniša Šegvić, 2010-2011)

ITA - Intelligent Text Analyser (HIT project - Croatian Institute of Technology, Principal investigator: Bojana Dalbelo Bašić, 2011-2012)

Computing Environments for Ubiquitous Distributed Systems (Scientific project 036-0362980-1921, Ministry of Science, Education and Sports, Republic of Croatia, Principal investigator: Siniša Srbljić, 2007-2013)

Universal Middleware Platform for e-Learning Systems (Project 036-0361994-1995, Ministry of Science, Education and Sport, Republic of Croatia, Principal investigator: Vlado Glavinić, 2007-2013)

Signal Integrity of Mixed-Signal Integrated Circuits (Project 036-0361621-1622, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Adrijan Barić, 2007-2013)

Knowledge discovery in textual data (036-1300646-1986, Croatian Ministry of Science, Education and Sports, principal investigator: Bojana Dalbelo Bašić, 2007-2013)

Sophisticated semiconductor structures for communication technology (Project 036-0361566-1642 Ministry of Science and Technology, Republic of Croatia, Principal investigator: Petar Biljanović 2007-2009, Vladimir Jovanović; 2009-2013)

Design Environments for Embedded Systems (Project 036-0362980-1929, Ministry of Science and Technology, Republic of Croatia, Principal investigator: Daniel Gajski, 2007-2013)

Nanometric electron devices and circuit applications (Project 036-0361566-1567 Ministry of Science and Technology, Republic of Croatia, Principal investigator: Tomislav Suligoj, 2007-2013)

Mapping and Assessing Traffic Infrastructure (MASTIF), Croatian National Foundation for Science, programme Partnership in basic research, project number #04/20; in collaboration with IPV Zagreb and TU Graz, coordinated by Siniša Šegvić, 2008-2011

Integrated voltage regulator using novel topologies and devices (INVENT - IWT Project; Adrijan Barić, 2011-2014)

Parsing and Multi-word Expressions. Towards linguistic precision and computational efficiency in natural language processing (COST Action IC1207; Jan Šnajder, 2013-2017)

A New Horizontal Current Bipolar Transistor (HCBT) for 0.18μm BiCMOS Integration (Asahi Kasei EMD Corp. Principal investigator: Tomislav Suligoj, 2006-2013)

Autonomy-Oriented Computing Structures (036-0361935-1954, Project leader: Slobodan Ribarić; 2007-2013)

De-identification for Privacy Protection in Multimedia Content, COST Action IC1206 project (Project leader /chair/: Slobodan Ribarić, 2013-2017.)

Modeling and Visualization of Complex Objects System – MVCOS (International project with industry, AVL-AST d.o.o. for Advanced Simulation Technologies Development, AVL List GmbH, Graz, Austia, Project leader: Zeljka Mihajlovic; 2011-2014)

International Links

Atila Jozsef University, Szeged, Hungary

Fakulta elektrotechniky a informatiky Slovenskej Technickej Univerzity v Bratislave, Slovakia

Politecnico di Bari, Dipartimento di Elettrotecnica e Elettronica, Bari, Italy

Universita degli Studi di Roma I "La Sapienza", Pictorial Computing Lab. (PCL), Dipartimento di Scienze dell' Informazione, Rome, Italy

University of Toronto, Toronto, Canada

Univerza v Ljubljani, Fakulteta za elektrotehniko, Ljubljana, Slovenja

Univerza v Ljubljani, Fakulteta za računalniątvo in informatiko, Ljubljana, Slovenia

AMI Semiconductor, Belgium

Robert Bosch, Germany

Cadence Design Systems, France

Cambridge Semiconductors, UK

Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

Inter-university MicroElectronics Center (IMEC), Belgium

Katholieke Universiteit Leuven, Belgium

University of Cambridge, UK

TU Graz, Austria

INRIA/IRISA Rennes, France

University of Maribor, Faculty of Electrical Engineering and Computer Science, Maribor, Slovenia

ON Semiconductor, Belgium

Group4Lab, California, USA

University of California, Irvine, USA

University of Southern California, Los Angeles, USA

GlobalLogic, San Jose, USA

Huawei, Santa Clara, USA

AVL List GMBH, Graz

Asahi Kasei Microdevices Co., Japan

Delft University of Technology, Netherlands

Radboud University Nijmegen, Netherlands

University of California, Los Angeles, USA

College of Information Science & Engineering, Northeastern University, Shenyang, China

MNIT - Malaviya National Institut of Technology, Jaipur, India

5.12. Department of Wireless Communications

Faculty and Staff

▼ Professors

Juraj Bartolić – electromagnetic wave theory, microwave engineering, antennas and propagation, remote sensing, EMC, EMI

**Davor Bonefačić** – microwave engineering, small, active and wearable antennas, radar systems, EMI

Mislav Grgić – digital mammography, computer-aided detection and diagnosis (CAD) for breast

Founded in 1954

Head of Department:
Prof. **Sonja Grgić,** Ph.D.

Phone: + 385 1 6129 857
Fax: + 385 1 6129 717
E-mail: rc@fer.hr
Web: www.rc.fer.hr

cancer, face recognition, biometrics, image and video compression, multimedia communications
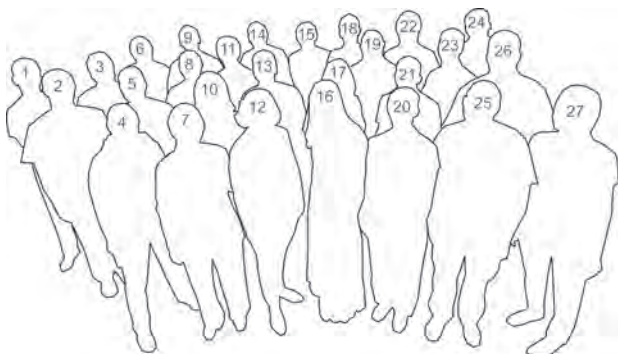
1 Marko Bosiljevac   2 Silvio Hrabar   3 Mislav Grgić
4 Iva Bačić   5 Emil Dumić   6 Borivoj Modlic
7 Branka Zovko-Cihlar 8 Branimir Ivšić 9 Zvonimir Šipuš
10 Dina Šimunić   11 Mario Muštra   12 Sonja Grgić
13 Damir Muha   14 Robert Nađ   15 Tin Komljenović
16 Dijana Tralić   17 Jelena Božek Mouthuy
18 Dario Bojanjac   19 Davor Zaluški   20 Josipa Baček
21 Tomislav Kos   22 Josip Vuković
23 Radovan Zentner   24 Gordan Šišul
25 Damir Petričević   26 Davor Bonefačić   27 Ljerka Nuić

Sonja Grgić – video signal processing and communications, picture quality assessment, digital video broadcasting

Silvio Hrabar – electromagnetic wave theory, application of microwaves, antennas, optoelectronic circuits

Tomislav Kos – radio positioning and navigation, television, cable television systems, broadband networks

Krešimir Malarić – electromagnetic wave theory, microwave communications, satellite communications, EMC, biomedical effects of electromagnetic fields

Borivoj Modlic – broadcasting, wireless access networks, EMC

Robert Nađ – mobile and wireless communications, RF and microwave small signal amplifiers, circuits and communication system weak nonlinearities problems

Dina Šimunić – wireless communications, biomedical effects of electromagnetic fields, green communications, intelligent transport systems

Zvonimir Šipuš – optical communication systems, computational electromagnetics, antennas

▼ Associate Professors

Gordan Šišul – wireless access networks, mobile communications, digital communications, propagation

Radovan Zentner – radio channel modelling, wireless communication, MIMO systems, antennas, propagation

▼ Assistant Professors

Dubravko Babić – optoelectronics, microwave engineering, optical communication systems

▼ Retired Professors

Boris Kviz – optical communication systems, radio telemetry, radiolocation and navigation

Ervin Zentner – antennas and propagation, mobile communications, microwave circuits, electromagnetic compatibility, radar systems

Branka Zovko-Cihlar – digital television, multimedia communications, television broadcasting, broadband network mobile communication

▼ Senior Assistants

Marko Bosiljevac

Jelena Božek Mouthuy

Tomislav Debogović

Emil Dumić

Branimir Ivšić

Tin Komljenović

Mario Muštra

Davor Zaluški

▼ Assistants

Leonard Novosel

▼ Research Assistants

Iva Bačić

Dario Bojanjac

Damir Muha

Pavel Najman

Dijana Tralić

Josip Vuković

Laboratory Support

Damir Petričević

Administrative Staff

Ljerka Nuić

Educational Activities

Antennas and propagation. Advanced electromagnetic engineering. Application of microwaves in industry and science. Biomedical effects of electromagnetic fields. Broadband networks for television signal distribution. Digital television. Digital video. Video communication technologies. Frequency and signal synthesis. Microwave communications. Radio-frequency systems. Microwave engineering. Microwave measurements. Microwave semiconductor electronics. Mobile communications. Mobile Internet. Modulation methods. Navigation systems. Noise analysis in communication system. Numerical analysis of antennas and guiding structures. Optical communication systems. Optical sensors and components. Optoelectronic circuits. Picture quality evaluation. Protection of wireless communication systems. Radar systems. Radio-frequency amplifier design. Radio frequency electronics. Satellite communications. Spread spectrum systems. Theory of communication systems. Theory of electromagnetic waves. Wireless access networks. Wireless circuits design. Wireless communication systems.
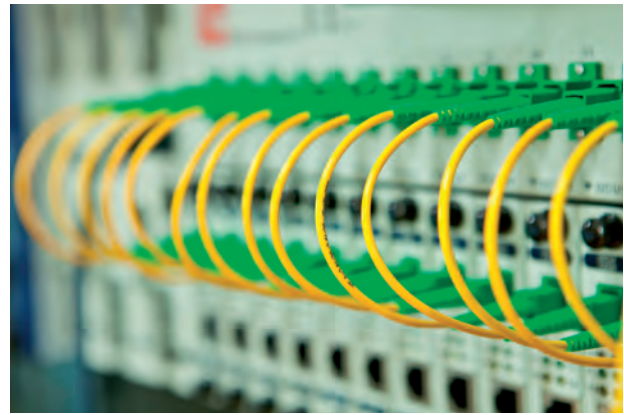
First Cycle Study

Mandatory Courses

- Applied Electromagnetics
- Electronic Communications
- Mobile Communications
- Multimedia Technologies

Elective Courses

- Digital Video
- Optical Communication Technology
- Public Mobile Network
- Radio Navigation
- Technical Standardization and Legislative

Courses for Advanced Students

- Modern Physics and Applications in Electrical Engineering

Skills

- Chess

Second Cycle Study

Mandatory Courses

- Laboratory of Electronics 1
- Laboratory of Electronics 2
- Laboratory of Information Processing 1
- Laboratory of Wireless Technologies 1
- Laboratory of Wireless Technologies 2

Theoretical Courses

- Antennas and Propagation
- Microwave Engineering
- Optical Communication Systems
- Radio-Frequency Electronics
- Radio-Frequency Systems
- Video Communication Technologies
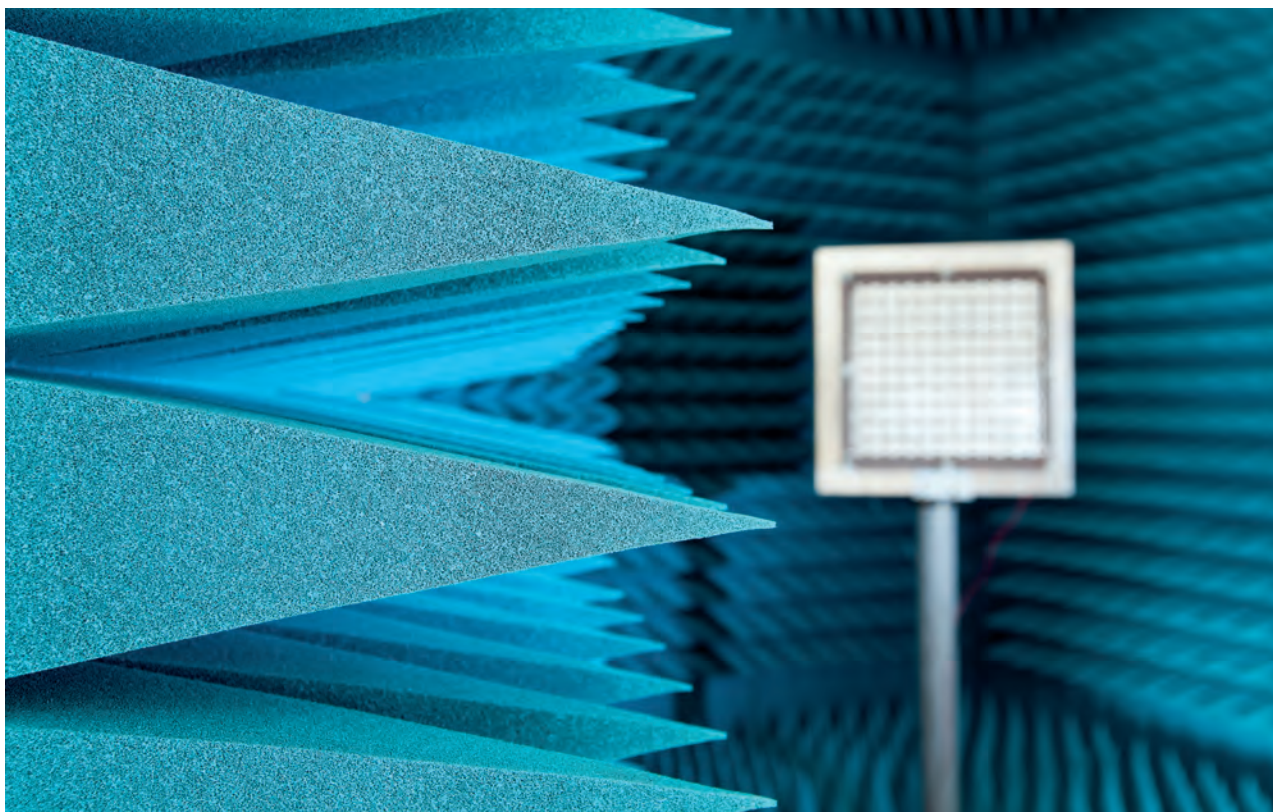
▼ Specialization Courses

- Digital Broadcasting
- Mobile Internet
- Mobile Systems Planning
- Optical Networks
- Radio-Frequency and Microwave Measurements
- Satellite Communication Technology
- Wireless Access Networks

▼ Recommended Elective Courses

- Cable Networks for Interactive Communications
- Design of Radio-frequency and Microwave Integrated Circuits
- Economy and Ecology of wireless systems
- EMI Protection of Communication Systems
- Innovative Electromagnetic Systems - from Idea to Practical Realization
- Radar Systems
- Radio-Frequency Amplifiers
- Remote Sensing and Radiometry

▼ Skills

- Chess

Postgraduate Doctoral Study

- Active Antennas
- Advanced Electromagnetic Engineering
- Advanced Modulation Methods
- Biomedical Effects of Electromagnetic Fields
- Broadband Networks for Television Signal Distribution
- Communications for Multimedia Services
- Electronic Tracking Systems
- Microwave Instrumentation and Measuring Methods
- MIMO in Mobile Communication Systems
- Multimedia Content Retrieval
- Navigation Systems
- Optical Fiber Communication and Sensor Systems
- Picture Quality in Digital Video Communications
- Quality of Service in Wireless Networks
- Radiofrequency System Design
- Satellite Communication Systems
- Signal Equalization in Wireless Transmission
- Spread Spectrum Systems
- Theory of Wireless Communications Systems

Research and Development

Antennas and propagation. Reconfigurable antennas for communication and radar systems. Textile wearable antennas for health care, multimedia, and personal communication applications. Planar and quasi-planar antennas for mobile base station and terminal applications. Numerical methods in electromagnetic wave scattering and antenna analysis. Conformal antennas - microstrip arrays on general convex structures. Broadband radiating elements: stacked patch antennas on planar and cylindrical structures. Textile and wearable antennas. On-body and off-body propagation. Electromagnetic interferences in communication and radar systems: detection, measurement and suppression. Land and satellite mobile radio communication spectrum efficiency. Electromagnetic compatibility of wireless systems. Multimedia communications and services. Digital image and video compression algorithms. Multimedia transmission over broadband and wireless networks. Quality of service for video communications. Subjective assessment of picture quality. Objective image and video quality measures. Digital image forensics. Digital mammography, computer-aided detection and diagnosis. Theoretical and experimental study of TEM and GTEM cells. Electromagnetic field measurements. Biomedical effects of electromagnetic fields. High precision RF and microwave measurements. Dosimetry and densitometry of electromagnetic fields. Optoelectronic components for communication systems, Optical sensors and actuators. Numerical modelling of optical components. Passive and active metamaterials. New structures with metamaterials. Impact if ionospheric and tropospheric propagation on satellite positioning performance.

▼ Projects

CARE - Coordinating the Antenna Research in Europe (EU FP7 CA project, ICT, FER project partner: Juraj Bartolić, 2010-2012).

TRANSMIT - Training Research and Applications Network to Support the Mitigation of Ionospheric Threats (EU FP7 Marie Curie project, FER project partner: Tomislav Kos, 2011-2015).

CylCloak - Metamaterial-Based Cylinders Used for Invisible Cloak Realization (Bilateral project, EOARD - European Office of Aerospace Research and Development, Principal investigator: Zvonimir Šipuš, 2010-2011).

Constitutive Parameters of Metamaterial Structures Used for Invisible Cloak Realization (Bilateral project, EOARD - European Office of

Aerospace Research and Development, Principal investigator: Zvonimir Šipuš, 2012-2013).

NEWFOCUS - New frontiers in millimetre / sub-millimetre waves integrated dielectric focusing systems (Multilateral project, ESF Research Networking Programme, Croatian partner: Zvonimir Šipuš, 2010-2015).

COST-TERRA - Techno-Economic Regulatory Framework for Radio Spectrum Access for Cognitive Radio/Software Defined Radio (COST Action IC0905, Cooperation in Science and Technology, European Commission, MC member and national coordinator: Mislav Grgić, 2010-2014).

EURO-TELEPATH - Telepathology Network in Europe (COST Action IC0604, Cooperation in Science and Technology, European Commission, MC member and national coordinator: Mislav Grgić, 2007-2011).

COST C1004 - Cooperative Radio Communications for Green Smart Environments (COST Action C1004, Cooperation in Science and Technology, European Commission, MC member and national coordinator: Radovan Zentner, 2011-2015).

COST TD 1001 OFSeSa - Novel and Reliable Optical Fibre Sensor Systems for Future Security and Safety Applications (COST TD 1001, Cooperation in Science and Technology, European Commission, MC member and national coordinator: Zvonimir Šipuš, 2011-2014).

COST IC1102 VISTA - Versatile, Integrated, and Signal-aware Technologies for Antennas (COST Action IC1102, Cooperation in Science and Technology, European Commission, MC member and national coordinator: Juraj Bartolić, 2011-2014).

COST IC1105 3D-ConTourNet - 3D Content Creation, Coding and Transmission over Future Media Networks (COST IC1105, Cooperation in Science and Technology, European Commission, MC member: Emil Dumić, 2012-2016).

Averaging mirrors for passive optical networks based on self-seeded semiconductor optical amplifiers (BICRO project, Project leader: Zvonimir Šipuš, 2011).

Ultra-Stable Laser Source for Nephelometry (BICRO project, Project leader: Dubravko Babić, 2013).

Intelligent Image Features Extraction in Knowledge Discovery Systems, (Ministry of Science, Education and Sport, Principal investigator: Mislav Grgić, 2007-2013).

Picture Quality Management in Digital Video Broadcasting, (Ministry of Science, Education and Sport, Principal investigator: Sonja Grgić, 2007-2013).

Electromagnetic effects and structures in communication systems (Ministry of Science, Education and Sport, Principal investigator: Zvonimir Šipuš, 2007-2013).

Multifunctional Antennas in Communication and Radar Systems (Ministry of Science, Education and Sport, Principal investigator: Juraj Bartolić, 2007-2013).

Laboratory for electromagnetic compatibility and biological effects of EM fields (Ministry of Science, Education and Sport, Principal investigator: Krešimir Malarić, 2007-2013).

Environment for satellite positioning (Ministry of Science, Education and Sport, Principal investigator: Tomislav Kos, 2007-2013).

Electromagnetic Metamaterials and Nanoelectromagnetics (Ministry of Science, Education and Sport, Principal investigator: Silvio Hrabar, 2007-2013).

Efficiency increase of wireless communications systems (Ministry of Science, Education and Sport, Principal investigator: Dina Šimunić, 2007-2013).

Electromagnetic Compatibility-Environmental Protection (Ministry of Science, Education and Sport, Principal investigator: Borivoj Modlic, 2007-2013).

International Links

Air Force Research Laboratory, Wright-Patterson AFB, USA

Brno University of Technology, Faculty of Electrical Engineering and Communication, Brno, Czech Republic

Brunel University, Department of Systems Engineering, UK

Chalmers University of Technology, Department of Signals and Systems, Göteborg, Sweden Czech Technical University, Department of Electromagnetic Field, Prague, Czech Republic

Deutsches Zentrum für Luft- und Raumfahrt (DLR), Neustrelitz, Germany

Ecole Polytechnique Fédérale de Lausanne (EPFL), Laboratory of Electromagnetics and Acoustics (LEMA), Switzerland

International Centre for Theoretical Physics (ICTP), Trieste, Italy

Jožef Stefan Institute, Ljubljana, Slovenia

Motorola, Electromagnetics Research Laboratory, Florida, USA

Pacific Northwest National Laboratory, USA

Politecnico di Torino, Torino, Italy

Radboud University Nijmegen Medical Centre, Department of Radiology, Diagnostic Image Analysis Group, Nijmegen, Netherlands

Slovak University of Technology in Bratislava, Slovakia

Swiss Federal Institute of Technology, Department of Electrical Engineering, Zurich, Switzerland

Technical University of Budapest, Department of Microwave Telecommunications, Hungary

Technische Universität Graz, Institut fur Elektro- and Biomedizinische Technik, Austria

Third University of Rome, Department of Electrical Engineering, Italy

Université de Rennes 1, Institut d'Electronique et de Télécommunications de Rennes (IETR), France

University of Bologna, Department of Electronics, Computer Sciences and Systems, Bologna, Italy

University of Essex, Department of Electronics Systems Engineering, UK

University of Florence, Department of Electronics and Telecommunication, Italy

University of Gent, Department of Information Technology, Belgium

University of Maribor, Faculty of Electrical Engineering and Computer Science, Slovenia

University of Massachusetts Amherst, Department of Electrical and Computer Engineering, USA

University of Mining and Metallurgy, Telecommunications Department, Krakow, Poland

University of Michigan, Department of Electrical Engineering & Computer Science, Ann Arbor, Michigan, USA

University of Nottingham, UK

University of Oxford, Department of Engineering Science, Institute of Biomedical Engineering, UK

University of Siena, Department of Information Engineering, Italy

University of Utah, Electrical Engineering Department, Salt Lake City, Utah, USA

5.12.

6.

Management, Administration and Support

6.1. Dean and Vice Deans
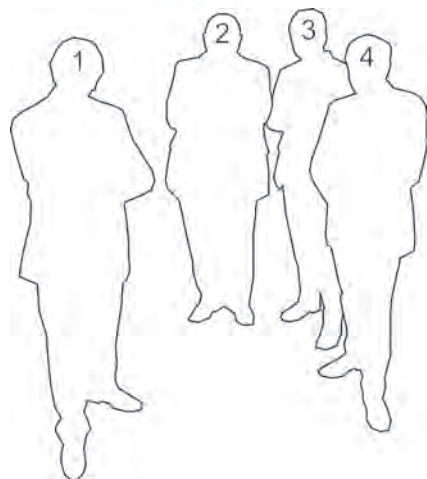
Nedjeljko Perić – Dean
Davor Petrinović – Vice Dean
Hrvoje Domitrović – Vice Dean
Mislav Grgić – Vice Dean

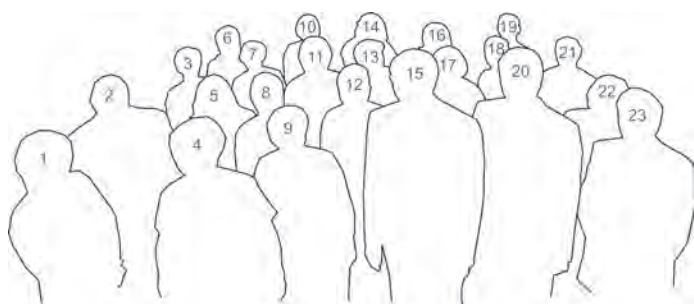|	
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2 Hrvoje Domitrović
3 Mislav Grgić
4 Davor Petrinović

6.2. Management and Administration

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4 Mira Silov   5 Jožica Poslon   6 Mara Mihaljević
7 Gordana Šincek   8 Martina Petrović   9 Branka Filipović
10 Ivana Borilović   11 Marija Kovačević

12 Gordana Gluščević   13 Jadranka Matleković
14 Jasna Matijević   15 Nedjeljko Perić
16 Marija Rumac   17 Dijana Bontempo   18 Ana Zelić
19 Miroslav Šladarec   20 Mislav Grgić
21 Vladimir Malarić 22 Đurdica Jelić 23 Davor Petrinović

6.3. Secretary's Office

Goran Ranogajec – Head of Office

Marija Rumac – Head of Dean's Office

Ana Zelić – Vice Deans' Office

Đurdica Jelić – Head of Registry Department

Nikolina Miljan

Marija Kovačević – Head of Office for General Affairs

Jožica Poslon

Jadranka Matleković – Head of Human Resources Office
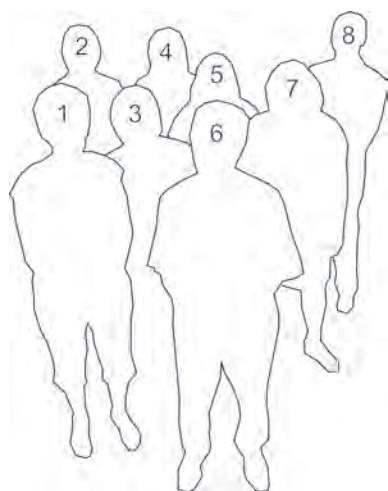
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Renata Peček

Miroslav Šladarec

Srećko Papac

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2 Marija Kovačević
3 Jadranka Matleković
4 Marija Rumac
5 Jožica Poslon
6 Vladimir Malarić
7 Đurdica Jelić
8 Miroslav Šladarec

6.4. Finance Department

Olga Župnić – Head of Finance Department

Dijana Bontempo
Ivana Borilović
Branka Filipović
Gordana Gluščević
Anka Jurić
Jasna Matijević
Mara Mihaljević
Martina Petrović
Mira Silov
Gordana Šincek

Phone: + 385 1 612 9 722
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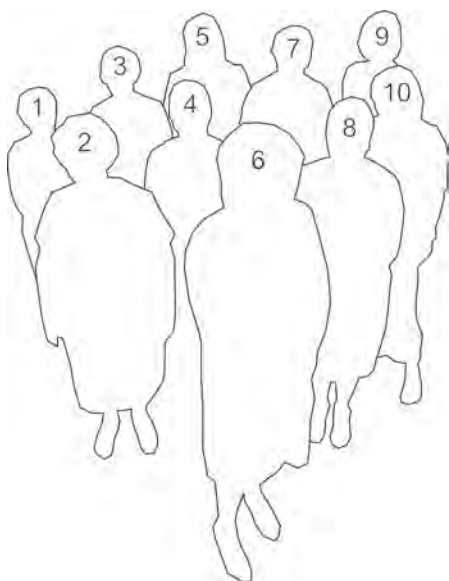
1 Branka Filipović   2 Mira Silov   3 Gordana Šincek
4 Martina Petrović   5 Mara Mihaljević   6 Olga Župnić
7 Jasna Matijević   8 Gordana Gluščević
9 Ivana Borilović   10 Dijana Bontempo

6.5. Student Administration Office

Includes admission of students, enrolment in academic year, keeping examination records, providing certificates and transcripts for earning all sorts of student rights-scholarships, organizing accommodation in student dorms, student meal discount, public transportation, and organization of promotions of graduate engineers. Also includes working with incoming and outgoing exchange students.

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Petra Lukina – Head of Student Administration Office

Željka Bratić Odobašić

Ana Mari Čajsa

Mirjana Grubiša
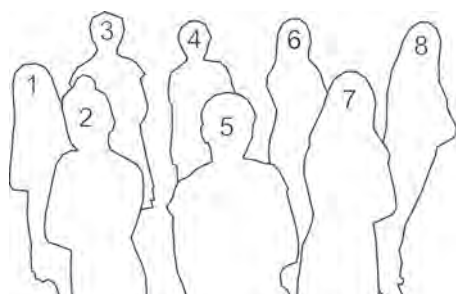
Sanja Horvat

Silvija Jurić-Bubić

Monika Karlović

Smiljanka Turkalj

Ana Zelić

1 Silvija Jurić-Bubić
2 Monika Karlović
3 Mirjana Grubiša
4 Smiljanka Turkalj
5 Petra Lukina
6 Ana Mari Čajsa
7 Ana Zelić
8 Sanja Horvat

6.6. FER Central Library

Jadranka Lisek – Head of Central Library

Branka Marijanović – Librarian

Stjepan Šimara – Librarian

Zora Žitnik – Assistant Librarian

Dina Vrkić – Librarian

Ana Hanzer – Librarian

Marko Pavlovski – Librarian

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Web: www.fer.hr/knjiznica

FER Central Library, as an organizational unit of the Faculty, finds its calling and mission in providing a high-quality support to research and teaching procedure, as an active partner in enhancing the quality of the learning outcomes.

By the usage of the Library holdings, and the skills of information retrieving, and searching the available online databases, the Library staff recommends
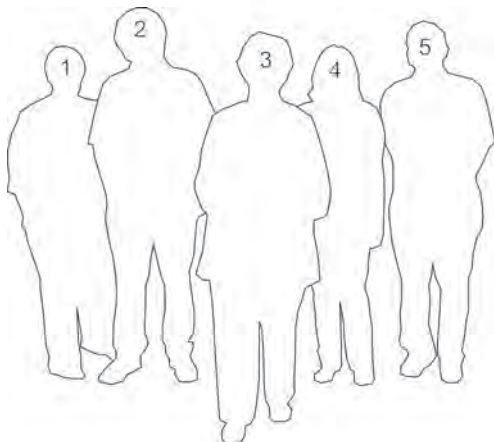
1 Zora Žitnik
2 Marko Pavlovski
3 Jadranka Lisek
4 Ana Hanzer
5 Stjepan Šimara

literature to the Faculty students, as well as to graduating students, postgraduates, high-school students, Faculty employees, and all who need help in finding necessary technical-scientific publications (approximately 5,000 users).

For the purposes of entry and processing of data related to the service of literature search on demand, a database was developed in the Library, as well as an interlibrary loan database. On the basis of the above mentioned databases, two web-forms for communicating with the Library users were also developed.

The FER Central Library acts as a support in lecturing a humanities class called Research, Publication and Responsibility in Science at the graduate study program, and the Library staff is a part of the organizing committee of the annual conference of the Croatian academic and scientific libraries, which, for the 9th time in a row, takes place at the Faculty.

Central library has begun process of redefining itself by the means of implementing new technologies and new means of communication with its patrons. Implementation of new open source integrated library management software Koha has been one of the crucial steps towards library 2.0; also we communicate with our patrons through social networks (Facebook page, Twitter, Meebo) acknowledging high reception of that kind of communication.

Recognizing information needs for new generations of students and scientists has become primary goal as it is necessary for transformation of Central library into digital library for 21st century study needs.

The Library staff also participates in a scientific project financed by the Ministry of Science, Education and Sports of the Republic of Croatia (MZOS).

▼ Projects

Evaluation of Library Services: Academic and Public Libraries (122-1221210-0759) (Project leader: Kornelija Petr Balog, Faculty of Philosophy, Osijek)

6.7. Information Support Centre

Kristijan Zimmer – Head of Information Support Centre

Kata Banožić
Igor Brkić
Josip Herceg
Damir Kirasić
Vedran Klasić
Krešimir Kroflin
Vlatka Paunović
Svebor Prstačić
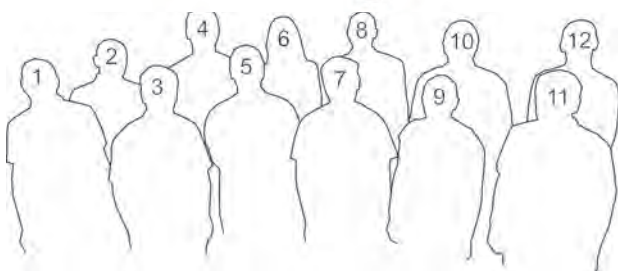**Siniša Tomić**
Ivan Voras
Tomislav Žganec

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The main purpose of the Information Support Centre (ISC) is to provide IT support for the Faculty. This includes:

- planning and procuring network equipment, computer equipment and software;
- planning, developing and maintaining FER's public web site, intranet and e-learning services, student information and timetabling system;
- managing faculty-wide networking infrastructure, IT security and various information services.

1 Damir Kirasić   2 Svebor Prstačić   3 Tomislav Žganec
4 Igor Brkić   5 Krešimir Kroflin   6 Kata Banožić
7 Siniša Tomić   8 Kristijan Zimmer   9 Vlatka Paunović
10 Ivan Voras   11 Josip Herceg   12 Vedran Klasić

In the past two years, the ISC has continued introducing modern solutions at all levels of information technology - from infrastructure to software and services.

FER's content management system "Quilt CMS", which serves as FER's public web site and intranet, as well as the basis for application integration, has extensively been improved with the set of advanced modules under collective name "Teaching activities" supporting teaching and organizational processes.

"Teaching activities" enable advanced and detailed structuring of courses, grouping of students, students' group exchange, grading, automatic grading of written exams (OCR), including publishing the results to students, detailed personalised calendar, tracking students' attendance at lectures and teaching assistants' presence at exams.

The CMS supports many teaching and organizational processes, including those for tracking activities related to diploma thesis and final work, managing students' summer internships, managing invitations to events such as the celebration of the anniversary of its foundation, managing students' debt, tracking professional development of FER's staff, as well as preparation of data for this publication – the Progress report.

An extensive analysis of timetabling systems for creation of timetable of lectures, laboratory exercises, midterm and final exams have been undertaken prior to choosing the next generation solution for FER's complex and fragile time-space continuum. As the system best matching FER's needs, "UniTime – University Timetabling", an open source solution initially developed by the Purdue University has been deployed. Integration software for importing and exporting timetable data to and from the CMS has been developed to enable bi-directional access to the teachers' and students' calendars in the CMS.

FER's "Opter" system for distribution and calculation of the teachers' workload has been re-implemented as a module of the CMS and improved with various user-centric functionalities.

A Contract management system has been implemented as another module of the CMS. It enables tracking of details of proposal for business collaboration, their review by the FER's Secretary's office, Finance department and vice dean, and finally entering of contract details upon signing. After project's end, details about fulfilment and payments are entered. Different analytical functionalities have been implemented as well.

A new CRM system has been deployed, a customised popular open source system "Mantis bug tracker".

Integration with the "SAP" ERP system used by the Finance department has been developed, enabling automatic creation and archiving of user accounts in the CMS and all integrated systems, as they are created and achieved in "SAP".

The learning management system "Moodle", used at FER since 2005, has been additionally integrated with the CMS enabling not only automated creation of courses and the synchronization of students' accounts and their enrolments into courses, but also retrieval of grades from "Moodle" back to the CMS.

As the University computing centre Srce started "opening" the national student information system "ISVU" by implementing a new, functional API, a two-way exchange of different useful datasets has became possible. The ISC has implemented on FER's side calls to most of available API functions, including retrieval of all sorts of information from the "ISVU" and publishing of students' grades, course and group enrolments to the "ISVU", saving massive time of the Student administration office's staff.

Set of modules, covering support for the material inventory, has been developed, making the process more visible to all employees.

A staggering number of over 1.000 specific reports have been created for different educational, scientific, organizational and financial needs.

As a result of a directive by the Senate of the University of Zagreb, FER's public web site, as well as departments' web sites, have been degraded from the top-level *fer.hr* domain to the University of Zagreb's *fer.unizg.hr* domain.

To enable VPN access to online scientific databases, regardless of teachers' and researchers' physical location as well as to protect e-mails from malware, the "Astaro" appliance and 5-year "Astaro Full Guard Premium" license have been purchased and deployed.

A new antivirus/antimalware system "Microsoft Security Center 2012 Endpoint Protection" has been systematically deployed, replacing the previously used McAfee's solution.

FER has extended its membership in the "Microsoft DreamSpark" programme, which allows teachers and students to use various Microsoft's programs. Similarly, FER has supported adoption of new versions of MathWorks' "Matlab", Wolfram's "Mathematica" and StatSoft's "Statistica".

To help teachers create rich multimedia e-learning content, FER has purchased licenses of the "Adobe eLearning Suite", containing Adobe's popular professional tools for e-learning, presentation, multimedia, image, audio and web authoring.

As part of the operational activities, the support for central management and installation of dozens of servers and more than 300 PCs has been enhanced and expanded in capacity.

The ICS has also supported many of FER's activities within and outside of FER's premises, such as scientific and professional associations' workshops, student organizations' events, pupils' and students' IT competitions and provided technical support for FER's booth at the University of Zagreb's annual fair.

The ISC continued to be actively involved in the organization of the "The best student computer program" competition, as its initiator and coordinator.

The Quilt CMS system has been implemented at several additional Croatian higher education institutions. As part of the bilateral scientific cooperation with the Estonian Innovation Centre for Digital Education, a project of development of the national repository of learning objects and learning materials has been completed. The repository hosts more than 4.500 courses and parts of courses of all Estonian universities and most of vocational schools, with support for professional review process and quality assurance.

Since April 2012 the ISC with other FER's researchers has been involved in the 3-year long Competitiveness and Innovation Programme - CIP-ICT-PSP-2011-5 project "Open Discovery Space: A socially-powered and multilingual open learning infrastructure to boost the adoption of eLearning resources". The role of the ISC in the project is to provide knowledge and expertise in integration of national and institutional learning object repositories (LOR's) and cultural collections by harvesting, validating and enriching learning objects' metadata. The ICS is contributing in 3 work packages: Open Learning Content, Social Learning Data and Socially Empowered Open Discovery Space Portal.

FER's network infrastructure has been significantly upgraded.

The new IT network of the Faculty, with backbone speeds of 10 Gbps and access speeds of 1 Gbps to workplaces has been installed, tested and is now in operational use in the Building C.

At the cabling level, the backbone is optical (OM3), while cables from the access switches to workplaces are S/FTP, category 7. In the Building C a total of 36,8 km of cables and 1.123 connectors have been installed, mostly by FER's Technical support and maintenance's staff. Cable connections have been tested according to the EN 50173-1 standard for the class EA (speeds up to 10 Gbps) by the ISC.

New central networking equipment have been installed, configured and tested. As a result, FER's new main router is Cisco Catalyst 6506, Cisco ASA 5550 new firewall for critical central infrastructure and two Cisco AIR 5508's act as WiFi access point (AP) controllers.

On each floor a 42-unit network cabinet with a Cisco Catalyst 3560-E24 distribution switch and 4-5 Extreme Summit X350-24t's access switches has been installed.

Three Cisco Aironet 1140 WiFi AP's have been installed on each floor. With additional new AP's installed in other buildings, a total of 70 new AP's are now in operation, compared to only 10 (very outdated products) before this project.

Two main logical networks have been configured related to the WiFi network – FERWlan, mainly used by FER's employees and students, and Eduroam, mainly used by (academic) guests. Numerous FER's events and projects can now easily get their own ad-hoc SSID's and specific authorization types.

The IPv6 protocol has been enabled on the central network equipment and three departments which have taken part in the pilot project.

With help from the Croatian Academic and Research Network – CARNet, FER-CARNet optical link has been upgraded from 1 Gbps to 10 Gbps.

FER's sports hall "Martinovka" has been connected to CARNet with 1 Gbps optical link.

The new open source network observation and monitoring system "Observium" has been implemented.

In a separate project, a new 40 KVA UPS for the central network and server equipment has been installed and tested.

As part of a 3-year plan for upgrading FER's server infrastructure new IBM x3630 and IBM x3250 servers have been purchased.

In the project of upgrading previous e-mail server from Microsoft Exchange 2003 to 2010, 2 CAS Exchange 2010 servers (primary and secondary) have been deployed, with Hub Transporter roles. Other servers have been deployed as Mailbox Exchange 2010 servers.

The biggest challenges for the project have been making old and new Exchange servers work simultaneously during the migration phase while supporting many non-standard specifics of the old configuration as well as the need to support various clients on many different platforms.

As a result, FER's e-mail server infrastructure has now been significantly modernised, more robust and reliable in both hardware and software sense, with much better support for increasing number of mobile clients.

▼ Projects

- Competitiveness and Innovation Programme - CIP-ICT-PSP-2011-5 project "Open Discovery Space: A socially-powered and multilingual open learning infrastructure to boost the adoption of eLearning resources".
- "Quilt Academic Content Management System" – implementations in over 20 Croatian higher education institutions, government bodies, scientific and professional NGO's and corporations
- "Estonian E-Campus" – bilateral project with the Estonian Innovation Centre for Digital Education
- "UniTime Timetabling System" - implementation and customisation in the Faculty of Philosophy, University of Split
- "Open source private cloud" – FER's collaboration with T-Com (contribution of the ISC to researchers of the Department of Control and Computer Engineering)

6.8. Technical Support and Maintenance

Aleksandar Petrović – Head of Technical Support and Maintenance

Dubravko Dajević – Deputy Head of Technical Support Department

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Zoran Babok
Josipa Baček
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Vesna Borošak
Željko Bosilj
Mirjana Brozović
Dušan Bušljeta
Ivan Čajsa

Marija Čukelj
Vera Čukelj
Zdenka Dandić
Đurđica Dandić
Mira Đurašin
Boris Grgin
Carmen Gršić
Miroslav Iličić
Edita Ivanović
Barica Kenig-Sovina
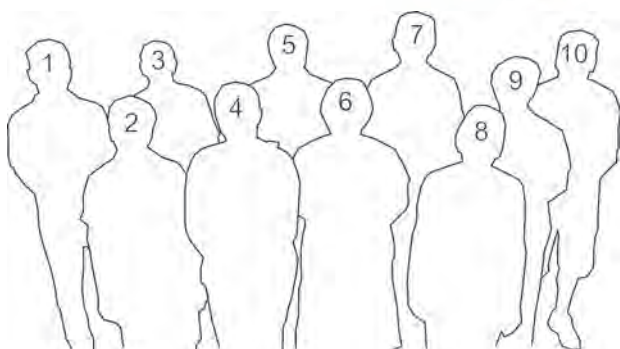
1 Marijan Kundih   2 Zrinka Plodinec   3 Dušan Bušljeta
4 Željkica Šikuten   5 Božo Armelin   6 Branka Rihtarić
7 Aleksandar Petrović   8 Mira Đurašin   9 Vera Čukelj
10 Zoran Babok

Zlatko Kereković
Marija Kočiš
Marijan Kundih
Mihaela Lehner
Josip Leskovec
Branka Marjanović
Manda Marković
Marija Mikić
Ljiljana Mišerić
Gordana Ožvald
Kata Peh
Mirta Petrlić
Dubravko Plemenčić
Zrinka Plodinec
Vesna Popović
Nada Rabik

Marija Raljević
Ana Relotić
Anastazija Rendulić
Branka Rihtarić
Ivka Sokolović
Željko Stojin
Đurđica Šešerinac
Željkica Šikuten
Gordana Štih
Martina Štorga
Marijana Trputec
Ankica Turkalj
Robert Veljković
Ruža Vukelić
Miljenko Vukmanić

7.

List of Publications

Department of Applied Physics – List of Publications

▼ Books

Petković, Tomislav. Eksperimentalna fizika i spoznajna teorija ; Postskriptum 3. izdanju: Predavanje o preciznim pokusima u standardnome modelu i novoj očekivanoj fizici na LHC-u u CERN-u. // Zagreb : Školska knjiga, d.d., 2011

Petković, Tomislav. Zadaci iz fizike. Primjeri i zadaci za studente Prehrambeno-biotehnološkog fakulteta Sveučilišta u Zagrebu, 2. prošireno i promijenjeno izdanje. // Zagreb : Element d.o.o., 2011

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Grgić, Davor; Ječmenica, Radomir; Pevec, Dubravko. Lattice Codes Pin Power Prediction Comparison. // Nuclear Engineering and Design. 246 (2012) ; 27-40.

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Glück, Alexander; Hüffel, Helmuth; Ilijić, Saša; Kelnhofer, Gerald. The Active Universe. // International journal of bifurcation and chaos in applied sciences and engineering. 21 (2011), 7; 2043-2046

Horvat, Dubravko; Ilijić, Saša; Marunović, Anja. Radial pulsations and stability of anisotropic stars with quasi-local equation of state. // Classical and quantum gravity. 28 (2011), 2; 025009-1-025009-12

Horvat, Dubravko; Ilijić, Saša; Marunović, Anja. Radial stability analysis of the continuous pressure gravastar. // Classical and quantum gravity. 28 (2011), 19; 195008-195021

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A. Marunović and M. Murković, „A novel black hole mimicker: a boson star and a global monopole nonminimally coupled to gravity", [arxiv: gr-qc/1308.6489], accepted for publication in Class. Quantum Grav. (2013)

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Petković, Tomislav. Stoljetni međaš kvantne fizike: Bohrov model atoma 1913. - 2013.. // Čovjek i svemir. LV (2013.), 4 (2012/2013); 29-31

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Voras, Ivan: Benchmarking FreeBSD // BSDCan 2013.

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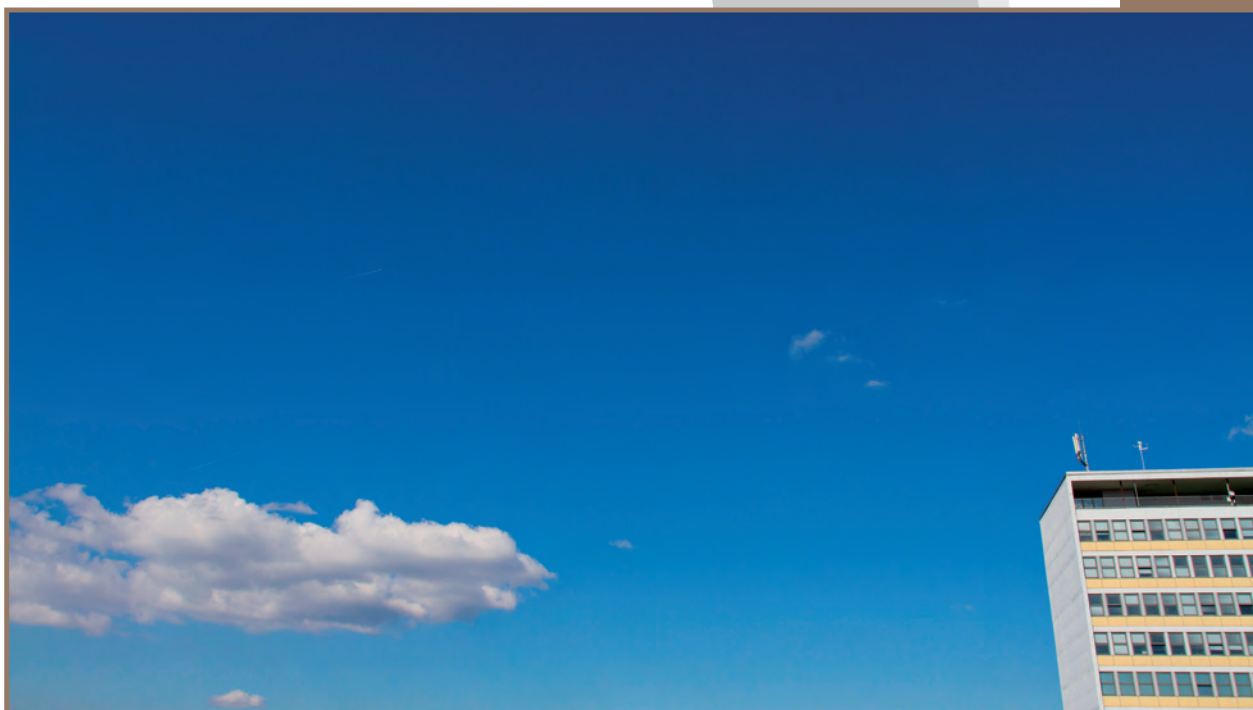Mentor: Davor Bonefačić

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