

**RESEARCH INSTITUTE  
FOR INTELLIGENT COMPUTER SYSTEMS**

**TERNOPIL NATIONAL ECONOMIC UNIVERSITY,  
MINISTRY FOR EDUCATION AND SCIENCE, UKRAINE**

**V.M. GLUSHKOV INSTITUTE FOR CYBERNETICS,  
NATIONAL ACADEMY OF SCIENCES, UKRAINE**

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## CONTENTS

FOREWORD.....	3
1. GENERAL INFORMATION.....	4
ICS History .....	4
ICS Management.....	5
2. ICS RESEARCH STAFF .....	8
Senior Staff.....	8
Junior Staff.....	18
3. RESEARCH PROJECTS .....	22
Current.....	22
Completed.....	25
4. RESEARCH ACTIVITIES .....	54
IDAACS Conferences .....	54
International Journal of Computing .....	57
Specialized Scientific Council K58.082.02.....	62
IEEE Instrumentation & Measurement/Computational Intelligence Joint Societies Chapter.....	62
IEEE Student Branch.....	65
Other Research Activities .....	66
5. ACADEMIC ACTIVITIES.....	68
Cooperation Agreements with Universities and Companies.....	68
Defended Theses and Awarded Degrees.....	68
Defended Master Theses .....	69
Defended Diploma Projects.....	71
Internship of Staff, PhD Students and Students.....	76
6. PUBLICATIONS.....	77
Monographs (Parts of Monographs), Books (Parts of Books) .....	77
Journal Papers .....	77
Conference Proceedings .....	80
Patents.....	84
7. PARTICIPATION IN CONFERENCES, SYMPOSIUMS AND WORKSHOPS, AND RESEARCH VISITS .....	85
Conferences .....	85
Research Visits.....	87
8. AWARDS.....	91
9. STATISTICAL DATA.....	92

## FOREWORD

It is my pleasure to present a regular Annual Report of Research Institute for Intelligent Computer Systems (ICS), Ternopil National Economic University (TNEU) and the Glushkov Institute for Cybernetics, National Academy for Science, Ukraine for 2015. This report is anniversary since the ICS was established in 2004 on a base of the Branch Research Laboratory for Automated Systems and Networks (founded in 1984).

The ICS consists of the fourteen research groups. During its history the ICS staff has received more than 150 invention certificates of the former USSR and 31 Ukrainian patents, published more than 900 papers and defended the five D.Sc. and 20 Ph.D. dissertations.

The high level of the ICS' research and development are confirmed by awarding the 15 international grants and followed projects within the INTAS, CRDF, NSF, NATO, STCU, FP7 and bilateral programs. As a result, the hardware and software were developed and implemented in intelligent data acquisition systems, robotics, and image processing, and wireless sensor networks and security systems. In these projects the ICS collaborated with a huge number of worldwide universities as well as governmental institutions and private companies. Additional 11 projects have completed with the finding from the Ministry for Education and Science, Ukraine. Besides, I would like to pay attention this time to achievements of the Research Group on Intelligent Sensor Data Acquisition leading by Dr. Volodymyr Kochan and noticeable activities of Dr Ihor Maykiv and Dr Oleksiy Roshchupkin.

The ICS is running the regular the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS), [www.idaacs.net](http://www.idaacs.net) every two years since 2001. In particular last one was held in Warsaw, Poland, 2015 and you may find some details inside of this report.

The 3<sup>rd</sup> IEEE International Symposium on Wireless Systems within the IDAACS Conference (IDAACS-SWS'2016) will be held in Offenburg, Germany, 26-27 September 2016 and the ICS staff is engaged into IDAACS-SWS'2016 preparation.

The ICS staff continues to keep good links with IEEE within the IEEE Student Branch at TNEU and the Instrumentation and Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section. A Chapter has completed the 8 Technical Meetings in 2015.

The International Journal of Computing is issuing quarterly in English language. In particular, the four issues have published in 2015. The IJC Journal is indexed in Finnish publication forum, Norwegian Social Science Data Services and in Google Scholar, and since November 2015 the Journal is indexed by Index Copernicus International.

Finally, I would like to thank Mr. Taras Lendyuk and Ms Diana Zahorodnia and Mr Oleksandr Osolinsky for their help in preparing and designing this report.

Enjoy,  
ICS Advisor



Prof. Anatoliy Sachenko

March 25, 2016

## 1. GENERAL INFORMATION

### ICS History

Research Institute for Intelligent Computer Systems (ICS) was established to push a preparation and improve the efficiency of the national and international research projects execution in the area of design and implementation of intelligent computer systems.

The Institute is located in the campus building #2 of Ternopil National Economic University (TNEU). The ICS frame has the fourteen problem-oriented research groups, in particular: Intelligent Distributed Systems Group, Intelligent Sensor Data Acquisition Group, Intelligent Robotic Systems Group, Neural Networks and Parallel Computing Group, Knowledge Bases and Ontologies Group, Information Technology and Specialized Computer Systems Group, Image Processing and Pattern Recognition Group, Wireless Systems Security Group, Project and Program Management on the base of Information Technologies and Knowledge Group, Cybernetics of Complex Systems Group, Information Security Group, Intelligent Cyber Security and Defense Group, Metrology of Information Measuring Systems Group, Simulation and Algorithmization of Complex Technological Processes Control Group.

The ICS was established in 2004 on a basis of Branch Research Laboratory of Automated Systems and Networks, which in turn inherited rights and experience of the Branch Research Laboratory of Automated Data Acquisition and Processing Systems, established in 1984 by joint order of the Ministry of Electronic Industry of the USSR and the Ministry of Higher and Specialized Secondary Education of the Ukrainian SSR. According to a trend for strengthening links between the Ministry of Education and Science and National Academy of Sciences of Ukraine the ICS is under joint supervision of the TNEU and the Glushkov Institute of Cybernetics, National Academy of Sciences of Ukraine since 2007.

High level of the ICS' research and development are proved since 1997 by winning a number of international grants within the INTAS, CRDF, NSF, NATO, STCU, FP7 and bilateral programs. In these projects the ICS partners were the Universities of Thessaloniki (Greece), Calabria (Italy), Coruna (Spain), Mons (Belgium), Maine and New Jersey (USA), Kaunas (Lithuania), Minsk and Brest (Belarus) as well as the governmental research institutions. Additional 11 projects were executed during this period with funding from the Ministry of Education and Science of Ukraine. This active work of ICS staff enabled to push the research facilities and infrastructure of the Institute, in particular the Ternopil Information-Communication Center was created using NATO funds.

ICS researchers are founders of the IDAACS Charity Foundation, which supports organization of regular International Intelligent Data Acquisition and Advanced Computing Systems (IDAACS) Workshop since 2001 every two years under IEEE's support. In particular, the previous IDAACS Workshops were held in Foros, Crimea (2001), in Lviv (2003), in Sofia, Bulgaria (2005), Dortmund, Germany (2007), Rende (Cosenza), Italy (2009), Prague, Czech Republic (2011), and Berlin, Germany (2013), Warsaw, Poland (2015).

Two IEEE International Symposiums on Wireless Systems within the Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS) were held in Offenburg, Germany, in 2012 and 2014 correspondingly.

The ICS researchers established the IEEE Student Branch at TNEU in 1998. The Instrumentation and Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section was created in 2005, and its activities were awarded with IEEE Outstanding Chapter Award for activities in 2007 and 2014 correspondingly. In 2002 the International Journal of Computing was founded, [www.computingonline.net](http://www.computingonline.net), which has a professional status in Ukraine, and it's distributed worldwide. The Journal is issued quarterly in English language.

## ICS Management

Director – Dr. Volodymyr Kochan  
Scientific Advisor – Prof. Anatoliy Sachenko  
Scientific Secretary – Dr. Myroslav Komar

ICS office address:  
Research Institute for Intelligent Computer Systems  
3 Peremogy Square  
Ternopil, 46020  
Ukraine  
Phone. +380 (352) 475050 ext. 12234  
Fax +380 (352) 475053 (24 hours)  
e-mail: ics@tneu.edu.ua  
web: www.ics.tneu.edu.ua

## ICS Frame

### Intelligent Distributed Systems Group (IDS)

Principal researcher – Prof. Anatoliy Sachenko

Group members:

- Pavlo Bykovyy
- Volodymyr Kochan
- Myroslav Komar
- Olexandr Osolinskyy
- Vasyl Yatskiv

### Intelligent Sensor Data Acquisition Group (ISDA)

Principal researcher – Dr. Volodymyr Kochan

Group members:

- Mykhailo Chyrka
- Zbyshek Dombrovsky
- Orest Kochan
- Ihor Maykiv
- Olexandr Osolinskyy
- Oleksiy Roshchupkin
- Radislav Smid
- Iryna Turchenko
- Nadia Vasylykiv

### Intelligent Robotic Systems Group (IRS)

Co-Researchers, Principal researchers – Prof. Robert Hiromoto, Dr. Vasyl Koval

Group members:

- Oleh Adamiv
- Vladimir Golovko
- Kostyantyn Kovalok
- Alex Nykorak
- Anatoliy Sachenko

### Neural Networks and Parallel Computing Group (NNPC)

Principal researcher – Dr. Volodymyr Turchenko

Group members:

- Vitaliy Dorosh
- Volodymyr Kochan
- Anatoliy Sachenko

- Vladyslav Shults

### **Knowledge Bases and Ontologies Group (KBO)**

Principal researcher – Prof. Sergey Rippa

Group members:

- Anatoliy Sachenko
- Taras Lendyuk
- Andriy Melnyk
- Serhiy Voznyak

### **Information Technology and Specialized Computer Systems Group (ITSCS)**

Principal researcher – Prof. Yaroslav Nykolaychuk

Group members:

- Orest Volynskyy
- Arthur Voronych
- Natalia Vozna
- Oleg Zastavnyy

### **Image Processing and Pattern Recognition Group (IPPR)**

Co-Heads, Principal researchers – Prof. Viktor Krylov, Dr. Ihor Paliy

Group members:

- Anatoliy Sachenko
- Diana Zagorodnya
- Kostyantyn Kovalok

### **Wireless Systems Security Group (WSS)**

Principal researcher – Dr. Vasyl Yatskiv

Group members:

- Robert Hiromoto
- Anatoliy Sachenko
- Taras Tsavolyk
- Orest Volynskyy
- Natalia Yatskiv

### **Project and Program Management on the base of Information Technologies and Knowledge Group (PPMITK)**

Principal researcher – Prof. Sergey Bushuyev

Group members:

- Ninel Dobrovolska
- Mykhailo Dombrovsky
- Zbyshek Dombrovsky
- Oksana Dunets
- Grygoriy Gladiy
- Yuriy Ivanyshak
- Taras Lendyuk
- Oksana Lyashenko
- Volodymyr Neizzhalyi
- Sergey Rippa
- Anatoliy Sachenko
- Oleg Sachenko
- Oksana Rymar

**Cybernetics of Complex Systems Group (CCS)**

Principal researcher – Dr. Roman Pasichnyk

Group members:

- Grygoriy Gladiy
- Andriy Melnyk
- Yuriy Pigovskyy

**Information Security Group (IS)**

Principal researcher – Prof. Mykola Karpinsky

Group members:

- Pavlo Bykovyy
- Lesya Dubchak
- Myroslav Komar

**Intelligent Cyber Security and Defense Group (ICSD)**

Co-Heads, Principal researchers – Prof. Vladimir Golovko, Prof. Anatoliy Sachenko

Group members:

- Pavlo Bykovyy
- Myroslav Komar

**Metrology of Information Measuring Systems Group (MIMS)**

Co-heads, Principal researchers – Dr Roman Kochan, Dr Volodymyr Kochan

Group members:

- Mykhailo Chyrka
- Orest Kochan
- Igor Maykiv
- Oldexandr Osolinsky
- Nadia Vasylykiv

**Simulation and Algorithmization of Complex Technological Processes Control Group (SACTPC)**

Principal researcher – Dr Igor Dobrotvor

Group members:

- Dmytro Bodnar
- Anatoliy Sachenko
- Grygoriy Gladiy
- Diana Zagorodnya

## 2. ICS RESEARCH STAFF

### Senior Staff

#### Oleh Adamiv



Specialist (2000), Information Systems in Management, Ternopil Academy of National Economy, Master of Economic Cybernetics (2001), Ternopil Academy of National Economy, Ph.D. student (2001), Computational Machines, Systems and Networks, Department for Information Computer Systems and Control, IEEE member (1998), IEEE Student Branch Chairman in TANE (1998), Lecturer (2002), Department for Information Computer Systems and Control, Ph. D. in Artificial Intelligence Systems and Tools (2007), IDAACS 2001-2009 Organizing Committee Member, IRS group (2004).

Room 2013, phone: 47-50-50 ext. 12-312

e-mail: oad@tneu.edu.ua, o.adamiv@ieee.org

**Research interests:** robotics, artificial intelligence, navigation methods for mobile robots.

#### Dmytro Bodnar



Specialist (1971), Mathematics, Ivan Franko Lviv State University, Doctor of Physics and Mathematics Sciences, Professor, Mathematical Analysis, Professor at Department of Economic Cybernetics and Informatics, Ternopil National Economic University, SACTPC Group Member (2014).

Room 2210, Phone: 12-270 (internal)

e-mail: d.bodnar@tneu.edu.ua

**Research interests:** analytical foundations of the theory of branched continued fractions and their usage.

#### Pavlo Bykovyy



Bachelor (2004), Computer Engineering, Ternopil Academy of National Economy, Specialist (2005), Computer Systems and Networks, Engineer (2005), Basics PC Construction Laboratory of Department for Information Computer Systems and Control, IEEE Member (2004), IEEE Student Branch Chairman in Ternopil State Economical University (2005), Ph.D. Student (2007), Ph. D. in Computer Systems and Components (2011), IDAACS 2003-2013 Organizing Committee Member, IDS Group Member (2004), IS Group Member (2012), ICSD Group Member.

Room 2004, phone: 47-50-50

e-mail: pb@tneu.edu.ua

**Research interests:** security systems, databases, software development.

#### Sergey Bushuyev



Founder and president of the Ukrainian Project Management Association, Head of Project Management Department at Kyiv National University of Construction and Architecture. Member of the Board of Directors, a member of the Certification Department, First Assessor in seven countries, International Validator of Certification Programs at International Project Management Association (IPMA), Head of PPMITK Group (2014).

e-mail: sbushuyev@ukr.net

**Research interests:** project management.



### Mykhaylo Chyrka



Specialist (1969), Informational Measurement Techniques, Lviv Polytechnic Institute, Ph. D. in Technical Sciences (1997), Devices and Methods for Measuring Thermal Values, IEEE member (1998), Associate Professor, Department for Information Computer Systems and Control, (2001), Deputy Director of Computer Informational Technologies Institute for Part-time Studies (2001), Director of Problem-oriented Computer Systems Institute in Informational Devices and Technologies Carpathians State Headquarter in National Science Academy of Ukraine (2001), ISDA Group Member (2012), mivs GROUP Member (2014).

Room 2015, phone: 47-50-50 ext. 12-315

**Research interests:** contact and non-contact temperature measurement, instrumental error, methods and devices of metrological attendance measurement technique devices.

### Igor Dobrotvor



Specialist (1979), Mathematics and Physics, PhD Student (1979), PhD in Phys.-Math. Sciences (1984), Associated Professor at Department of Intelligent Information Technologies (then International Information, then Economic Cybernetics and Informatics) (2003), Doctor of Technical Sciences (2014), Head of SACTPC Group (2014)

Room 2210

e-mail: e-mail: idobr@yandex.ru

**Наукові інтереси:** методи та засоби цифрової обробки сигналів: цифрові фільтри; системи підтримки прийняття рішень; математична конфліктологія та розпізнавання образів

### Zbyshek Dombrovskyy



Specialist (1969), Radiotechnics, Kyiv Polytechnic Institute, Master in Organization Management (2000), Senior Researcher at Research Department of Ternopil Finance-Economic Institute, TFEI (1974), Inventor of USSR (1977), Head of Research Laboratory “Informatics” at TFEI (1988), Senior Lecturer (1996), Management Department, PMS group (2007), Ph. D. in Computer Systems and Components (2008), ISDA Group Member (2012), PPMITK Group Member (2012).

Room 1218, phone: 43-60-76

e-mail: zbig@tanet.edu.te.ua

**Research interests:** methods and means of digital signals processing, digital filters, decision support systems, arithmetic units and real time special processors, distributed objects automated control systems.

### Lesya Dubchak



Specialist in Mathematics and Informatics, Ternopil V. Hnatiuk State Pedagogical University (2003), Junior Researcher at Department of Information Systems Security (2003), Master in Computer Systems and Network, Ternopil Academy of National Economy (2004), Ph.D. Student (2005), Lecturer at Computer Science Department (2005), Ph.D. (2013), Computer Systems and Components, IS Group Member (2012).

Room 401, phone: 12-323

e-mail: dlo@tneu.edu.ua

**Research interests:** fuzzy logic systems, VHDL language.

**Robert Hiromoto**

Ph.D., University of Texas, Dallas, USA, Professor of Computer Science, University of Idaho, Idaho-Falls, USA, Fulbright Programm Fellow (2013-2014), TNEU, Co-Head of IRS Group (2013), WSS Group Member (2013).

Room 3212

e-mail: hiromoto@uidaho.edu

**Research interests:** parallel computing, wireless sensors security, wireless networks

**Grygoriy Gladyy**

Specialist (1979), Applied Mathematics, Chernivtsi State University, Ph.D. (1990), Mathematical Methods, Models and Information Technologies in Economics, Associated Professor (2013), Department for Information Computer Systems and Control, CCS Group Member (2013), PPMITK Group Member (2014), SACTPC Group Member (2014).

Room 2301, phone: 47-50-50

e-mail: hladiy@yahoo.com

**Research interests:** flow methods of imitation simulation of economy systems and processes.

**Vladimir Golovko**

Master (1979), Computer Engineering, Moscow Bauman State Technical University, PhD (1990), in Computer Science (1990), Doctor of Technical Sciences (2003), Head of Intelligence Information Technologies Department and Laboratory of Artificial Neural Networks of the Brest State Technical University, IRS Group Member (2014), Co-head of ICSD Group.

e-mail: gva@bstu.by

**Research interests:** artificial intelligence; neural networks; information security, mobile robots

**Mykola Karpinsky**

Specialist (1980), Electrical Drive and Automation of Industrial Units, Ph.D. Student (1985), Ph.D., Lviv Polytechnical Institute (1989), D.Sc. in Devices and Means of Electrical and Magnete Values Measuring (1995), Professor, Department of Information Systems Security (2001), Head of IS Group (2012).

e-mail: mkarpinski@ath.bielsko.pl

**Research interests:** specialized computer systems, wireless information technologies and systems of their security.

**Orest Kochan**

Specialist (2006), Physics of Metals, Lviv National University named after I. Franko, IDSCS group member (2007), training researcher (2008), Research Institute for Intelligent Computer Systems, Ph. D. Student (2008), Ph. D. in Devices and Methods of Heat Value Measuring (2011), Senior Lecturer, Department for Information Computer Systems and Control (2011), ISDA Group Member (2008), MIMS Group Member (2014).

Room 2008, phone: 47-50-50 ext. 12-315

e-mail: oko@tneu.edu.ua

**Research interests:** intellectual temperature measurement systems.

### Roman Kochan



Specialist (1998), Informational Measurement Techniques, State University “Lviv Polytechnic”, Ph. D. student (2000), Computational Technique Elements and Devices and Control Systems, Ternopil Academy of National Economy, IEEE member (2001), Ph. D. in Technical Sciences (2005), D.Sc. Technical Sciences (2013), Head of MIMS group (2014).

Room 2009, phone: 43-60-38 (12-234)

e-mail: roman.kochan@gmail.com

**Research interests:** distributed measurement systems, microprocessor systems, analog-digital converters.

### Volodymyr Kochan



Specialist (1973), Informational Measurement Techniques, Lviv Polytechnic Institute, Ph. D. in Technical Sciences (1989), Devices and Methods for Measuring Thermal Values, Associate Professor of Department for Information Computer Systems and Control (1996), Associate Professor of Department of Specialized Computer Systems (2002), IEEE member (2002), Member of Specialized Academic Council K58.082.02 at TNEU (2002), Director of the Research Institute for Intelligent Computer Systems (2004), IDAACS 2001-2013 OrgCom Vice-Chair, IDS Group Member (2004), NMPC Group Member (2004), Head of ISDA Group (2009), MIMS Group member (2014).

Room 2009, phone: 47-50-50 ext. 12-315

e-mail: vk@tanet.edu.te.ua

**Research interests:** intelligent measurement devices, informational-measurement systems and complexes.

### Myroslav Komar



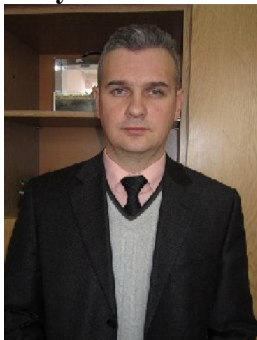
Specialist (2001), Information Systems in Management, Ternopil Academy of National Economy, Master (2002), Economic Cybernetics, Ternopil Academy of National Economy, Programmer (2002), Laboratory of Computing Systems and Networks at Department for Information Computer Systems and Control, Ph.D. Student (2008), Information Technologies, Ph.D. (2013), Information Technologies, IDS Group (2008), IS Group Member (2012), ICSD Group Member (2014).

Room 2014, phone: 47-50-50

e-mail: mko@tneu.edu.ua

**Research interests:** artificial intelligence, systems of information security.

### Vasyl Koval



Specialist (1998), Management Information Systems, Ternopil Academy of National Economy, M.S. in Economic Cybernetics (1999), Ternopil Academy of National Economy, Ph.D. Student (1999), Computing Machines, Systems and Networks, Lecturer (2001), Department for Information Computer Systems and Control, IEEE member (2000), IDAACS International Symposium Organizational Committee Member (2001-2005), Ph.D. in Artificial Intelligence Systems and Means (2004), Associate Professor of the Department for Information Computer Systems and Control (2007), Faculty of Computer Information Technologies, IDAACS 2005-2007 OrgCom Vice-Chair, Co-Head of the IRS group (2009),.

Room 803, phone: 43-18-39 ext. 18-102

e-mail: vko@tneu.edu.ua

**Research interests:** mobile robots, signal and image processing, technical vision systems, artificial intelligence, distributed systems.



**Victor Krylov**

Specialist in radiotechnics, Odessa Polytechnic Institute (1978), Ph.D. in Radiotechnical and Television System and Devices (1986), D.Sc. in Control Automate Systems and Advanced Information Technologies (2003), Professor, Department of Applied Mathematics and Information Technologies in Business (2005), Odessa National Polytechnic University, co-head of IPPR group (2012).

e-mail: viktor\_krylov@inbox.ru

**Research interests:** digital images processing, images recognizing.

**Oksana Lyashenko**

Specialist in mathematics, informatics and computers, Ternopil State Pedagogical Institute (1994), Specialist in Finance and Credit, Ternopil Academy of National Economy (1998), Ph.D. in Economic Simulation (2001), D.Sc. in Mathematical Methods, Models and Information Technologies in Economy (2010), Head of Department of Economical Cybernetics and Informatics (2011), PPMITK Group Member (2014).

Room 2212, phone: 12270,

e-mail: oksanal2008@gmail.com

**Research interests:** economic simulation, project management

**Ihor Maykiv**

Specialist (1996), Radio Engineering, State University “Lviv Polytechnic”, Ph. D. student (2005), Elements and Devices and Control Systems of Computer Engineering, Junior Researcher (2009), Research Institute for Intelligent Computer Systems, Ph. D. in Computer Systems and Components (2012), ISDA Group Member (2008), MIVS Group Member (2014).

Room 2009, phone: 47-50-50

e-mail: mim@tanet.edu.te.ua

**Research interests:** investigation and development of optimal architectures for components of measurement-control systems, microprocessors and PLM, VHDL language.

**Andriy Melnyk**

Bachelor (2005), Economic Cybernetics, Ternopil Academy of National Economy, Master in Economic Cybernetics (2006), Ternopil State Economic University, Ph.D. student (2007), Ph.D. in Information Technologies (2012), KBO Group Member (2005), CCS Group Member (2009).

e-mail: melnyk.andriy@gmail.com

**Research interests:** ontology, knowledge discovery.

### Yaroslav Nykolaychuk



Specialist Specialist Electrification and Automation of Oil and Gas Production (1967), Lviv Polytechnic Institute, Ph. D in Elements and Devices of Computer Engineering and Control Systems (1980), D. Sc. in Elements and Devices of Computer Engineering and Control Systems (1989), Prof. (1993), Department of Automated Control, Ivano-Frankivsk Institute of Oil and Gas, director of Carpathian State Center of Information Tools and Technologies of National Academy of Sciences of Ukraine (1994), full member of Ukrainian Academy of National Progress (1995), Head of Department of Specialized Computer Systems (1999), Vice-director on science of Institute of Computer Information Technologies (2000), IEEE member (2000), Vice-head of Special Scientific Council K58.082.02 at TNEU (2002), Head of ITSCS group (2007).

Room 823, phone: 43-18-09

e-mail: yn@tneu.edu.ua

**Research interests:** embedded computer systems, signal processing, information theory and data encoding, autonomous sensors, low-level sensor networks.

### Ihor Paliy



Specialist (2002), Information Systems in Management, Ternopil Academy of National Economy, master (2003), Economical Cybernetics, Ternopil Academy of National Economy, PhD student (2004), Computational Machines, Systems and Networks, trainee-lecturer (2004), Department for Information Computer Systems and Control, Scientific Associate (2006), Research Institute for Intelligent Computer Systems, IDAACS 2005-2007 organizing committee member, Ph. D. in Systems and Means of Artificial Intelligence (2009), IDAACS 2011 OrgCom Vice-Chair, ICS Scientific Secretary (2009), Co-Head of IPPR Group (2004).

Room 2014, phone: 47-50-50 ext. 12-312

e-mail: ipl@tneu.edu.ua

**Research interests:** face detection and recognition, image processing, artificial neural networks, parallel computing.

### Roman Pasichnyk



Specialist in Applied Mathematics (1979), Lviv State University named after I. Franko, Ph. D. in Phys.-Math. Sciences (1989), Computational Mathematics, Assistant Prof. of Department of Economic Cybernetics, (1997), Vice-head of Department of Economic Cybernetic (2001), Head of CCS Group (2009).

Room 2010, phone: 47-50-50 ext. 12-312

e-mail: rp@tneu.edu.ua

**Research interests:** ontologies, knowledge discovery.

### Yuriy Pihovsky



Master in Economic Cybernetics (2004), Ternopil Academy of National Economy, lecturer (2004), Department for Information Computer Systems and Control, IDAACS 2003 international symposium organizational committee member, Ph. D. Student, Ph. D. in Mathematical Modelling and Calculus Methods (2008), CCS Group Member (2009).

e-mail: pigovsky@gmail.com

**Research interests:** mathematical modeling, algorithms.

**Sergey Rippa**

Specialist in Organizing Machine Processing of Economic Information (1979), Rostov-on-Don Institute of National Economy, Ph. D. in Economic-Mathematical Methods and Usage of Computer Engineering in National Economy Control (1985), D. Sc. in Economic-Mathematical Modelling (1998), Head of Department of Calculating-Information Technologies Development at Taxing Problems Research Center at Academy of Tax Service of Ukraine (1999), Prof. (1999), Department of Intelligent Information Technologies, Head of KBO Group (2008), PPMITK Group Member (2014).

e-mail: rippa\_serg@ukr.net

**Research interests:** knowledge bases, ontology, knowledge discovering.

**Oleksiy Roshchupkin**

Specialist (2004), Computer Systems and Networks, Yuriy Fedkovych Chernivtsi National University, Assistant at Department of Computer Systems and Networks, Faculty of Computer Science, Yuriy Fedkovych Chernivtsi National University (2005), PhD Student at Ternopil National Economic University (2010), Computer Systems and Components, Head of IEEE student branch at TNEU, ISDA Group Member (2004).

Room 2009, phone 47-50-50

e-mail: o.roshchupkin@chnu.edu.ua, alrosh@rambler.ru

**Research interests:** information-measuring systems, microcontrollers, multisensor systems, neural networks, sensors.

**Anatoliy Sachenko**

Specialist in Information Measurement Technology (1968), Ph.D. in Electrical Engineerings (1978), Scientific Advisor of Branch Research Laboratory for Automated Systems and Networks (1984), D. Sc. in Computer Engineering (1988), Prof. of Department for Information Computer Systems and Control (1991), Honored Inventor of Ukraine (1992), Full Member of Ukrainian Academy of Economics Cybernetics (1998) and New- York Academy of Sciences (1998), Member of Specialized Scientific Council in State University "Lviv Polytechnic" (1994), Chairman of Specialized Scientific Council K58.082.02 at TNEU (2002), Editor-in-Chief of International Journal of Computing, Doctoral Dissertations Chapter Editor in "IEEE I&M Magazine", Head of Department for Information Computer Systems and Control, Dean of Institute for Computer Information Technologies (1994-2005), Scientific Advisor of the ICS (2004), IDAACS 2001-2013 Co-Chairman, Head of IDS Group (2004), Co-Head of ICSD (2014), NNPC Group Member (2004), KBO, WSS Groups Member (2008), IPPR, PPMITK and SACTPC Groups Member (2014).

Room 2302, phone: 47-50-50 ext. 12-322

e-mail: as@tneu.edu.ua

**Research interests:** Artificial intelligent systems, distributed sensor networks, computational, intelligence, intelligent robotics systems, parallel computation systems, cybersecurity and safety systems, project management, wireless sensor networks.



### Jürgen Sieck



Master in mathematics (1981), Humboldt University Berlin, Germany, PhD in Computer Science (1989), Humboldt University Berlin, Germany. Senior researcher at the research group “Informations- und Kommunikationsanwendungen” (INKA), professor for computer sciences with a specialisation on algorithms, multimedia and mobile application for the degree programme Applied Computer Science at the University of Applied Sciences HTW Berlin. WSS Group member.

e-mail: [j.sieck@htw-berlin.de](mailto:j.sieck@htw-berlin.de)

**Research Interests:** multimedia, computer graphics, virtual reality and wireless communication.

### Radislav Smid



Ph.D. (2000), Czech Technical university in Prague, Faculty of Electrical Engineering, Head of Laboratory of Diagnostics and Non-destructive Testing, Associate Professor at Department of Measurement, Faculty of Electrical Engineering, Czech Technical university in Prague, Prague, Czech Republic. Dr Smid is an member of IMEKO and IEEE. ISDA Group member.

e-mail: [smid@fel.cvut.cz](mailto:smid@fel.cvut.cz)

**Research Interests:** signal processing, measuring, testing, autonomous sensors embedded computer systems.

### Iryna Turchenko



Specialist (1997), Information Systems in Management, Ternopil Academy of National Economy, training lecturer (2002), Department of Specialized Computer Systems, Ph. D. Student (2003), Information Technologies, Lecturer (2006), Department for Information Computer Systems and Control, Ph. D. (2008), Computer Systems and Components, Assistant Professor of Department for Information Computer Systems and Control (2011), ISDA Group Member (2004).

Room 2017, phone: 47-50-50 ext. 12-315

e-mail: [itu@tneu.edu.ua](mailto:itu@tneu.edu.ua)

**Research interests:** neural networks, intelligent and distributed sensor networks, multi-parameter sensors.

### Volodymyr Turchenko



Specialist (1995), Computing Machines, Systems, Complexes and Networks, Brest Polytechnic Institute (rep. Belarus), Ph. D. in Computer Engineering (2001), Assistant Professor (2002), Associate Professor (2004), Department for Information Computer Systems and Control, IEEE member (1999), IDAACS 2001-2011 OrgCom Vice-Chair and member, member of Specialized Academic Council K58.082.02 at TNEU (2002-2009), FP7 Marie Curie Postdoctoral Research Fellow at the Center of Excellence of High Performance Computing, Department of Electronics, Informatics and Systems, University of Calabria, Italy (2009-2011), Deputy editor-in-chief of International Journal “Computing” (2009), ACM member (2009-2011), Member of Marie-Curie Association, Head of NNPC Group (2004).

Room 2017, phone: 47-50-50 ext. 12-315

e-mail: [vtu@tneu.edu.ua](mailto:vtu@tneu.edu.ua), web: <http://www.ics.tneu.edu.ua/vtu/>

**Research interests:** Neural networks, parallel programming, parallel and distributed computations.

**Nadia Vasylykiv**

Specialist (1981), Physics, Lviv State University, Senior Lecturer (1995), Department for Information Computer Systems and Control, Ph. D. in Devices and Methods of Heat Value Measuring (2011), Assistant Professor of Department for Information Computer Systems and Control (2011), ISDA group member (2012), MIMS groups member (2014).

Room 2301, phone: 47-50-50 ext. 12-315

e-mail: nv@tneu.edu.ua

**Research interests:** metrological support for information measurement systems.

**Artur Voronych**

Master (2008), Automation Control of Technological Processes, Ph.D. student (2010), Department of Computer Systems and Network, Ivano-Frankivsk National Technical University of Oil and Gas, ITSCS group (2012).

e-mail: archy.bear@gmail.com

**Research interests:** signal processing, theory of information and data encryption.

**Natalia Vozna**

Specialist (1998), Management Information Systems, Ternopil Academy of National Economy, PhD student (2005), Computers, Systems and Networks, lecturer (2009), Department of Specialized Computer Systems, PhD (2009), Computer Systems and Components, ITSCS group (2013).

Room 823, phone: 43-18-09

e-mail: nvozna@ukr.net

**Research interests:** computer systems design, information theory and data decoding, lower computer networks.

**Orest Volynskyy**

Master (2009), Specialized Computer Systems, Ternopil National Economic University, Training-Researcher RIICS (2009), Ph. D. (2013), ITSCS group member (2009), WSS group member (2014).

Room 2009, phone 47-50-50

e-mail: ovo@tneu.edu.ua

**Research interests:** special processors in bounded systems of residual classes.

**Natalia Yatskiv**

Specialist (1997), Physics-Engineer, Ivano-Frankivsk Oil and Gas State Technical University, Ph. D. in Technical Sciences, Computational Machines, Systems and Networks (2003), Associate Professor (2007), Department for Information Computer Systems and Control, WSS Group Member (2012).

Room 2305B phone: 47-50-0\*12-321

e-mail: jatskiv@ukr.net

**Research interests:** human-computer interaction; wireless communication technologies.



### Vasyl Yatskiv



Specialist (1996), Automation Technological Processes and Manufacturing, Ivano-Frankivsk Oil and Gas State Technical University, Ph. D. in Technical Sciences, Computational Machines, Systems and Networks (2001), Senior Lecturer (2001), Associate Professor (2002), Department of Specialized Computer Systems, Secretary of the Specialized Academic Council K58.082.02 at TNEU (2002), IDS Group Member (2004), Head of WSS Group (2012),.

Room 2305B phone: 47-50-0\*12-321

e-mail: jazkiv@ukr.net, vy@tneu.edu.ua

**Research interests:** cordless optical connection channels, modular arithmetic based special processors development.

### Oleh Zastavny



Specialist (2002), Information Security in Computer Systems, Ternopil Academy of National Economy, Ph. D. student (2002), Elements and Devices of Computer Engineering and Control Systems, Assistant (2002), Department of Specialized Computer Systems, Ph. D. (2007), Elements and Devices of Computer Engineering and Control Systems, ITSCS group (2007).

Room 823, phone: 43-18-09

e-mail: oz@tanet.edu.te.ua

**Research interests:** embedded computer systems, signal processing, information theory and data encoding, autonomous sensors, low-level sensor networks.

## Junior Staff

### Ninel Dobrovolska



Specialist (1993), mathematics, Ternopil State Pedagogical Institute, specialist (2000), finances, Ternopil Academy of National Economy, lecturer (2001), department of economical cybernetics, (2012) Department for Information Computer Systems and Control, PPMITK Group Member (2013).

Room 2301

e-mail: [ninel.dobrovolska@gmail.com](mailto:ninel.dobrovolska@gmail.com)

**Research interests:** economic-mathematical simulation.

### Mykhailo Dombrovsky



Specialist (1998), Finances and Credits, Ternopil Academy of National Economy, training management and information systems Consortium for improving business and management education in Ukraine (2000-2002), research fellow (part-time work) Scientific Research Department of Ternopil National Economic University (TNEU) (2009-2013), engineer of the first category university educational computer cybernetic laboratory TNEU (2015), part-time lecturer (2000-2012), Department of International Economics, PPMITK Group Member (2013).

Room 1212, 1211, 11201, phone: 47-50-50

e-mail: [Mik2\\_wsf@gmx.com](mailto:Mik2_wsf@gmx.com)

**Research interests:** project management.

### Vitaliy Dorosh



Bachelor (2009), Software of Automated Systems, Ternopil National Economic University, Engineer (2009), ISDA Group Member (2009), Laboratory of Personal Computers at Department for Information Computer Systems and Control, NNPC Group Member (2013).

Room 2013, phone: 47-50-50 ext. 12-312

e-mail: [vdo@tneu.edu.ua](mailto:vdo@tneu.edu.ua)

**Research interests:** neural networks

### Oksana Dunets



Bachelor (2015), Information Technologies, Computer Science, Ternopil National Economic University, is pursuing Master degree in Project Management (2017), technician at Department for Information Computer Systems and Control (2015), PPMITK Group Member (2015).

Room 2305, phone: 47-50-50\*12-321

e-mail: [o.dunets@tneu.edu.ua](mailto:o.dunets@tneu.edu.ua)

**Research interests:** neural networks, web development, project management, artificial intelligence, modeling, web technologies.

### Yuriy Ivanyshak



Bachelor (2014), International Information, Master (2015), Project Management, Ternopil National Economic University, Engineer (2015), PhD Student (2015), Department for Information Computer Systems and Control, PPMITK Group Member (2015).

Room: 2007, phone: 47-50-50\*12-324

e-mail: y.ivanyshak@tneu.edu.ua

**Research interests:** cybernetics in management, system approach in management, TRIZ.

### Kostyantyn Kovalok



Master (2012), professional education (computer technologies), Ternopil V. Gnatyuk National Pedagogical University, engineer (2012), Department for Information Computer Systems and Control, IPPR Group Member (2013), IRS Group Member (2013).

Room 2305, phone.: 47-50-50 (12-312)

e-mail: kko@tneu.edu.ua

**Research interests:** pattern recognition

### Taras Lendyuk



Specialist (1985), Industry Planning, Ternopil Finance Economic Institute, Engineer-Programmer (1986), Ph. D. student (1999), Economic-Mathematical Modelling, Department for Information Computer Systems and Control, IDAACS 2001-2011 organizing committee member, KBO Group Member (2009), PPMITK Group Member (2014).

Room 2011, phone: 47-50-50 ext. 12-234

e-mail: tl@tneu.edu.ua

**Research interests:** economic-mathematical modelling, project management.

### Volodymyr Neizzhalyi



Bachelor (2015), Information Technologies, Computer Science, Ternopil National Economic University, is pursuing Master degree in Project Management (2017), technician at PC Lab, Department for Information Computer Systems and Control (2015), PPMITK Group Member (2015).

Room: 2303

e-mail: neizzhalyi@gmail.com

**Research interests:** management of investment projects.

### Alex Nykorak



Technician (2010), Chernivtsi industrial college, bachelor (2012), computer engineering, master (2013), computer systems and networks, Chernivtsi Yury Fedkovych National University, Junior Researcher (2013), Department for Information Computer Systems and Control, IRS Group Member (2013).

Room 2009, phone.: 47-50-50

e-mail: aleks.nykorak@gmail.com

**Research interests:** systems and tools of artificial intelligence, control systems and processes, computer systems and components, information technologies, automation of control processes

**Olexandr Osolinsky**

Bachelor (2004), Computer Engineering, Ternopil Academy of National Economy, Specialist (2005), Computer Systems and Networks, Ternopil Academy of National Economy, Junior Scientist (2005), Research Institute for Intelligent Computer Systems, IDAACS 2005-2009 organizing committee member, ISDA and IDS Groups Member (2004), MIMS Group Member (2014).

Room 2002, phone: 47-50-50

e-mail: oso@tneu.edu.ua

**Research interests:** software development, web-design, distributed systems, computer systems architectures.

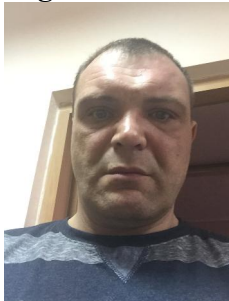
**Oksana Rymar**

Bachelor (2012), English filology, Ternopil V. Gnatyuk National Pedagogical University, Master (2013), project management, Ternopil National Economic University, junior-lecturer (2013), Department for Information Computer Systems and Control, PPMITK Group Member (2014).

Room 2301, phone 47-50-50 (12-312)

e-mail: oksanarymar@ukr.net

**Research interests:** project management

**Oleg Sachenko**

Specialist (1992), International Economy, Ternopil Institute of National Economy, Lecturer, Department for Information Computer Systems and Control, TNEU (2013), PPMITK Group Member (2014).

Room 2011, phone: 47-50-50

e-mail: olsachenko231@gmail.com

**Research interests:** project management

**Taras Tsavolyk**

Bachelor (2013), Computer Engineering, Master (2014), Specialized Computer Systems, Ternopil National Economic University, PhD Student (2014), Lecturer (2016), Department for Information Computer Systems and Control.

Room: 2305B

e-mail: tth@tneu.edu.ua

**Research interests:** wireless sensor networks, the system of residual classes.

**Vladyslav Shults**

Bachelor (2011), Computer Engineering, Master (2012), Computer Systems and Networks, Ternopil National Economic University, Junior Researcher (2012), Department for Information Computer Systems and Control, NNPC Group Member (2012).

Room 2003, phone: 47-50-50 (12-312)

e-mail: vshu@tneu.edu.ua

**Research interests:** parallel computing, neural networks.



### Serhiy Voznyak



Engineer-Economist (1996), Information Systems in Management, Ternopil National Economic University Director Deputy of Exploitation and Security (1997), Lecturer, Department of Computer Engineering (1997), KBO Group Member (2012).

Room 1101, phone: 47-58-65

e-mail: sv@tneu.edu.ua

**Research interests:** computer networks and infrastructure, web-technologies

### Diana Zagorodnya



Bachelor (2008), Pedagogic Education, Teacher of Mathematics and Basics of Informatics, V. Hnatiuk Ternopil National Pedagogic University, Master (2009), Pedagogic Education, Teacher of Mathematics and Basics of Informatics, V. Hnatiuk Ternopil National Pedagogic University, Head of Training Courses (2009), Ternopil Municipal “Station of Junior Technics”, Administrative Assistant, Ph.D. student (2012), Department for Information Computer Systems and Control, Ternopil National Economic University (2012), IPPR Group Member (2012), SACTPC Group Member (2014).

Room 2301, phone: 47-50-50\*12-321

e-mail: dza@tneu.edu.ua

**Research interests:** images identification, images analysis algorithms for computer recognition systems.

### 3. RESEARCH PROJECTS

#### Current

#### [Project 1] Distributed Sensor Networks with Computing Nodes Reconfiguration

Principal investigator: Prof. Anatoliy Sachenko

Co-investigator: Dr. Igor Maykiv

**Foreign partner:** Technical University of Moldova, Moldova

**Duration:** 2014 – 2015

**Objectives:** Development of methods for structural synthesis of universal modules with the reconfiguration possibility.

#### Main project results:

- On the basis of morphological analysis and synthesis technique of structural synthesis of universal modules comprising functional analysis, structural synthesis and finding the set of optimal solutions was developed. The technique combines lexicographical criterion advantages (L-criterion) for the selection of electronic components during functional analysis and absolute criterion of preference (optimality Pareto,  $\pi$ -criterion) during the search of the set of optimal solutions that are considered in the literature as alternative methods to find optimal solutions. The combination of L- and  $\pi$ -criteria to reduce the number of alternatives synthesized during structural synthesis. An formalized discrete optimization solution that is versatile for a wide range of problems of optimal structural synthesis of computing systems.
- A new universal module structure with improved functional properties through a separate process execution processing and data sharing capabilities as well as reconfiguration of hardware and software through the use of programmable logic integrated circuits (FPGAs) was designed.
- A 4-level model that graphically displays the relationship information between different processes of receiving and transmitting messages to the controller serial interfaces (KPI) and is an effective tool in their implementation both at the functional analysis and structural synthesis.
- An experimental model of network application processor with the possibility of reconfiguring the methodology and its testing was created.

#### Team:

- Anatoly Sachenko;
- Igor Maykiv;
- Volodymyr Kochan;
- Nadia Vasylykiv;
- Oleksiy Roshchupkin;
- Diana Zahorodnia;
- Yuriy Ivanyshak;
- Olexandr Osolinsky;
- Taras Lendyuk;
- Oksana Dunets.

**[Project 2] Wireless Multimedia Sensor Networks on the Base of Modular Arithmetics and Galois Codes for Videomonitoring Systems**

Principal investigator: Prof. Anatoliy Sachenko

Co-investigator: Dr. Vasyl Yatskiv

**Foreign partner:** Pedagogical University Huazhong, China.

**Duration:** 2013 – 2014

**Objectives:** developing of improved methods for training of artificial neural networks on heterogeneous parallel computing systems consisting of grid, providing high efficiency of parallelization and development of grid-based library functions for paralel training of artificial neural networks.

**Main project results:**

- There were developed new methods of data coding and transmitting based on modular arithmetic, which enables increased efficiency of wireless multimedia sensor networks (WMSN). There were developed methods targeted for using in devices with limited hardware resources and autonomous power supply.
- Method of network coding based on data system of residual classes. There was investigated of the overall bandwidth of wireless sensor networks and scope of data distribution schemes for different residues.
- Method of coding and redundancy reducing of multimedia data without loss in system of residual classes, which provides 2-3 times reducing of image processing time by division of the image on the modules of residual classes system and parallel encoding of obtained residues. Application of Huffman codes for residues compressing provides lossless compression ratio depending on the class of images: 1,6 – 4 – for photo-realistic images; 4 – 8 – for images with large areas of the same color.
- Method of improving of data reliability based on modified correcting code system of residual classes, which is characterized by a lower computational complexity and allow about 5 times increasing of encoding speed versus R – source code RNS and Reed – Solomon RS (127, 87).

**Team:**

- Anatoliy Sachenko
- Yaroslav Nykolaychuk
- Natalia Yatskiv
- Vasyl Yatskiv
- Orest Volynskyy
- Petro Humeny

**[Project 3] Neural network method for improving of the accuracy of information-measurement systems of ultraviolet radiation**

Principal investigator and project executor: Prof. Anatoliy Sachenko

Project is executed within interuniversity network Erasmus Mundus together with partners from Alaxender Ioan Kuza University, Iassi, Romania.

Duration: 01.01.2013-31.12.2014

**Goal:** development of new neural network method for improving of the accuracy of information measuring systems for measurement of ultraviolet radiation.

**Research purpose:** neural network methods and means of accuracy improving of the information-measuring systems for measurement of ultraviolet radiation.

**Research methods:** structural and functional analysis (error analysis of measuring systems for measuring of UV radiation level and UV sensors); methods of neural networks theory, the method of gradient ascent in the space of weight coefficients and neurons thresholds of (for NN training); simulation methods (for experimental research of developed methods); technique of primary transformer investigation.

**Current project results:**

- The methods of signal processing of multiparameter sensors was proposed. Simulations was conducted in MathLab.
- The software for modeling of the real multiparameter sensors behavior was developed. The software allows to type include into the model random and systematic errors as well, and identify the limits of the proposed methods.
- Application for Ukrainian patent and for useful model was made.

**Team:**

- Anatoliy Sachenko
- Oleksiy Roshchupkin
- Volodymyr Kochan



## Completed

### **[Project 4] Methods and Tools of Wireless Multimedia Sensor Networks Based on Modular Arithmetic.**

Principal investigator – Prof. Yaroslav Nykolaichuk

Duration: 01.01.2013 – 31.12.2014

**Goal:** development of methods and tools for data encoding and transmitting in wireless multimedia sensor networks aimed at improving the reliability of their operation and functionality.

**Abstract:** The project developed new methods and algorithms for data encoding and transmitting using mathematical tools of modular arithmetic, aimed at improving the performance of wireless multimedia sensor networks (WMSM). A Verilog – encoder model for noise-immune data encryption using modified correcting codes is designed.

#### **Main results:**

- The method of adaptive coding and transmission of multimedia data based on modular arithmetic and multipath routing using adaptive distribution packages and their transfer from multipath routing, providing efficient use of the total bandwidth of wireless sensor networks.
- The method of network data coding based on system of residual classes (SRC), which would reduce the data volume by 50%, including the retransmission of packets that needs to restore messages. The proposed method of packages selecting of relatively simple modules, where modules are selected bit different, because remnants of the bit transmitted by the common route is approximately equal to the bit residues on specific routes. The method of network coding improves overall network capacity by about 60%.
- A modified correcting code system of residual classes, characterized by the formation of the simplified procedure of check symbols, providing increased performance encoding is about 5 times as compared with other correcting codes. Using modified correcting codes RNS in wireless sensor networks will improve the reliability and overall network capacity by reducing the number of retransmissions.

#### **Team:**

- Yaroslav Nykolaichuk
- Anatoliy Sachenko
- Vasyl Yatskiv
- Natalia Yatskiv
- Natalia Vozna
- Petro Humenny
- Orest Volynsky

### **[Project 5] Neural Network Methods for Evaluation of Microprocessors in Power Consumption of Instructions**

Principal investigator: Dr. Zbyshek Dombrovsky

**Duration:** 2010 – 2012

**Objectives:** development of hardware-software complex, which will allow to built mathematical models of processor cores power consumption.

#### **Main tasks:**

- development of appropriate specialized hardware, which allow evaluate power consumption of instruction in normal microprocessor work mode;
- development of testing methods (calibration) of created hardware;
- using of artificial neural networks for prediction of energy consumption of those instructions modes (addressing, conditions and etc.) which was not tested experimentally in full amount;
- using of experiment planning methods for the additional decreasing of experiments volume.

**Team:**

- Anatoliy Sachenko
- Volodymyr Kochan
- Andrii Borovyi
- Oleh Havryshok
- Ihor Maykiv
- Orest Volynskyy

**Published results:**

1. A. Borovyi, V. Kochan, Th. Laopoulos, Sachenko A. Improved Sorting Methodology of Data-processing Instructions, International Journal of Computing, vol. 10, issue 1, 2011, pp. 50-55.
2. A. Borovyi, I. Maykiv, R. Kochan, Z. Dombrovskyy, V. Kochan. The Unit of Measurement of Consumers Pulse Energy, Patent of Ukraine 90922 UA, MPK (2009) G05F 5/00 G01K 17/00, no. a2008 06325 ; applied 13. 05. 2008; published 10. 06. 2010, Bulletin no. 11.
3. Time-domain analysis of ARM7TDMI core instructions [Text] / A. Borovyi, V. Kochan, Th. Laopoulos, A. Sachenko // Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS'2011). – Vol. 2. – [S. l. : s. n.], 2011. – September 15-17. – P. 785 –790.

## **[Project 6] Parallel Grid-aware Library for Neural Networks Training – PaGaLiNNeT**

Principal investigator: Dr. Volodymyr Turchenko

Scientific advisor: Prof. Anatoliy Sachenko

Partners: Prof. Lucio Grandinetti, Center of Excellence on High Performance Computing, Department of Electronics, Computer Science and Systems, University of Calabria, Italy.

Grant No FP7 MC IIF 221524 – 908524 according to the 7th EU Frame Programme, Grant of Marie Curie for researches from the third countries (International Incoming Fellowships – IIF), return phase

**Duration:** 2011 – 2012

### **Objectives:**

Development of the enhanced training methods for artificial neural networks in heterogeneous parallel computing systems within the Grid, providing high efficiency of parallelization and development of the Grid-based library for parallel neural networks training.

### **Main results:**

- As part of the project design there are created three levels of grid-based library: (i) at the level of a single supercomputer / cluster homogeneous computing nodes, (ii) at the heterogeneous computing nodes within a cluster, (iii) at the grid computing system with heterogeneous hosts and heterogeneous communication channels between them. A parallel version of the library for the level (i) was installed on parallel machines with ccNuma architecture. A strategy for resource brokering based on Pareto optimization [1] is implemented on C programming language and included in the library. The developed library for the level (i) which include the routines for parallel training of multilayer perceptron [2] and recurrent neural network was used for the prediction of the stock price for financial markets. The results are published in [6]. A parallel version of the library for the level (ii) was developed and installed on the computing cluster of heterogeneous architectures. The resource brokering sub-routine based on Pareto optimization [1] is called from the code of resource broker separately before executing the main task. The performance analysis of computing nodes of the cluster is based on a modified BSP-based model with improved computational complexity of parallel training algorithm for multilayer perceptron [2]. The results are published in [5];
- Within the application of parallel algorithms for neural network training to speed up the execution of practical tasks, an application task of convolution neural network for the detection the number of micronucleus's in the human lymphocytes is considered. The accurate detection of the number of micronucleus's in the human lymphocytes can be used as biological dosimeter in order to relieve the presence and the action of carcinogenic factors and could enhance the correctness of the final medical response. It was proven the application of convolution NN for the development of this task because this NN model provides good detection properties and showed good detection results on the more complicated task of human face detection. The human lymphocyte images were acquired by the image flow cytometer which causes the different types of noise that influence on the acquired image. We have tested the CNN for the images altered by a zoom factor. The CNN provides no false alarms for each zoom factor. The number of false negative detections is much lower in comparison with the pattern matching method, implemented as a LABVIEW routine (IMAQ Match Pattern method) inside the flow cytometer. The detection rate of 87.5% provided by the CNN is much higher than 25% of detection rate by the IMAQ Match Pattern method on the considered example images. The results are published in [3, 4].

**Published results:**

1. Turchenko V.O. Brokering methodology of Grid-resources using Pareto-optimality // Measuring and Computing Technologies Equipment in Technological Processes. – 2011. # 1. – pp. 312-318.
2. Turchenko V.O. Efficiency Comparison of Multilayer Perceptron Group Training on Parallel Computer and Computation Cluster // Transactions KPI. Informatics, management and computing technology: Proceedings – Kyiv: Vek+. – 2011. – No. 54. – pp. 130-138.
3. Paliy I., Lamonaca F., Turchenko V., Grimaldi D., Sachenko A. Detection of Micro Nucleus in Human Lymphocytes Altered by Gaussian Noise Using Convolution Neural Network, Proceedings of 2011 IEEE International Instrumentation and Measurement Technology Conference (I2MTC 2011), 2011, Binjiang, Hangzhou, China, pp. 1097-1102.
4. Lamonaca F., Turchenko V., Grimaldi D. Aspetti innovativi della progettazione hardware e software di citofluorimetro ad immagini, Atti del XXVIII Congresso Nazionale Gruppo Misure Elettriche ed Elettroniche, 2011, Genova, Italy, pp. 289-290.
5. Turchenko V., Puhol T., Sachenko A., Grandinetti L. Cluster-Based Implementation of Resource Brokering Strategy for Parallel Training of Neural Networks, Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems IDAACS2011, Sep 15-17, 2011, Prague, Czech Republic, pp. 212-217.
6. Turchenko V., Beraldi P., De Simone F., Grandinetti L. Short-term Stock Price Prediction Using MLP in Moving Simulation Mode, Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems IDAACS2011, Sep 15-17, 2011, Prague, Czech Republic, pp. 666-671.
7. Turchenko V. Efficiency Comparison of Batch Pattern Training Algorithm of Multilayer Perceptron on Parallel Computer and Computational Cluster, Scientific Journal of National Technical University of Ukraine “Kyiv Polytechnic Institute”, Kyiv, 2011, No 54, pp. 130-138 (in Ukrainian).
8. Sachenko A., Kulakov Yu., Kochan V., Turchenko V., Bykovvy P., Borovyy A. Computer Networks: A Tutorial, Ternopil, Ekonomichna dumka, 2012, 476 p. // Chapter 15. Grid-computations based on network technologies, pp. 416-439 (in Ukrainian).
9. Turchenko V., Grandinetti L., Sachenko A. Parallel Batch Pattern Training of Neural Networks on Computational Clusters, Proceedings of the 2012 International Conference on High Performance Computing & Simulation (HPCS 2012), July 2 – 6, 2012, Madrid, Spain, pp. 202-208.
10. Turchenko V., Golovko V., Sachenko A. Parallel Batch Pattern Training of Recirculation Neural Network, Proceedings of the 9th International Conference on Informatics in Control, Automation and Robotics (ICINCO 2012), July 28 – 31, 2012, Rome, Italy, pp. 644-650.
11. Turchenko V., Golovko V., Sachenko A. Parallel Training Algorithm for Radial Basis Function Neural Network, 7th International Conference on Neural Networks and Artificial Intelligence (ICNNAI'2012), October 10-12, 2012, Minsk, Belarus, pp. 47-51.

## **[Project 7] Efficient Parallel Batch and Single Pattern Neural Network Training Algorithms Using Open MPI and GPU-computing**

Principal investigator: Dr. Volodymyr Turchenko

Partners: Prof. Jack Dongarra, Innovative Computing Lab, University of Tennessee, Knoxville, TN, USA.

Grant: Fulbright Scholar Program 2012/13

**Duration:** 09/2012 – 06/2013

### **Objectives:**

1. test enhanced batch pattern parallel algorithm for NN training by changing the parameters of the internal algorithms of MPI collective functions on different parallel architectures;
2. develop GPU-based versions of the parallel batch and single pattern algorithms for NN training;
3. test experimentally the efficiency improvement of the GPU-based version of the algorithms in comparison with their Open MPI implementations.

### **Main results:**

1. The parallelization efficiency of the neural network training algorithm on the example of the recirculation neural network model has researched. The Open MPI, OpenMP and CUDA-based versions of the parallel batch pattern training algorithm for recirculation neural network were implemented using C language. The parallelization efficiency of the developed algorithms has been researched on many-core parallel machine with 48 AMD Opteron 6180 SE processors, on computational cluster with 48 Intel Xeon E5520 processors, on 60-core Intel GPU Xeon Phi Coprocessor 5110P card and NVidia Tesla C2050 GPU card using its 64 cores only (total is 1024). The experimental research of the developed algorithm using Open MPI technology showed the parallelization efficiency of 75% on 48 processors of the many-core system, 60% on 48 processors of the cluster, 70% on 60 processors of the Intel GPU Xeon Phi card. The experimental research of the developed algorithm using OpenMP technology showed lower figures, 40% of parallelization efficiency on 48 processors of the many-core system. The experimental research of the developed algorithm using CUDA technology showed 14-times speedup on one Nvidia Tesla GPU card. The developed algorithms are included to the developing library PaGaLiNNeT capable to speed-up scientific computations based on neural networks on general-purpose and hybrid (CPU+GPU) high performance computing systems.
2. The research project entitled “An Adaptive End-to-End Approach for Terabit Data Movement Optimization” were investigated. The goal of this project is to develop a novel architecture and related approaches to the end-to-end optimization of terabyte size data movement on next-generation networking and storage system technologies. The moving scientific data sets at terabits per second transfer rates over wide-area networks between geographically dispersed data centers were modeled. The set of events which describe a drop of the bandwidth in the communication network were obtained. A predictive model based on artificial neural networks to predict the duration of the event and the value of the maximum bandwidth drop was developed. I have used the developed library for parallel neural network training PaGaLiNNeT (developed by me within my previous project) and the model of a multi-layer perceptron. The experimental researches are showed that the modeled events have stochastic nature and therefore it is necessary to tune the neural network model to provide desirable prediction results. This scientific collaboration with the host institution will be continued in the future.

### **Published results:**

4. Turchenko V., Bosilca G., Bouteiller A. and Dongarra J. “Efficient Parallelization of Batch Pattern Training Algorithm on Many-core and Cluster Architectures”, Proceedings of the 7th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems, Sep 12-14, 2013, Berlin, Germany, pp. 692-698.

**[Project 8] Human Biometric Identification in Video Surveillance Systems**

**Foreign partner:** Technical University of Sofia, Bulgaria

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Bulgaria: Dr. Ognian Bumbarov

**Duration:** 2009 – 2010

**Objectives:** design of intelligent biometrical sub-system for detection and recognition of human faces in the video surveillance systems for monitoring of public places, database support of staff or factory's visitors etc.

**Main tasks:**

- development of methods and algorithms for movement detection on the captured videoframes;
- development of methods and algorithms of videoframes preliminary processing by skin color;
- improvement of methods and algorithms of detection and tracing of human face;
- development of methods and algorithms of face recognition.

**Team:**

- Anatoliy Sachenko
- Ihor Paliy
- Yuriy Kurylyak
- Taras Leshko

**Published results:**

1. Ihor Paliy, Anatoliy Sachenko, Yuriy Kurylyak, Ognian Boumbarov, Strahil Sokolov. Combined Approach to Face Detection for Biometric Identification Systems // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, 21-23 September 2009, Rende (Cosenza), Italy, pp. 425-429.
2. Ognian Boumbarov, Strahil Sokolov, Plamen Petrov, Anatoliy Sachenko, Yuriy Kurylyak. Kernel-based Face Detection and Tracking with Adaptive Control by Kalman Filtering // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, 21-23 September 2009, Rende (Cosenza), Italy, pp.434-439.
3. Y. Kurylyak, I. Paliy, A. Sachenko, A. Chohra, K. Madani. Face Detection on Grayscale and Color Images using Combined Cascade of Classifiers // International Journal of Computing. – Ternopil (Ukraine). – 2009. – Vol. 8, Issue 1. – pp. 61-71.
4. Y. Kurylyak A Real-Time Motion Detection for Video Surveillance System // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS2009). – Rende (Cosenza), Italy, 2009. – pp.386-389.
5. Paliy I.O. Methods of Face Detection in Systems of Computer Recognizing on the Base of Combined Cascade of Neural Network Classifiers. – PhD Thesis, Ternopil National Economic University. – Ternopil. – 2009.

## **[Project 9] Development of Intelligent Video Surveillance Systems**

Principal investigator: Dr. Volodymyr Kochan

Project executed together with V.M. Glushkov Institute for Cybernetics, Prof. Vitaliy Boyun.

**Duration:** 2009 – 2010

**Objectives:** development of highspeed and relevant video surveillance system on the base of intelligent videocamera, which allow to decrease information streams between camera and worksatation central processor, as well as to read and process large images with high frame rate.

### **Main tasks:**

- increasing of efficiency for communication channels between intelligent videocamera and personal computer;
- development of methods and algorithms of videoframes preliminary processing by skin color and movement;
- development of methods and algorithms of human face recognition on the base of combined cascades classifiers, classifiers training paralleling, and improvement of neural network training method in frame of combined cascade;
- development of algorithms of faces tracing;
- development of software and highlevel programe interface for interaction with intelligent camera; coddng of developed algorithms in processor computer code for digital processing of intelligent videocamera images.

### **Team:**

- Anatoliy Sachenko
- Ihor Paliy
- Yuriy Kurylyak

### **Published results:**

1. Kurylyak Y.O., Sachenko A.O. Method of background image renewal for movement segmentation // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 44.
2. Paliy I.O. Training of neural network classifiers with combined cascade for face detection // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 42.
3. Paliy I. Face detection on grayscale and color images using combined cascade of classifiers // International Journal of Computing. – 2009. – Vol. 8. – Issue 1. – pp.61-71.

**[Project 10] Development of 3D Localization Methods for Navigation of Mobile robot**

**Foreign partner:** Kaunas Technical University, Lithuania

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Lithuania: Prof. Rimvydas Simutis

**Duration:** 2009 – 2010

**Objectives:** the main aim of project is development of the unified structure for autonomous mobile robot control and providing of 3D localization and navigation in non-structured environment with dynamical objects by using of new methods and means, which allow to get the possibility to give for mobile robots improved navigation characteristics and get new application of known methods.

**Main tasks:**

- 1) Analysis of known methods for design of control structure system for mobile robots (MR) and development of unified structure for autonomous MR control.
- 2) Development of Dataflow Diagram (DFD) for robot control system and analysis of time characteristics of DFD main modules. Setting of requirements for main MR modules.
- 3) Development of improved methods and means of MR control system:
  - a) Development of new method of acquisition and processing of sensor data;
  - b) Development of MR 3D localization methods.
- 4) Development of hardware and software for autonomous MR.
- 5) MR composing according requirements set in point 2, taking into account applied needs and MR hardware/software means developed in points 3-4.
- 6) Verification and testing of MR prototype functioning.

**Team:**

- Anatoliy Sachenko
- Vasyl Koval
- Oleh Adamiv
- Viktor Kapura

**Published results:**

1. Roth H., Sachenko A., Koval V., Chanim J., Adamiv O., Kapura V. The 3D Mapping Preparation using 2D/3D Cameras for Mobile Robot Control // Artificial Intelligence journal, Donetsk, Ukraine. – 2008. – Vol. 4. – pp. 512-521.
2. Adamiv O., Sachenko A., Kapura V. Gradient Method for Autonomous Robot Navigation // Proceedings of the Ninth International Conference “Modern Problems of Radio Engineering, Telecommunications and Computer Science” (TCSET’2008). – Lviv-Slavsko (Ukraine), 2008. – pp. 640-642.
3. O. Adamiv, V. Koval, V. Dorosh, G. Sapozhnyk, V. Kapura Mobile Robot Navigation Method for Environment with Dynamical Obstacles // Proceedings of the 5-th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS’2009). – Rende (Cosenza), Italy, 2009. – pp.515-518.
4. O. Adamiv, A. Lipnickas, A. Knyš. A stereovision system for autonomous robot navigation in 3-D // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 28.



**[Project 11] Development of Stereovision Methods and Devices for Autonomous Navigation of Mobile Robots**

**Foreign partner:** University of Sigen, Germany

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Germany: Prof. Hubert Roth

**Duration:** 2008 – 2009

**Objectives:** Development of stereovision methods for autonomous navigation of mobile robots.

**Main tasks:**

- Development of stereo camera preliminary data processing methods for future integration with a mobile robot;
- Methods of generation of stereo images;
- Image filtering and analysis methods.
- Development of stereo image fusion and mobile robot environment 3D map generation methods:
- Image description methods;
- Stereo image corresponding points search and 3D map of environment generation methods.
- Development and implementation of sensor data fusion algorithms.
- Verification and testing of the developed methods using a mobile robot.

**Team:**

- Anatoliy Sachenko
- Vasyl Koval
- Oleh Adamiv
- Viktor Kapura

**Published results:**

1. Roth H., Sachenko A., Koval V., Chanim J., Adamiv O., Kapura V. The 3D Mapping Preparation using 2D/3D Cameras for Mobile Robot Control // Artificial Intelligence journal, Donetsk, Ukraine. – 2008. – Vol. 4. – pp. 512-521.
2. Adamiv O., Sachenko A., Kapura V. Gradient Method for Autonomous Robot Navigation // Proceedings of the Ninth International Conference “Modern Problems of Radio Engineering, Telecommunications and Computer Science” (TCSET’2008). – Lviv-Slavsko (Ukraine), 2008. – pp. 640-642.
3. H. Roth, A. Sachenko, V. Koval, O. Adamiv, V. Kapura Evaluation of Camera Calibration Methods for Computer Vision System of Autonomous Mobile Robot // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 29.

## **[Project 12] Development of Design and Optimization Methods of Early Intrusion Detection Systems**

**Foreign partner:** Institute of Technology, Gebze, Turkey

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Turkey: Dr Serkan Aksoy

**Duration:** 2008 – 2009

**Objectives:** development of a Computer Aided Design (CAD) system for development of perimeter security systems optimized for quality-price, reliability-price criteria and later testing the CAD system on real security systems.

### **Main tasks:**

- Analysis of existing solutions and creation of a set of criteria and limitations for functional and cost analysis of security systems. Development of improved components and database for security systems.
- Development of methods and algorithms for structural synthesis and multi-criteria optimization of security systems. Development of a CAD system for security systems design based on the developed methods and algorithms.
- Development of a pilot security system built using the developed CAD. Testing of the pilot system.
- Carrying out a comparative analysis of the developed pilot system against existing systems. Introduction of necessary changes to the CAD system based on the conducted analysis.
- Carrying out the pilot security system testing to measure risks of undetected intrusions and risks of false alarms. Introduction of necessary changes to the pilot security system based on the conducted tests.
- Testing of the CAD system.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Kochan
- Volodymyr Turchenko
- Pavlo Bykovyy

### **Published results:**

1. Bykovyy P. Design optimization of distributed technical security systems using a genetic algorithm // Visnyk of Vinnitsa Polytechnic Institute. – 2008, Issue #6, pp 28-34.
2. Bykovyy P., Pigovsky Yu., Kochan V., Sachenko A., Markowsky G., Aksoy S. Genetic Algorithm Implementation for Distributed Security Systems Optimization // Proceedings of the IEEE International Conference on Computational Intelligence for Measurement Systems and Applications (CIMSA 2008), 14-16 July 2008. – Istanbul, Turkey. – pp. 120-124.
3. Bykovyy P.Ye., Kochan V.V. Cryptographically secure protocol for networks of security sensors // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 189.
4. Bykovyy P.Ye. Distributed sensor network for security systems // International journal of Computing. – Ternopil (Ukraine). – 2009. Vol. 8, Issue 2. – pp. 157-164.
5. P. Bykovyy, V. Kochan, Y. Kinakh, A. Sachenko, O. Roshchupkin, S. Aksoy, G. Markowsky. Data Communication Crypto Protocol for Security Systems Sensor Networks // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS’2009). – Rende (Cosenza), Italy, 2009. – pp. 375-379.
6. P. Bykovyy, Y. Pigovsky, A. Sachenko, A. Banasik. Fuzzy Inference System for Vulnerability Risk Estimation of Perimeter Security // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS’2009). – Rende (Cosenza), Italy, 2009. – pp. 380-384.

### **[Project 13] Computer Telecommunication System Based on Noise Signals**

Principal investigator: Prof. Yaroslav Nikolaychuk

Project is executed together with JSC Ternopil Radio Plant 'Orion', chief designer Volodymyr Kordyak.

**Duration:** 2007 – 2009

**Objectives:** to increase noise-immunity and active range of radio stations, produced by the Orion plant; introduction a mode of code based division of transmission channels; development of computerized system of data acquisition based on autonomous sensors.

**Project tasks:**

- Design of a noise-signal based radio station with low range of operation for construction companies;
- Analysis of possible application areas for 2D noise signals;
- Analysis of possible application areas and prospective customers of computer systems based on autonomous sensors.
- Preparation of project solutions related to radio system serving construction areas.

**Team:**

- Yaroslav Nykolaychuk
- Oleh Zastavnyy
- Nazar Krutskevyeh

**Published results:**

1. Nykolaychuk Y., Krutskevyeh N., Zastavniy O. Multibases Processors of Two-dimensional Correlation for Noise Immunity of Transfer Information // Proc. of the IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 315-317.

## **[Project 14] Dynamically Reprogrammable Network Capable Application Processor with Internet Capability**

**Foreign partner:** Esensors Inc., USA

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from USA: Dr Darold Wobschall, PhD

**Grant** #UE2-2534-TE-07.

**Duration:** 2007 – 2009

**Objectives:** to enter the US smart sensors market with the Network Capable Application Processor (NCAP) developed within the project CRDF #UE2-2534-TE-03 – device oriented on software data processing in smart distributed measurement and control systems which uses adaptive software reconfiguration for intelligent functions execution (self-adapting and self-training). The NCAP being developed will have the following features:

- ability work in distributed measurement control systems utilizing the Internet;
- online remote reprogramming of user application software;
- support of a wide set of network interfaces;

### **Main tasks:**

- the minimal set of the design documentation sufficient for production of a prototype NCAP has been developed;
- two prototype NCAP devices have been developed and undergo testing;
- testing of certain NCAP modules is performed, the NCAP software is being developed as well.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Kochan
- Roman Kochan
- Andrew Stepanenko
- Ihor Maykiv
- Iryna Turchenko
- Natalia Vozna

### **Published results:**

1. Maykiv I., Stepanenko A., Wobschall D., Kochan R., Kochan V., Sachenko A., Vasylykiv N. Remote Reprogrammable NCAPs: Issues and Approaches // Proc. of the IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 109-113.
2. Maykiv I.M., Kochan V.V., Bilousov I.A. Project analysis of methods of serial interfaces controllers realization // Transactions of Ternopil State technical University. – 2009. – No. 1. – pp. 110-115.
3. Maykiv I.M. Investigation of I2C interface controllers realizations method on the programmed logical matrix // Proceedings of 5-th International Youth Conference “Modern Problems of Radiotechnics and Telecommunication”. – Sevastopol (Ukraine), 2009. – pp. 284.
4. Maykiv I.M., Kochan V.V. Software-hardware controller of consecutive interfaces in network nodes of data acquisition // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET'2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 138.
5. Maykiv I.M. Methodology of structural synthesis of network capable application processors // Proceedings of National Conference in Ternopil Ivan Pul'uj State Technical University. – Ternopil (Ukraine), 2009. – pp. 176.

6. Maykiv I.M. Software-hardware method of sequential interfaces controllers realization // Proceedings of 11-th International Conference “System Analysis and Information Technologies” (SAIT-2009). – Kyiv (Ukraine), 2009. – pp. 437.
7. Maykiv I.M. Network capable application processor for distributed measuring-control systems // Transaction “Problems of Informatization and Control”, Kyiv (Ukraine). – 2009. – No. 2 (28). – pp. 187-191.
8. Maykiv I.M. Universal control of serial interfaces // Transactions of Chernivtsi University. Series: Physics. Electronics, Chernivtsi (Ukraine). – 2009. – No. 3 (186). – pp. 130-135.
9. Maykiv I.M., Stepanenko A.V., Wobschall D. A method for structural synthesis of network capable application processors. // International Journal of Computing – Ternopil (Ukraine). – 2009. – Vol. 8. – Issue 2. – pp.126-138.
10. I. Maykiv, D. Wobschall, A. Stepanenko, R. Kochan, A. Sachenko, V. Kochan. Multi-port Serial NCAP using IEEE1451 Smart Transducer Standard // Proceedings of IEEE Sensor Application Symposium (SAS-2009). – New Orleans, LA, (USA), 2009. – pp. 293-297.
11. I. Maykiv, A. Stepanenko, D. Wobschall, R. Kochan, V. Kochan, A. Sachenko. Universal Controller of Serial Interfaces // Proceedings of the 5-th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS'2009). – Rende (Cosenza), Italy, 2009. – pp. 121-125.
12. Iryna Turchenko. Methods for Improving Efficiency of Data Processing Obtained from Multi-parameter Sensors in Distributed Computer Systems. Ph. D. Thesis on speciality 05.13.05 – Computer Systems and Components.- Ternopil National Economic University.- Ternopil.- 2008.- 200 p. (in Ukrainian)
13. Natalia Vozna. Forming and Organizing of Structured Data Movement in Multilevel Distributed Computer Systems. Ph. D. Thesis on speciality 05.13.05 – Computer Systems and Components.- Ternopil National Economic University. – Ternopil. – 2009. (in Ukrainian)

**[Project 15] Ternopil Education Communication Center****Foreign partner:** University of Maine, USA

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from USA: Prof. George Markowsky

Project is granted by NATO Program of Security through Science Network Infrastructure Grant, and performed together with the University of Maine, USA.

**Duration:** 2006 – 2009

**Objectives:** Make common communication center for universities of Ternopil, agree and integrate educational networks of Ternopil Universities, introduce high-speed network for educational and research exchange.

**Main tasks:**

- Connect educative institutions of Ternopil to Internet through Ternopil Education Communication Center;
- Make basis for cooperation of all universities of Ternopil;
- Make basis for educative and research cooperation between universities of Ternopil and University of Maine and other researchers;
- Provide high-speed access to UARNET and GEANT networks;
- Provide abilities for holding video-conferences between Ternopil and other cities;
- Develop prototype of system, that can be implemented in other areas of Ukraine;
- Implement 16 processor cluster for GRID-processing that will be used in universities – project members;
- Create on-line library;
- Create Wi-Fi service for universities of Ternopil.

**Team:**

- Anatoliy Sachenko
- Serhiy Voznyak
- Ihor Romanets'
- Roman Romanyak

**Published results:**

1. Sachenko A. Ternopil Education Communication Center // Innovation and Communication Security (ICS) Panel Meeting. – 2006. – Kyiv (Ukraine).
2. G. Markowsky, A. Sachenko, S. Voznyak, V. Spilchuk, R. Romanyak, V. Turchenko, I. Romanets. The Ternopil Educational Communication Center – A NATO Project to Integrate Regional Information Technology Resources. Computing, 2008, Vol. 7, Issue 1.
3. Palagin O., Alishov N., Markowsky G., Sachenko A., Turchenko V. Security Tools for GRID-systems // Proceedings of the 2007 International Conference on Security and Management. - 2007. Las Vegas, NV (USA).

## **[Project 16] Instruction Parameters Analysis for Power Modeling of Embedded Microprocessors**

**Foreign partner:** Aristotle University of Thessaloniki, Thessaloniki, Greece

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Greece: Prof. Theodore Laopoulos

Project is granted by Ministry of Education and Science of Ukraine and Greek Government (agreement #M/85-2006), and performed together with the Aristotle University of Thessaloniki, Greece.

**Duration:** 2006 – 03.2008

Principal investigator from Ukraine: Main aim of the project is determining power consumption of each parameter of instruction: determining number and value of registers, immediate values, values and addresses of operands, address of command call, pipeline panel and substitution, examination and analysis of correlation of instructions' parameters in power consumption of instructions; examination and analysis of each parameter in power consumption of instructions; developing of accurate power models for execution level of ARM7TDMI core's instructions.

### **Main tasks:**

Additional investigating of instructions' parameters power consumptions and developing of measurement methodology using existing measurement setup; developing new approach in measurement methodology that can determine processor's configuration. This approach can measure and analyze correlation of instructions' power consumptions according to instruction's parameters; determining of power consumptions; analyze and processing power consumption values; developing power models for instructions; experimental proving for achieved theoretical results.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Kochan
- Volodymyr Turchenko
- Andrii Borovyι

### **Published results:**

1. Borovyι A., Kostandakos V., Kochan V., Sachenko A., Yaskilka V. Analysis of CPU's Instructions Energy Consumption Device Circuits // Proceedings of Fourth IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 42-46.
2. Borovyι A., Kochan V. Analysis of Microcontroller Instructions Power Consumption Measurement Circuits. Visnyk of Khmelnytsky National University. – 2007. – Vol. 1. – #2. – pp. 105-109.
3. Borovyι A.M., Kochan V.V., Turchenko V.O. Stand for investigation of current moment value consumed by microprocessor // Transaction of Ternopil State Technical University. – 2009. – No. 1. – pp. 131-137.
4. Borovyι A.M. Analysis of power consumption by ARM7TDMI processor kernel // Proceedings of National Conference in Ternopil Ivan Pul'uj State Technical University. – Ternopil (Ukraine), 2009. – pp. 101.
5. A. Borovyι, V. Kochan, Z. Dombrovskyy, V. Turchenko, A. Sachenko Device for Measuring Instant Current Values of CPU's Energy Consumption // Proceedings of the 5-th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS'2009). – Rende (Cosenza), Italy, 2009. – pp.126-130.

**[Project 17] Financial Analytics Method with Applications of Knowledge Bases**

Principal investigator from ICS: Prof. Anatoliy Sachenko

This is a joint project between National University of the State Taxation Department of Ukraine, Irpin, Ukraine and Research Institute for Intelligent Computer Systems, Ternopil, Ukraine.

**Duration:** 09.2008 – 11.2008

**Objectives:** evaluation of the present state and selection of priority directions for implementation of intelligent information technologies of financial analytics and knowledge bases in governmental resource management processes.

**Main tasks:**

- evaluation of the present state and investigation of theoretical research in information technologies for financial analytics with application of knowledge bases in management of governmental institutions;
- investigation of possible intelligent computer technologies application in the domain of financial analytics ontologies in governmental management;
- evaluation of state and perspectives of ontology intelligent tools using in methods of financial analytics;
- forming of technologies in area of intellectulazation of information-analytical processes and creation of financial analytics knowledge bases in governmental management;
- the conducted activity enabled to provide functional completeness of solutions for the defined research tasks and creation of documentation as per the Requirements Specification;
- research and creation of the output documentation were performed based on a systematic approach, conceptual completeness of results and consistency;
- the conducted work follows the principal of minimal implementation costs for the proposed solutions.

**Team:**

- Anatoliy Sachenko
- Taras Lendyuk

**Published results:**

1. Palagin A., Rippa S. and Sachenko A. Conceptualization and problems of ontologies // Journal of Artificial Intelligence, 2008 Vol. 3, pp 374-379.



## **[Project 18] Development of Effective GRID-technologies for Ecology Monitoring Using Satellite Data**

Principal investigator from ICS: Prof. Anatoliy Sachenko

Principal investigator NSAU: Prof. Nataliya Kussul

Collaborative project of Scientific-Technologic Centre in Ukraine and National Sciences Academy of Ukraine has been performed together with the Space Research Institute of National Sciences Academy of Ukraine and National Aerospace Agency of Ukraine, Kyiv.

**Grant** STCU #3872

**Duration:** 12.2005 – 12.2007

**Objectives:** Development of an effective distributed computations techniques that provide simple and transparent solutions for computationally-complicated tasks in different areas, especially associated with space data processing.

### **Main tasks:**

- developing methodology for constructing temporal interpolation earth atmosphere photographs;
- developing methodology for predicting solar activity and corresponding algorithms for holding parallel computations;
- developing parallel implementation modeling methods algorithms for dynamics main processes in multi-component ground environments with the cluster using purpose.
- developing GRID-service for monitoring and control tasks' solutions process in system;
- developing GRID-service for balancing system loading;
- developing GRID-service for visualization computational results;
- developing GRID-service for granting users' access to system;
- developing service for system security purposes;
- uniting some clusters or computational networks into one complex for working under solution for the same task.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Turchenko
- Viktor Demchuk

### **Published results:**

1. Turchenko V., Demchuk V., Sachenko A. Interplanetary Shock Arrival Time Prediction Using Multi-Layer Perceptron // Proceedings of the 4th IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS'2007. – 2007. – Dortmund (Germany). – pp. 185-190.
2. Turchenko V. An Approach to IP Shock Arrival Time Prediction Using Approximating Neural Network // International Journal of Information Technology and Intelligent Computing. – 2007. – No. 4. – Vol. 1.
3. V. Turchenko, V. Demchuk, A. Sachenko, Y. Veremeyenko. An Approach to Interplanetary Shocks Prediction Using Single ACE/EPAM Channel Data // Proceedings of the Fourth International Conference on Neural Networks and Artificial Intelligence ICNNAI'2006. – 2006. – Brest (Belarus). – pp. 140-144.

**[Project 19] Development of Web Ontologies as Data Exchange and Decision Support Tools to Facilitate Economic Cooperation between Ukraine and USA**

**Foreign partner:** New Jersey Institute of Technology, USA

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from USA: Dr. Yefim Kats

Project had been performed according to Research program of the US National Science Foundation.

**Grant #** NSF-04-12

**Duration:** 2004 – 2007

**Objectives:** develop Web-ontologies as data exchange and decision making instrument for promotion of economic partnership between Ukraine and USA.

**Main tasks:**

- Standard ontology dictionary used in economical interchange, including dictionaries for typical e-commerce models, identification.
- Identifying objects as classes or relations with adequate limiting interpretation.
- Identifying specific ontology relations for (intelligence) agents based on automated processing.
- Developing Windows object library compatible apparatus for measuring possible ontology errors.

**Team:**

- Anatoliy Sachenko
- Roman Pasichnyk
- Yuriy Pihovsky
- Andrii Melnyk

**Published results:**

1. Pasichnyk R., Sachenko A. Semantic WEB-Search Developing by Problem-Oriented Ontology Means // Proceedings of the IEEE International Workshop IDAACS'2007. – 2007. – Dortmund (Germany). – pp. 445-448.
2. Hrusha V. Specifics of Ontologies Design and Application in proceedings of the 11th scientific conference of Ternopil State Technical University. – 2007. – Ternopil: TSTU. – pp. 78.
3. R. Pasichnyk, A. Sachenko, A. Melnyk “Formalization of ontology creation process using base classes” in proceedings of the 13th national conference “Modern problems of applied mathematics and informatics”, Lviv, October 3-5 2006, P.162-163.
4. Master thesis by Andrii Melnyk was defended in 2006.
5. Course thesis by Andrii Melnyk was defended in 2005.
6. Master thesis by Vitaliy Kharchuk was defended in 2004.

## **[Project 20] Dynamically Reprogrammable Network Capable Application Processor with Internet Capability**

Principal investigator: Prof. Anatoliy Sachenko

The project is funded under the Ministry of Education and Science of Ukraine

**Grant** #0107U005985.

**Duration:** 08.2007 – 12.2007

**Objectives:** to enter the US smart sensors market with the Network Capable Application Processor (NCAP) developed within the project CRDF #UE2-2534-TE-03 – device oriented on software data processing in smart distributed measurement and control systems which uses adaptive software reconfiguration for intelligent functions execution (self-adapting and self-training). The NCAP being developed will have the following features:

- ability work in distributed measurement control systems utilizing the Internet;
- online remote reprogramming of user application software;
- support of a wide set of network interfaces.

### **Main tasks:**

- a minimal set of the design documentation sufficient for production of a prototype NCAP had been developed, which allowed to choose its elemental basis and embodiment;
- there was developed a package of structural documentation;
- there was developed software for interface microcontroller, which provide software support of hardware drivers for supported interfaces – data link layer, IP protocol (Internet Protocol) – network layer, TCP protocol (Transport Control Protocol) – transport layer, HTTP protocol (Hypertext Transfer Protocol) – session layer, dynamical HTML-page, where are presented data get on all supported interfaces and available for the reading – presentation layer;
- two prototype NCAP devices had been developed and underwent testing, which allow to debug application software of its microcontrollers and their interaction between each another, as well as with server and measuring-control modules in real time.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Kochan
- Roman Kochan
- Andrew Stepanenko
- Ihor Maykiv
- Pavlo Bykovyy

### **Published results:**

1. Maykiv I., Stepanenko A., Wobschall D., Kochan R., Kochan V., Sachenko A., Vasylykiv N. Remote Reprogrammable NCAPs: Issues and Approaches // Proc. of the IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 109-113.
2. Stepanenko A., Maykiv I., Wobschall D., Kochan R., Kochan V., Sachenko A, Multi-port Serial NCAP Using IEEE1451 Smart Transducer Standard // Proceedings of the IEEE Sensor Application Symposium SAS'2009, 17-19 February, 2009, New Orleans, USA, pp. 293-297.

**[Project 21] Investigation of the Intelligent Properties of Re-Configurable Network Capable Application Processor in Adaptive Distributed Instrumentation and Control Systems**

**Foreign partner:** Sensors Development and Applications Group, National Institute Standards and Technologies, USA

Principal investigator from Ukraine: Dr. Volodymyr Kochan

Principal investigator from USA: Kang Lee

This project has been performed within US Civilian Research and Development Foundation (Cooperative Grant Program).

**Grant #** CRDF.CGP. UE2-2534-TE-03

**Duration:** 2005 – 2006

**Objectives:** Development of the IEEE-1451 standard compatible Network Capable Application Processor (NCAP) with dynamic software and hardware reconfiguration and to investigate its self-adaptive and intelligent properties in information-measurement systems.

**Main tasks:**

- Investigation of the NCAP's intelligent properties to be used with smart sensors, deployed in distributed information measurement systems with different architectures and functional requirements.
- Extension of the NCAP's functional features compatible with the IEEE1451 standard to support dynamic online reprogramming of software and a set of network interfaces.
- Development and investigation of the prototype NCAP and its programming methodology.

**Team:**

- Volodymyr Kochan
- Anatoliy Sachenko
- Roman Kochan
- Oleh Adamiv
- Iryna Turchenko
- Andriy Stepanenko

**Published results:**

1. Kochan V., Lee K., Kochan R., Sachenko A. Approach to Improving Network Capable Application Processor Based on IEEE 1451 Standard // Computer Standards & Interfaces. – 2005. – Vol. 28. – Issue2. – pp. 141-149.
2. Stepanenko A., Lee K., Kochan R., Kochan V., Sachenko A. Development of a Minimal IEEE1451.1 Model for 8051-Compatible Microcontrollers // Proc. of the 2006 IEEE Sensors Applications Symposium. – 2006. – Houston, Texas (USA). – pp. 88-93.
3. Kochan R., Kochan V., Sachenko A., Maykiv I., Turchenko V, Markowsky G. Interface and Reprogramming Controller for Dynamically Reprogrammable Network Capable Application Processor (NCAP). // Proc. of 3-th IEEE International workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2005). – 2005. – Sofia (Bulgaria). – pp. 639-642.
4. Kochan R., Kochan V., Sachenko A., Maykiv I. NCAP Based on FPGA // Proc. of the IEEE Instrumentation and Measurement Technology Conference IMTC/2005. – 2005. – Ottawa, Ontario (Canada). – pp. 813-817.
5. Kochan R., Lee K., Kochan V., Sachenko A. Development of a Dynamically Reprogrammable NCAP // Proc. of the IEEE Instrumentation and Measurement Technology Conference IMTC/2004. – 2004. – Como (Italy). – pp. 1188-1193.
6. Roman Kochan. Improvement of components of precision distributed information control systems: Ph.D. Theses on speciality 05.11.16 / Ternopil Academy of National economy. – Ternopil, 2005. – 193 p.

## **[Project 22] Methods and Algorithms for Face Detection and Recognition for Real Time Video Surveillance Systems**

**Foreign partner:** Belarus State University of Informatics and Radio Electronics, Belarus

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Belarus: Prof. Rauf Sadykov

This project has been performed in frames of State fund of fundamental research programs, Ministry of Education and Science of Ukraine order #356 dated to 14.06.05.

**Duration:** 2005 – 2006

**Objectives:** Development of algorithms for preliminary processing of images based on segmentations and development of algorithms and software for face detection in static vision conditions.

**Main tasks:**

- Development of effective algorithms and software for capturing face images in video stream;
- Development of approximate 3-dimension face models;
- Development of algorithms for selection of informative features and classification of images according to modified syntactical discriminator functions;
- conduct experimental diagnosis and configuration of proposed algorithms for achieving maximum results on program model;
- development of a software system which implements the designed recognition schema.

**Team:**

- Anatoliy Sachenko
- Vasyl Koval
- Ihor Paliy
- Yuriy Kurylyak
- Victor Kapura

**Published results:**

1. Y. Kurylyak. System of Face Detection at Static Images. – 2006. – 83p.
2. Y. Kurylyak, Ihor Paliy, Vasyl Koval, Anatoliy Sachenko. Improved Method of ace Detection Using Color Images // Proceedings of the International Conference “Modern Problems of Radio Engineering, Telecommunications and Computer Science” TCSET’2006. – Feb’28 – Mar’4, 2006. – Lviv-Slavske, Ukraine. – pp. 186-188.
3. A. Sachenko, V. Koval, I. Paliy, Y. Kurylyak. Approach to Face Recognition Using Neural Networks // Proceedings of the IEEE Second International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS’2005, Sofia, Bulgaria, September 5-7, 2005, pp. 112-115.

## **[Project 23] Development of Methods and Tools for Improvement of Robot Navigation in a non-Structured Environment**

**Foreign partner:** Kaunas Technical University, Lithuania

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Lithuania: Dr Arunas Raudis

This project has been performed in frames of State Fund for Fundamental Research Programs, Ministry of Education and Science of Ukraine order #174 dated by 23.03.05.

**Duration:** 2005 – 2006

**Objectives:** Development of methods and tools for improvement of mobile robot navigation in non-structured environment.

### **Main tasks:**

- Development of methodology for creation of a mobile robot management system, which reflects schemes for conforming mobile robot subsystems for ensuring unobstructed navigation in non-structured environment.
- Development and implementation of main concepts for processing sensor data and creating environmental local map to improve robot navigation in non-structured environment with the help of artificial neural networks.
- Development and implementation of effective and self-adaptive methods for robot navigation and pathway planning.
- Research of experimental methods (with the use of imitation modeling and neural network resources).

### **Team:**

- Anatoliy Sachenko
- Vasyl Koval
- Oleh Adamiv
- Yuriy Kurylyak
- Maxym Lunochkin
- Serhiy Maystrenko

### **Published results:**

1. Koval V., Adamiv O. The Software Structure Development for Mobile Robot Control // Proceedings of the IEEE Second International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS'2005. – 2005. – Sofia (Bulgaria). – pp. 120-124.
2. Oleh Adamiv. Models and Intelligent Means of Autonomous Mobile Robot Adaptive Control: Ph.D. Theses on speciality: 05.13.23 / Ternopil National Economic University. – Ternopil, 2007. – 166 p.

## **[Project 24] Development of Parallel Neural Networks Training Algorithms on Advanced High Performance Systems**

**Foreign partner:** Parallel Computing Laboratory, Department of Electronics, Computer Science and Systems, University of Calabria, Italy

Principal investigator from Ukraine: Dr. Volodymyr Turchenko

Principal investigator from Italy: Prof. Lucio Grandinetti

**Grant #** INTAS YSF 03-55-2493

**Duration:** 2004 – 2006

### **Main tasks:**

- Developed a parallel algorithm of enhanced data integration method using C programming language and MPI parallelization technology.
- Designed and implemented in C programming language and MPI parallelization technology two new methods of coarse-grain neural network parallelization which provides high efficiency of parallelization at the certain training parameters of neural networks and dynamic mapping method, which is more universal than static and showed better efficiency at different initial parameters of neural networks to be parallelizing. It is done a series of on-line computational experiments of the mentioned above algorithms of the parallel machines SGI Origin 300, NEC TX-7 and the computational grid consisted from the cluster of double-processor Compaq personal computers under Linux operation system and Globus middleware package.
- Developed and implemented on C programming language using MPI and MPE libraries the fine-grain parallel training algorithm of multilayer perceptron with parallelization of the outputs of hidden layer neurons on the forward stage of information processing inside neural network module.
- Compared the advantages and disadvantages of middleware technologies, in particular Globus, in a case of coarse-grain parallelization algorithm of Integration Historical Data Neural Networks with dynamic mapping on the parallel computer Origin 300 without using middleware package and on the computational grid operated by Globus middleware package.

### **Published results:**

1. V. Turchenko. Parallel Algorithm of Dynamic Mapping of Integrating Historical Data Neural Networks, Information Technologies and Systems, 2004, Vol. 7, No. 1, pp. 45-52, ISSN: 0135-5465, <http://www.tanet.edu.te.ua/iics/vtu/B7.pdf>.
2. V. Turchenko, V. Demchuk. Efficiency Analysis of Parallel Routine Using Processor Time Visualization, International Scientific Journal of Computing, 2005, Vol. 4, Issue 1, pp. 12-18, ISSN: 1727-6209, <http://www.tanet.edu.te.ua/computing/Computing2005Vol4Issue1-12-18.pdf>.
3. V. Turchenko. Computational Grid vs. Parallel Computer for Coarse-Grain Parallelization of Neural Networks Training, Lecture Notes in Computing Science LNCS 3762, Edited by Robert Meersman, Zahir Tari, Pilar Herrero, Berlin, Heidelberg, New York, Springer-Verlag, 2005, pp. 357-366, ISSN: 0302-9743, [http://dx.doi.org/10.1007/11575863\\_55](http://dx.doi.org/10.1007/11575863_55).
4. V. Turchenko, C. Triki, L. Grandinetti, A. Sachenko. Efficiency Estimation of Parallel Algorithm of Enhanced Historical Data Integration on Computational Grid, International Scientific Journal of Computing, 2005, Vol. 4, Issue 3, pp. 9-19, ISSN: 1727-6209, <http://www.tanet.edu.te.ua/computing/Computing2005Vol4Issue3-9-19.pdf>.
5. V. Turchenko. Fine-Grain Approach to Development of Parallel Training Algorithm of Multi-Layer Perceptron, Artificial Intelligence, 2006, Vol. 1, pp. 94-102, ISSN 1561-5359, <http://www.tanet.edu.te.ua/iics/vtu/B1.pdf>.

## **[Project 25] Development of a Web-based Measurement System with Distributed Intelligence**

**Foreign partner:** Laboratory of Signal Processing and Information Measurement University of Sannio, Benevento, Italy

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Italy: Prof. Pasquale Daponte

Project was performed under the Ministry of Education and Science of Ukraine order #M/79-2004, state registration #0104U006975.

**Duration:** 2004 – 2006

**Objectives:** to create a distributed measurement system (based on Intranet and Internet technologies), that can provide high accuracy sensor data processing by the use of artificial neural networks. The system's feature is remote units working in real time mode during long delays in data link layer, and costs decrease is achieved by shift of some intelligent functions to a main server.

### **Main tasks:**

- Development of distributed measurement system architecture with either Internet- or Intranet-technologies.
- Research and design of networked software structures. Development of software for distributed system using Web-technologies.
- Testing and verification of the developed software for distributed measurement system.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Turchenko
- Volodymyr Kochan
- Roman Kochan
- Iryna Turchenko
- Volodymyr Hrusha
- Olexandr Osolinskiy

### **Published results:**

1. V. Hrusha, O. Osolinskiy, P. Daponte, D. Grimaldi, R. Kochan, A. Sachenko, I. Turchenko. Distributed Web-based Measurement System // IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications. 5-7 September 2005, Sofia, Bulgaria – pp. 355 -358.
2. V. Hrusha, O. Osolinskiy, R. Kochan, G. Sapojnyk Development of Web-based instrumentation, Proc. of the International Conference “Modern Problems of Radio-Engineering, Telecommunications and Computer Science” TCSET’2006, February 28 – March 4, 2006, Lviv-Slavsko, Ukraine – pp. 199-201.
3. V. Hrusha, O. Osolinskiy, P. Daponte, D. Grimaldi, R. Kochan, A. Sachenko, I. Turchenko. Distributed Web-based Measurement System // IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications. 5-7 September 2005, Sofia, Bulgaria – pp. 355 -358.
4. I. Turchenko, V. Kochan, A. Sachenko, R. Kochan, A. Stepanenko, P.Daponte D. Grimaldi “Simulation Modeling of Neural-Based Method of Multi-Sensor Output Signal Recognition” in Proceedings of 2006 IEEE Instrumentation and Measurement Technology Conference IMTC/06. – April 24-27, 2006. – Sorrento (Italy). – pp. 1530-1535.



## **[Project 26] Design of Distributed Sensor Network for Ayers Island Security Using Value Analysis Technology**

**Foreign partner:** Department of Computer Science, University of Maine, USA

Projects investigator from Ukraine: Prof. Anatoliy Sachenko

Projects investigator from USA: Prof. George Markowsky

Project had been performed within the frames of the First Steps to Market program of the US Civilian Research and Development Foundation.

**Grant #** CRDF FSTM UM2-5012-TE-03

**Duration:** 2003 – 2005

**Objectives:** investigating possibilities for developing distributed sensor network with defined features for providing security Ayers Island, Orono, ME, USA.

### **Main tasks:**

- Analyzed component and perimeter security systems vendors, examined well-known perimeter security systems.
- Proposed algorithm for defining key functional indicators for perimeter security distributed systems components, that can optimize preparing procedure for CAD, appointed for design and optimization according to functional-price characteristics security system. This algorithm usage filled DB with functional-price characteristics for perimeter area security systems components that are unified and eligible for creating CAD.
- Morphological matrix method was proposed for optimization according to functional-price characteristics of designed security systems and selecting variants of DSN that create Pareto boundaries for all alternative variants according to two key functional characteristics.
- CAD software module was developed, functions for all modules were described, and major requirements to perimeter area security systems CAD were established. Proposed CAD allows design projects perimeter area security systems, using perimeter area security systems components database.
- Demonstrated CAD version that was used for developing perimeter area security systems for Ayers island in Orono, ME according to quality, reliability and price characteristics.

### **Team:**

- Anatoliy Sachenko
- Volodymyr Turchenko
- Volodymyr Kochan
- Pavlo Bykovyy

### **Published results:**

1. Bykovyy P. Choosing of Technical & Economic Indices for Knowledge Base of Perimeter Security Systems // Proceedings of the 2004 IEEE International Conference on Intelligent Systems 3. – 2004. Bulgaria. – pp. 54-57.
2. I. Turchenko, V. Turchenko, V. Kochan, P. Bykovyy, A. Sachenko and G. Markowsky. “Database Design for CAD System Optimizing Distributed Sensor Networks for Perimeter Security.” Proceedings of the 8th IASTED International Conference on Software Engineering and Applications SEA’2004 (2004): 59-64. (USA)
3. R. Kochan, V. Kochan, A. Sachenko, I. Maykiv, I. Turchenko and G. Markowsky. “Network Capable Application Processor based on FPGA.” Proceedings of the 22nd IEEE Instrumentation and Measurement Technology Conference IMTC 2005 II (2005): 813-817. (Canada)
4. P. Bykovyy, I. Maykiv, I. Turchenko, O. Kochan, V. Yatskiv and G. Markowsky. “A Low-Cost Network Controller for Security Systems.” Proceedings of the 3rd IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS’05 (2005): 388-391. (Bulgaria)

**[Project 27] Development of Intelligent Precision System for Thermal Objects Control**

**Foreign partner:** Department of Automatics, the University of Mons, Belgium

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Belgium: Prof. Marcel Remy

The project had been performed under the NATO (Cooperative Science & Technology Sub-Program).

**Grant** NATO PST.CLG.977647

**Duration:** 2002 – 2004

**Objectives:** development precision and self-adaptive temperature control system for temperature objects with multi-zone linked control.

**Main tasks:**

- Analysis of precision thermal objects and their control systems;
- Analysis of error control system components and ways for reducing their influence on general system error.
- Development of constructive-technological and structural-algorithmic methods for improving accuracy measuring channels and control channels for multi-zone thermal objects.
- Development of result processing methods for defining thermal objects parameters.
- Adaptation of random small perturbation method for thermal objects with multi-zone linked control.

**Team:**

- Anatoliy Sachenko
- Roman Pasichnyk
- Volodymyr Kochan
- Volodymyr Turchenko
- Roman Kochan
- Nadia Vasylykiv
- Yuriy Pihovsky
- Mykola Derlytsya

**Published results:**

1. Derlytsya M., Pihovsky Y., Pasichnyk R., Kochan V. Improved Control System of Multi-Zone Thermal Object // Scientific Journal of Khmelnytsky Podillya Technical University. – 2004. – No. 2. – Vol. 1. – pp. 30-33.
2. Kochan V., Vasylykiv N., Chyrka M. The Error Evaluation of Temperature Measurement in Diffusion Furnace // Proceedings of the VIII International Conference Temperature. – 2003. – Lviv (Ukraine). – pp. 33.
3. Sachenko A., Kochan V., Pasichnyk R. Development of the Simulation Model of Thermocouples // Proceedings of the IEEE Instrumentation and Measurement Technology Conference IMTC/2003. – 2003. – Vail, CO. – pp. 1673-1677.
4. Derlytsya M. Improvement of the PC Based System of Optimal Control of Multi-Zone Thermal Object // Master Thesis, Ternopil Academy of National Economy. – 2004.
5. Pihovsky Y. Simulation Model for Effectivity Control of the Chip Manufacturing Process // Master Thesis, Ternopil Academy of National Economy. – 2004.

**[Project 28] Using Multisensor Fusion and Neural Networks Techniques for Robot Control**

**Foreign partner:** Laboratory of Robotics Systems, University of La Coruña, Spain

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Ukraine: Prof. Richard Duro

The project had been performed under the NATO (Cooperative Science & Technology Sub-Program).

**Grant** NATO PST.CLG.978744

**Duration:** 2002 – 2004

**Objectives:** development and implementation main concepts of merging sensor data, using neural networks for controlling mobile robot. It is assumed that robot's movement is performed in unknown (dangerous for human) environment. Main purpose is the endpoint reached through obstructions.

**Main tasks:**

- Development of new methods for merging sensor data, using neural networks.
- Development of algorithms and software for merging sensor data subsystem.
- Hardware implementation of merging methods for sensor data on mobile robot.
- Verification and testing procedures of developed engines for merging sensor data on mobile robot.

-

**Team:**

- Anatoliy Sachenko
- Volodymyr Turchenko
- Vasyl Koval
- Oleh Adamiv

**Published results:**

1. Koval V. The Fusion of Structured Light and Video Image for Mobile Robot Control // Scientific and Technical Journal Artificial Intelligence. – 2004. – Donetsk (Ukraine). – No1.
2. Koval V. The Method of Obstacle Detection Using Fusion Technique of Heterogeneous Sensors // ASU and Automatic Devices. – 2004. – Kharkiv (Ukraine). – pp. 128-135.
3. Koval V., Turchenko V., Kochan V., Sachenko A., Markowsky G. Smart License Plate Recognition System Based on Image Processing Using Neural Network // Computing. – 2003. – Vol. 2. – Issue 2. – pp. 40-46.
4. Adamiv O., Koval V., Turchenko I. Predetermined Movement of Mobile Robot Using Neural Networks // International Scientific Journal Computing. – 2003. – Ternopil (Ukraine). – Vol. 2. – Issue 2. – pp. 64-68.
5. Koval V., Turchenko V., Sachenko A., Becerra J., Duro R., Golovko V. Infrared Sensor Data Correction for Local Area Map Construction by a Mobile Robot // The Lecture Notes in Artificial Intelligence, LNAI2718. – 2003. – pp. 306-315.
6. Koval V. The Method of Local Area Map Construction for Mobile Robot // Scientific Journal of Ternopil State Technical University I.Pulyuj. – 2002. – Ternopil (Ukraine). – Vol. 8. – No2. – pp. 80-88.
7. V. Koval, “Adversary merging sensor data algorithm on multisensor systems”, // Sensors and systems, #7 (38) Sep. 2002. pp.39-41.
8. Vasyl Koval. Methods and Algorithms of Map Development of Mobile Robot Environment Using Sensor Data Fusion: Ph.D. Theses on speciality 05.13.23 / Ternopil Academy of National Economy; NAS of Ukraine; State Research Institute of Information Infrastructure. – Ternopil, 2004. – 208 p.

## [Project 29] Development of an Intelligent Sensing Instrumentation Structure

**Foreign partners:** Electronic Laboratory, Aristotle University, Thessaloniki, Greece, Parallel Computations Laboratory, University of Calabria, Italy, Department of Electronics at Brest Polytechnic Institute, Belarus.

Principal investigator from Ukraine: Prof. Anatoliy Sachenko  
 Principal investigator from Greece: Prof. Theodore Laopoulos  
 Principal investigator from Italy: Prof. Lucio Grandinetti  
 Principal investigator from Belarus: Prof. Volodymyr Golovko

The project had been performed under the “INTAS Open Call” program, grant # INTAS OPEN 97-0606.

**Duration:** 1999 – 2001

**Objective:** development of information measurement system for increase of measurement accuracy using automated correction of instrumental compound measurement error.

### Research tasks:

- Target area analysis and requirements definition for intelligent sensor measurement system;
- Development of distributed structure for intelligent sensor measurement system;
- Development of methods for result processing with the target objective to increase the system’s operational characteristics;
- Development and testing of the prototype intelligent sensor measurement system.

### Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Volodymyr Turchenko
- Roman Kochan

### Published results:

1. Sachenko A., Kochan V., Turchenko V., Tymchyshyn V., Vasylykiv N. Intelligent Nodes for Distributed Sensor Network // Proceedings of the 16th IEEE Instrumentation and Measurement Technology Conference IMTC/99. – 1999. – Venice (Italy). – Vol. 3. – pp. 1479-1484.
2. Golovko V., Grandinetti L., Kochan V., Laopoulos T., Sachenko A., Turchenko V., Tymchyshyn V. Approach of an Intelligent sensing Instrumentation Structure Development // Proceedings of the IEEE International Workshop on Intelligent Signal Processing WISP’99? Budapest, Hungary, 4-6 September, 1999. – pp. 336-341.
3. Sachenko A., Kochan V., Turchenko V., Laopoulos T., Golovko V., Grandinetti L. Features of Intelligent Distributed Sensor Network Higher Level Development // Proceedings of the 17th IEEE Instrumentation and Measurement Technology Conference IMTC/2000. – 2000. – Baltimore (USA). – pp. 335-340.
4. Sachenko A., Kochan V., Turchenko V., Golovko V., Savitsky Y., Dunets A., Laopoulos T. Sensor Errors Prediction Using Neural Networks // Proceedings of the IEEE-INNS-ENNS International Joint Conference on Neural Networks IJCNN’2000. – 2000. – Como (Italy). – Vol. IV. – pp. 441-446.
5. Sachenko A., Kochan V., Kochan R., Turchenko V., Tshouridis K., Laopoulos Th. Error Compensation in an Intelligent Sensing Instrumentation System, 18th IEEE Instrumentation and Measurement Technology Conference IMTC/2001. – 2001. – Budapest (Hungary). – pp. 869-874.
6. Turchenko V., Kochan V., Sachenko A., Laopoulos Th. The New Method of Historical Data Integration Using Neural Networks // Proceedings of the International Workshop on Intelligent

- Data Acquisition and Advanced Computing Systems IDAACS'2001. – 2001. – Foros (Ukraine). – pp. 21-24.
7. Turchenko V., Kochan V., Sachenko A. Estimation of Computational Complexity of Sensor Accuracy Improvement Algorithm Based on Neural Networks // Lecture Notes in Computing Science, No 2130, Ed. By G.Gooss, J.Hartmanis and J. van Leeuwen, Springer-Verlag, Berlin, Heidelberg, New York. – 2001. – pp. 743-748.
  8. Volodymyr Turchenko. Neural Network Methods and Means of Efficiency Improvement of Distributive Networks of Sensor Data Acquisition and Processing: Ph.D. Theses on speciality 05.13.13 / Lviv National Polytechnical University. – Lviv, 2001. – 188 p.
  9. Volodymyr Tymchychyn. Efficiency Increasing of Specialized Computer System Design on the Base of Typical Microprocessor Platforms: Ph.D. Theses on speciality 05.13.13 / Lviv National Polytechnical University. – Lviv, 1999. – 200 p.
  10. Patent of Ukraine 25609A, MKI G06F 15/00. Two-Wired Local Area Network, Signal Repeater and Invertor for Using in it / V. Kochan, V. Tymchyshyn (Ukraine); Applied 30.10.97 # 97105295; Issued 30.10.98.
  11. Patent of Ukraine 25498A, MKI G06F 11/00. Method of Communication Channel Bandwidth Increasing on the Base of Serial Interface and Device for it Realisation / V. Kochan, V. Tymchyshyn (Ukraine); Applied 27.01.98 # 98010432; Issued 30.10.98.

## 4. RESEARCH ACTIVITIES

### IDAACS Conferences

The idea of IDAACS Workshop was proposed by Prof. Lucio Grandinetti (Italy), Prof. Theodore Laopoulos (Greece) and Prof. Anatoliy Sachenko (Ukraine) during the working meeting in Cetraro, Italy, in June, 2000. One of the main strategic goals of IDAACS is a promotion of the close scientific cooperation between the research teams and scientists from the countries of Western and Eastern Europe. Therefore the Workshop's motto is "IDAACS – the crossing point of Intelligent Data Acquisition & Advanced Computing Systems and East & West Scientists". Since 2001 the following IDAACS Workshops, Conferences and Symposia were organized:

- IDAACS'2001. July1-4 2001, Foros, Crimea, Ukraine.
  - Workshop Chairmen: Anatoly Sachenko
  - Co-Chairmen of International Program Committee (IPC): Theodore Laopoulos, Greece, Robert E. Hiromoto, USA
  - Statistics: 70 participants, 18 countries, 112 papers, 30 oral and 35 poster presentations, 280 P., 1 Vol.
  - Special Issues: International Journal of Computing
  - Sponsors: INTAS, NEC, HP invent, Science & Technology Center in Ukraine(STCU), Aval bank, Institute of Computer Information Technologies, IEEE Instrumentation & Measurement Society, IEEE Region 8.
- IDAACS'2003. August 8-10 2003, National University "Lviv's Polytechnic ", Lviv, Ukraine.
  - Workshop Co-Chairmen: Anatoly Sachenko, Bohdan Stadnyk, Ukraine
  - IPC Co-Chairmen: Lucio Grandinetti, Italy, Fernando Lopes Pena, Spain
  - Statistics: 85 participants, 21 countries, 112 papers, 60 oral and 52 poster presentations, 529 P., 1 Vol.
  - Special Issues: International Journal of Computer Standards & Interfaces, IEEE Transactions on Instrumentation and Measurement, International Journal of Computing, Sensors & Systems
  - Sponsors: Ternopil Academy of National Economy(TANE) of IEEE Instrumentation & Measurement Society, STCU at MES of Ukraine, Aval bank.
- IDAACS'2005. September 5-7 2005, Technical University of Sophia, Sophia, Bulgaria.
  - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Plamenka Borovska, Bulgaria
  - IPC Co-Chairmen: Domenico Grimaldi, Italy, Peter A. J. Reusch, Germany
  - Statistics: 99 participants, 27 countries, 147 papers, 96 oral and 51 poster presentations, 738 P., 1 Vol.
  - Special Issues: International Journal of Computer Standards & Interfaces, IEEE Transactions on Instrumentation and Measurement, Journal of Computing, Sensors & Systems
  - Sponsors: TANE, Technical University of Sophia, STCU, IEEE Bulgaria Section, IEEE Computer Chapter of Bulgaria Section.
- IDAACS'2007. September 6-8 2007, University of Applied Sciences Fachhochschule Dortmund, Dortmund, Germany.
  - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Peter J. A. Reusch, Germany
  - IPC Co-Chairmen: Richard Duro, Spain, Wieslaw Winiecki, Poland
  - Statistics: 105 participants, 35 countries, 180 papers, 95 oral and 52 poster presentations, 720 P., 1 Vol.

- Special Issues: IEEE Transactions on Instrumentation and Measurement, Journal of Computing, Sensors & Systems
- Sponsors: TNEU, University of Applied Sciences Fachhochschule Dortmund, IEEE Instrumentation & Measurement Society, RWE Systems AG, DSW21, Anna and Hermann Reusch Foundation, the Deutsche Forschungsgemeinschaft (German Research Foundation).
  
- IDAACS'2009. September 21-23 2009, Department of Electronics, Informatics and Systems, University of Calabria, Rende, Italy.
  - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Domenico Grimaldi, Italy
  - IPC Co-Chairmen: Vladimir Oleschuk, Norway, Dominique Dallet, France
  - Statistics: 122 participants, 25 countries, 142 papers, 86 oral and 56 poster presentations, 722 P., 1 Vol.
  - Special Issues: River Publishers, International Journal of Computing
  - Sponsors: Ukraine I&M / CI Joint Societies Chapter, University of the Calabria, Department of Electronics at University of the Calabria, IEEE Ukraine Section, IEEE Instrumentation & Measurement Society, IEEE Italy Section, IEEE Region 8. Workshop participant approved the IPS proposal to change the status from "Workshop" to "Conference"
  
- IDAACS'2011. September 15-17 2011, Czech Technical University in Prague, Prague, Czech Republic.
  - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Domenico Grimaldi, Italy
  - IPC Co-Chairmen: Dana Petcu, Romania, Axel Sikora, Germany
  - Statistics: 197 participants, 32 countries, 197 papers, 96 oral and 51 poster presentations, 738 P., 1 Vol.
  - Special Issues: International Journal of Computing, Sensors & Transducers Journal, Computer Standards & Interfaces.
  - Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, THEY, Czech Technical University in Prague, Faculty of Electrical Engineering at Czech Technical University, Office of Naval Research, Honeywell spol. s r.o., H TEST a.s., authorized distributor of Agilent Technologies Agilent Technologies H TEST a.s., IEEE Ukraine Section, IEEE Czechoslovakia Section, IEEE Instrumentation & Measurement Society, IEEE Region 8, River Publishers.

The first IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2012) was conducted in 2012.

- IDAACS-SWS'2012. September 20-21'2012, University of Applied Sciences in Offenburg, Offenburg, Germany.
  - Workshop Co-Chairmen: Evren Eren, Uwe Grossmann, Juergen Sieck, Axel Sikora, Germany
  - Statistics: participants from 12 countries, 39 papers, 27 oral presentations, 127 P., 1 Vol.
  - Special Issues: International Journal of Computing, Sensors & Transducers Journal, Computer Standards & Interfaces.
  - Sponsors: Faculty of Electrical Engineering and Information Technology at Offenburg University of Applied Sciences, IEEE Ukraine Section IM/CIS Joint Chapter, IEEE Instrumentation & Measurement Society.
  
- IDAACS'2013. September 12-14, Hochschule für Technik und Wirtschaft, University of Applied Sciences Berlin (HTW Berlin), Berlin, Germany.
  - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Jürgen Sieck, Germany
  - IPC Co-Chairmen: Vladimir Haasz, Czech Republic, Kurosh Madani, France
  - Statistics: 185 participants, 28 countries, 185 papers, 120 oral and 60 poster presentations, 940 pages, 2 volumes.

- Special Issues: River Publishers, Journal of Cyber Security and Mobility, International Journal of Computing, Elsevier Engineering Applications of Artificial Intelligence, Sensors & Transducers Journal.
- Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, THEY, University of Applied Sciences in Berlin, IEEE Instrumentation & Measurement Society, Office of Naval Research, The University of Maine, IEEE Region 8, River Publishers, IEEE Ukraine Section.

The second IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2014) was conducted in 2014.

- IDAACS-SWS'2014. September 11-12'2012, University of Applied Sciences in Offenburg, Offenburg, Germany.
  - Workshop Co-Chairmen:
    - Svitlana Antoshchuk, Volodymyr Brovko, Ukraine;
    - Evren Eren, Uwe Grossmann, Juergen Sieck, Axel Sikora, Germany
  - Statistics: participants from 7 countries, 15 papers, 15 oral presentations, 127 P., 1 Vol.
  - Sponsors: Faculty of Electrical Engineering and Information Technology at Offenburg University of Applied Sciences, IEEE Ukraine Section IM/CIS Joint Chapter, IEEE Instrumentation & Measurement Society.
  
- IDAACS'2015. September 24-26, Faculty of Electronics and Information Technology and Faculty of Mathematics and Information Science, Warsaw University of Technology, Warsaw, Poland.
  - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Wiesław Winiecki, Poland
  - IPC Co-Chairmen: Robert Hiromoto, USA, Linas Svilainis, Lithuania
  - Statistic: 180 participants, 29 countries, 185 papers, 24 oral and 3 poster sessions, 991 pages, 2 volumes.
  - Special Issues: River Publishers, Journal of Cyber Security and Mobility, International Journal of Computing, Elsevier Engineering Applications of Artificial Intelligence.
  - Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, TNEU, University of Applied Sciences in Berlin, IEEE Instrumentation & Measurement Society, Office of Naval Research, The University of Maine, IEEE Region 8, River Publishers, IEEE Ukraine Section.



## International Journal of Computing

The International journal of Computing was established on the base of Branch Research Laboratory of Automated Systems and Networks in 2002. Its main goal is to present results in the areas of Computer Science, Computer Engineering and Information Technology. The official languages of the Journal are English, Ukrainian and Russian. Journal registered in Periodicals Catalogue in Ukraine and published the 4 times per year.

The Journal's Editor-in-Chief is Prof. Anatoliy Sachenko, the Executive Editor is PhD, Associated Professor Volodymyr Turchenko, Associated Editors are Prof. Robert E. Hiromoto, University of Idaho, USA and Prof. Volodymyr Kochan. The Journal staff includes Mr. Taras Lendyuk, the Technical Editor and Mrs. Halyna Kryva the Economist.

The Editorial Board consists of more than 40 recognised scientists from 17 countries: Australia, Belarus, Bulgaria, Czech Republic, France, Germany, Greece, Italy, Lithuania, Norway, Poland, Portugal, Romania, Russia, Spain, Ukraine and USA.

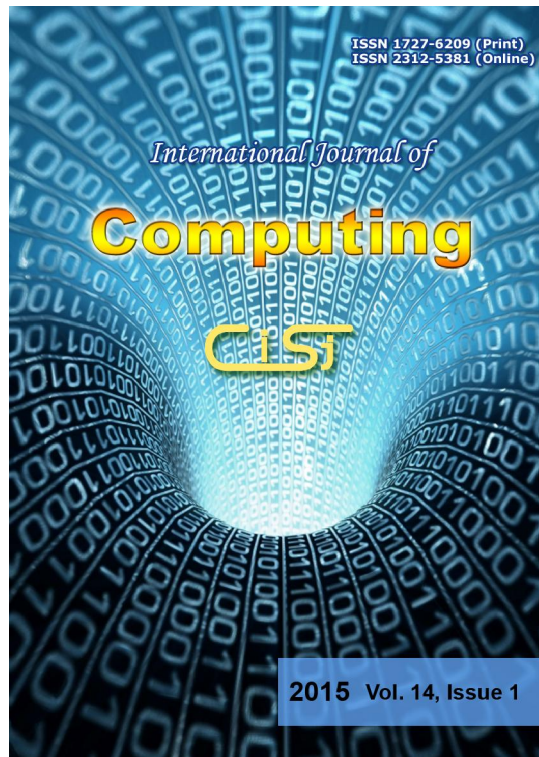
Publishing support of the Journal provided by Publishing House, TNEU according to requirements of Supreme Attestation Commission of Ukraine. Since 2010, the Journal is publishing quarterly.

Journal Topics are: Algorithms and Data Structure, Software Tools and Environments; Bio-Informatics; Computational Intelligence; Computer Modeling and Simulation; Cyber and Homeland Security; Data Communications and Networking; Data Mining, Knowledge Bases and Ontology; Digital Signal Processing; Distributed Systems and Remote Control; Education in Computing; Embedded Systems; High Performance Computing and GRIDS; Image Processing and Pattern Recognition; Intelligent Robotics Systems; Internet of Things; IT Project Management; Wireless Systems.

Issues	
<ul style="list-style-type: none"> <li>• 2015, Vol. 14, Issue 4</li> <li>• 2015, Vol. 14, Issue 3</li> <li>• 2015, Vol. 14, Issue 2</li> <li>• 2015, Vol. 14, Issue 1</li> <li>• 2014, Vol. 13, Issue 4 – thematic issue “ICT in Project Management”</li> <li>• 2014, Vol. 13, Issue 3</li> <li>• 2014, Vol. 13, Issue 2</li> <li>• 2014, Vol. 13, Issue 1</li> <li>• 2013, Vol. 12, Issue 4</li> <li>• 2013, Vol. 12, Issue 3</li> <li>• 2013, Vol. 12, Issue 2</li> <li>• 2013, Vol. 12, Issue 1</li> <li>• 2012, Vol. 11, Issue 4 – Special Issue on Advanced Computing Systems</li> <li>• 2012, Vol. 11, Issue 3</li> <li>• 2012, Vol. 11, Issue 2</li> <li>• 2012, Vol. 11, Issue 1 – Special Issue on Pattern Recognition and Intelligent Processing</li> <li>• 2011, Vol. 10, Issue 4 – Special Issue on Wireless Systems</li> <li>• 2011, Vol. 10, Issue 3</li> <li>• 2011, Vol. 10, Issue 2</li> <li>• 2011, Vol. 10, Issue 1 – Special Issue on Neural Networks and Artificial Intelligence</li> <li>• 2010, Vol. 9, Issue 4</li> <li>• 2010, Vol. 9, Issue 3 – Special Issue on Wireless Systems</li> <li>• 2010, Vol. 9, Issue 2</li> </ul>	<ul style="list-style-type: none"> <li>• 2010, Vol. 9, Issue 1 – Special Issue on Interactive Systems in Culture and Creative Industries</li> <li>• 2009, Vol. 8, Issue 3 2009, Vol. 8, Issue 2</li> <li>• 2009, Vol. 8, Issue 2 2009, Vol. 8, Issue 1 – Special Issue on Artificial Neural Networks and Intelligent Information Processing</li> <li>• 2008, Vol. 7, Issue 3</li> <li>• 2008, Vol. 7, Issue 2 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems</li> <li>• 2008, Vol. 7, Issue 1</li> <li>• 2007, Vol. 6, Issue 3</li> <li>• 2007, Vol. 6, Issue 2 – Special Issue on Virtual Instrumentation and Virtual Laboratories</li> <li>• 2007, Vol. 6, Issue 1</li> <li>• 2006, Vol 5, Issue 3 – Special Issue on Neural Network and Artificial Intelligence</li> <li>• 2006, Vol5, Issue 2</li> <li>• 2006, Vol 5, Issue 1</li> <li>• 2005, Vol. 4, Issue 3 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems</li> <li>• 2005, Vol. 4, Issue 2 – Special Issue on Cyberspace Security</li> <li>• 2005, Vol. 4, Issue 1</li> <li>• 2004, Vol. 3, Issue 3</li> <li>• 2004, Vol. 3, Issue 2</li> </ul>

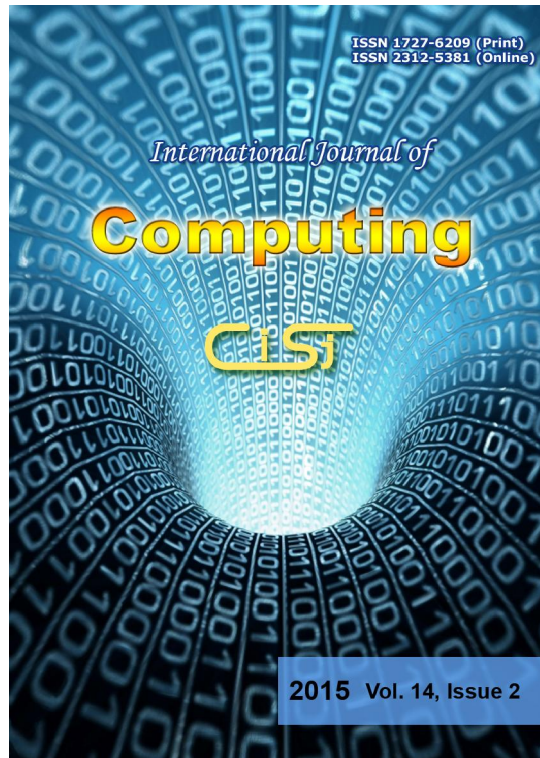
<ul style="list-style-type: none"> <li>• 2004, Vol. 3, Issue 1 – special issue ICNNAI'2003, Minsk, Belarus</li> <li>• 2003, Vol. 2, Issue 3</li> <li>• 2003, Vol. 2, Issue 2 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems</li> <li>• 2003, Vol. 2, Issue 1</li> </ul>	<ul style="list-style-type: none"> <li>• 2002, Vol. 1, Issue 2 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems</li> <li>2002, Vol. 1, Issue 1 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems</li> </ul>
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### Contents of Journal of Computing, 2015, Vol. 14, Issue 1



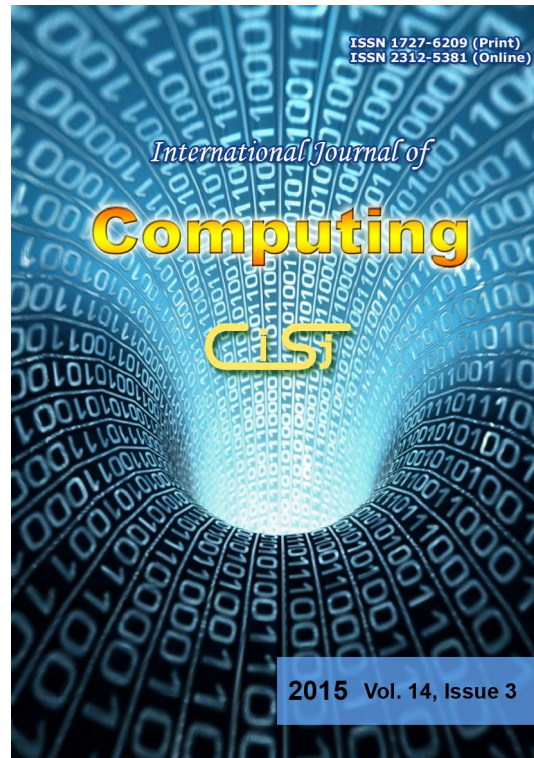
1. V. Haasz, J. Roztocil, J. Breuer, V. Vigner. Precise Synchronization in Industrial System Using IEEE 1588 Precise Time Protocol. – p. 8-14.
2. Yu. Kolokolov, A. Monovskaya. Fractal Approach to Analyze the Instrumental Time Series of Temperature Observations. – p. 15-21.
3. D. A. Fotiadis, K. Papathanasiou, A. Astaras, P. D. Bamidis, A. Kalfas. A Novel Signal Processing Method Based on Frequency Modality for Intra-body Medical Instrument Tracking. – p. 22-29.
4. B. Rusyn, O. Lutsyk, Y. Varetskyy. Probabilistic Approach to Domain Selection for Integrating the Normal's Field in 3D Reconstruction. – p. 30-35.
5. V. Golovko, S. Artsiomenka, V. Kisten, V. Evstigneev. Towards Automatic Epileptic Seizure Detection in EEGs Based on Neural Networks and Largest Lyapunov Exponent. – p. 36-47.

Contents of Journal of Computing, 2015, Vol. 14, Issue 2



1. W. Winiecki, P. Bilski. Implementation of Symmetric Cryptography in Embedded Measurement Systems. – p. 66-76.
2. P. J. Zeno. Emulating the Functionality of Rodents' Neurobiological Navigation and Spatial Cognition Cells in a Mobile Robot. – p. 77-85.
3. H. Yang, V. Oleshchuk. Attribute-based Authentication Schemes: A Survey. – p. 86-96.
4. A. Momenzhad, M. Shamsi, H. Ebrahimzhad, L. Asgharian. The Effect of using Hamming Window and Linear Predictive Coding Model in EEG-P300 Signals Classification. – p. 97-106.
5. S. Gupta, S. Arora. Boosting Simulated Annealing with Fitness Landscape Parameters for Better Optimality. – p. 107-112.

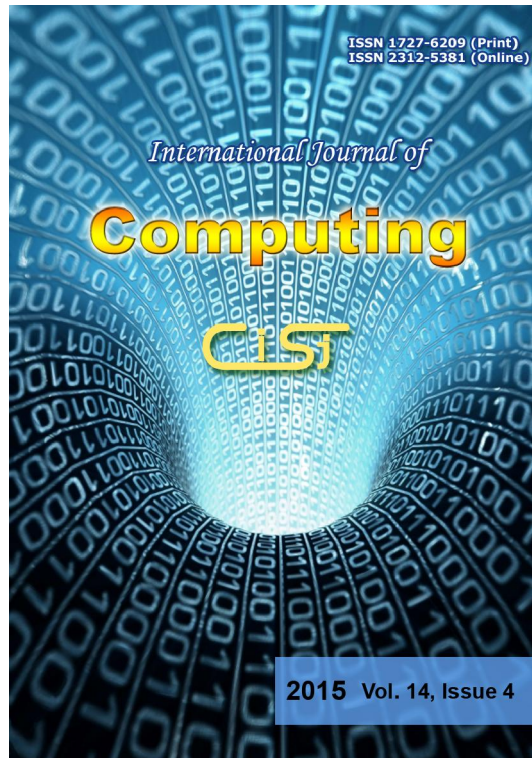
## Contents of Journal of Computing, 2015, Vol. 14, Issue 3



1. J. M. Dias Pereira, R. M. N. Salgado. Data Acquisition and Data Processing Challenges in Heavy Metal Measurements. – p. 130-140.
2. J. V. Vourvoulakis, J. A. Kalomiros, J. N. Lygouras. Design Details of a Low Cost and High Performance Robotic Vision Architecture. – p. 141-156.
3. G. Žylius, R. Simutis, V. Vaitkus. Evaluation of Computational Intelligence Techniques for Daily Product Sales Forecasting. – p. 157-164.
4. M. B. Mansour, Y. Mlouhi, I. Jabri, T. Battikh, L. Maalej, M. N. Lakhoua. An Image-Processing Technique for Glaucoma Detection on the Basis of Ophthalmic Images. – p. 165-171.
5. K. Jakowska-Suwalska, M. Wolny. Support Model of Material Requirements Planning in a Coal Mine. – p. 172-179.



Contents of Journal of Computing, 2015, Vol. 14, Issue 4



1. D. Vidacic, R. A. Messner. Biologically Inspired Filters Utilizing Spectral Properties of Toeplitz-Block-Toeplitz Matrices. – p. 198-207.
2. J. Sieck, V. Yatskiv, A. Sachenko, T. Tsavolyk. Two-Dimensional Error Control Based on Modular Corrective Codes. – p. 208-215.
3. L. Shumylyak, V. Zhikharevich, S. Ostapov. Cellular Automata Modeling of Impurities Segregation in the Melt Crystallization Process. – p. 216-226.
4. Y. V. Kolokolov, A. V. Monovskaya. Advanced Experimental Bifurcation Analysis: Baseline Scenario of Dynamics Evolution. – p. 227-233.
5. A. Sugak, O. Martynyuk, O. Drozd. A Hybrid Agent Model of Behavioral Testing. – p. 234-246.

### Specialized Scientific Council K58.082.02

Specialized scientific council in specialties:

- 05.13.05 – Computer Systems and Components;
- 05.13.06 – Information Technologies;

In 2015 was held defences of such theses:

- **V. Gryga**, PhD thesis “Hardware-oriented Specialized Devices Performin Mathematical Operations”, speciality 05.13.05 – Computer Systems and Components.
- **Yu. Roshchupkin**, PhD thesis “Methods and Means of Accuracy Improving of ultraviolet Information Measuring systems”, speciality 05.13.05 – Computer Systems and Components.
- **N. Anufrieva**, PhD thesis «Information Technology Reduce the Influence of Artifacts to the Process of Three-dimensional Reconstruction of Local Damage of Metal Surfaces», speciality 05.13.06 – Information Technologies.
- **A. Kryshchuk**, PhD thesis «Multiagent Information Technology Computer Systems Diagnosing the Presence of Bot Networks in Corporate Networks», speciality 05.13.06 – Information Technologies.

### IEEE Instrumentation & Measurement/Computational Intelligence Joint Societies Chapter

The Instrumentation & Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section were established on June 7, 2005. The Chairman of the Chapter is Prof. Anatoliy Sachenko. The Chapter consists of 38 members from Lviv, Ternopil, Khmelnytsky, Kyiv, Kharkiv, Ivano-Frankivsk, Zaporizhzhya, Chernivtsi and Odessa, in particular:

Prof. S. Antoshchuk, Odessa National Polytechnic University  
 Dr P. Bykovyy, Ternopil National Economic University  
 Dr O. Blazhko, Odessa National Polytechnic University  
 Prof. E. Volodarsky, National Technical University of Ukraine “Kyiv Polytechnic Institute”  
 Prof. M. Dorozhovets, Lviv National Technical University  
 Prof. A. Drozd, Odessa National Polytechnic University  
 Prof. O. Ivakhiv, Lviv National Technical University  
 Prof. R. Kochan, Lviv National Technical University  
 Dr O. Kochan, Ternopil National Economic University  
 Dr V. Kochan, Ternopil National Economic University  
 Prof. V. Krylov, Odessa National Polytechnic University  
 Dr S. Lysenko, Khmelnytsky National University  
 Dr V. Lyashkevych, Yury Fedkovych Chernivtsi State University  
 Dr I. Maykiv, Ternopil National Economic University  
 Dr V. Mukhin, National Technical University of Ukraine “Kyiv Polytechnic Institute”  
 Dr A. Piskozub, Lviv National Technical University  
 Prof. O. Pomorova, Khmelnytsky National University  
 Prof. M. Pryymak, Ternopil Ivan Pul’uj State Technical University  
 Prof. Yu. Rak, Lviv National State University for Life Safety  
 Prof. S. Rippa, National University of the State Taxation Department of Ukraine  
 Prof. A. Sachenko, Ternopil National Economic University  
 Dr V. Turchenko, Ternopil National Economic University  
 Prof. M. Cherkassky, Lviv National Technical University  
 Dr G. Shilo, Zaporizhzhya National Technical University  
 Dr V. Yatskiv, Ternopil National Economic University

List of technical meetings, which have run by the I,&M/CI Chapter:

- I. At March 18, 2015, a Joint Technical Meeting of Information Computer Systems and Control Department and IEEE IM/CI Joint Societies Chapter was held in Ternopil National Economic University. There were two presenters: PhD student Kostantyn Kovalok provide a topic entitled “Methods of Image Contour Extraction” and a junior researcher Alex Nykorak provide topic entitled “Characteristic Requirements for Data Bandwidth between Cooperating Robots”. The total number of participants 15 (10-IEEE).
- II. At March 21, 2015 a Technical Meeting of IEEE IM/CI Joint Societies Chapter was held at Ternopil National Economic University. The Associate Professor Bjarne Rerup Schlichter from Aarhus University, School of Business and Social Sciences (Denmark) provide a talk “IT Public Value” within his regular visits to Ternopil National Economic University. Also Dr. Pavlo Bykovyy provide a talk “Texas Instruments Innovation Challenge: Europe Analog Design Contest” at the Meeting. The members of Chapter, students of direction “Computer Science” and members of Research Institute for Intelligent Computer Systems were present at the Meeting. It was 29 people in total. (11- IEEE)
- III. On April 29th the 3rd-15 IEEE IM/CI Joint Societies Chapter Meeting was held within the visit of Yves Demazeau, the President of Artificial Intelligence Research in France to Ternopil National Economic University. Yves Demazeau deliver lecture “Practical User-Centered Multi-Agent Systems” and during his visit to the Research Institute of Intelligent Computer Systems Dr. Vasyl Koval delivered a topic “Multi-Agent Based Distributed Measurement Systems”. The members of Chapter, students of direction “Computer Science” and members of Research Institute for Intelligent Computer Systems were present at the Meeting. It was 25 people in total. (10- IEEE)
- IV. On May 6 the 4th-15 IEEE IM/CI Joint Societies Chapter Meeting was held at Ternopil National Economic University within the visit of Prof. Wolfgang Tysiak form the Faculty of Business Studies, University of Applied Acience and Arts, Dortmund, Germany. Prof. Tysyak delivered a topic: “The European Master in Project Management (EuroMPM)” for members of Chapter, students of directions “Computer Science” and “Project Management”, and members of Research Institute for Intelligent Computer Systems. Another presenter delivered by Dr. Zbyshek Dombrowsky “Risk in Project Management”. It was 18 people in total. (10- IEEE)
- V. On May 19, 2015 the 5th-15 IEEE Meeting of IEEE IM/CI Joint Societies Chapter within the visit of a delegation from University of Aarhus, Aarhus University, School of Business and Social Sciences, Denmark was held. Associate Professor Bjarne Schlichter provide introduction talk “Master’s degree programme in ITKO – IT, communication and organisation” followed by presentations of the students from this master program. Also, associate professor Sune Dueholm Müller from the same university provides a topic entitled: “Innovation processes”. After the meeting, delegation visited laboratories and personnel of the Research Institute of Intelligent Computer Systems and Information Computer Systems and Control department. It was 32 people in total, (12 IEEE)
- VI. On July 03, 2015p. the 6th-15 IEEE IM/CI Joint Societies Chapter Meeting was held at Ternopil National Economic University. Speakers: Prof. Vladimir Golovko from Brest State Technical University, topic: “Deep Learning Neural Networks”, and Prof. Volodymyr Kochan topic “10 Breakthrough Technologies of 2015”. It was 23 people in total, (13 IEEE)
- VII. On September 15, 2015 the 7th-15 IEEE IM/CI Joint Societies Chapter Meeting was held within the International scientific and practical conference "Project Management: Status and

Prospects” at Kobleve, Mykolaiv Regin. It was provided two presentations of Prof. Anatoly Sachenko "Improving project management" and Mr. Yuriy Ivanyshak "Project management of informational infrastructure of the university". It was 21 people in total, (10 IEEE)

- VIII. At September 24, 2015 the 8th-15 IEEE IM/CI Joint Societies Chapter Meeting was held within the Plenary Session of 8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS'2015), Warsaw, Poland. Presenters: Prof. Anatoly Sachenko “Welcome introduction to IDAACS” and Prof. Robert E. Hiromoto “Parallelism and Complexity of the Small-World Network Model”. 58 people, 26 IEEE



## **IEEE Student Branch**

The Institute of Electrotechnical and Electronics Engineers (IEEE) Student Branch at Ternopil National Economic University (TNEU) was founded in 1998.

Student Branch consists of students of the Faculty of Computer Information Technologies, PhD students and junior researchers of TNEU. As of 2015 there were 6 active members in the Branch. The Branch Committee consists of the Chair – Oleksiy Roshchupkin, a Vice-Chair – Olexander Osolinskyy, a Secretary – Diana Zahorodnia, a Treasurer – Kostyantyn Kovalok, a Counselor – Prof. Anatoliy Sachenko.

Members of the IEEE Student Branch at TNEU take part in international conferences and projects. Also they assist in organization and preparation of the series of Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS) IEEE Workshops: 2001, 2003 – Ukraine, 2005 – Bulgaria, 2007 – Germany, 2009 – Italy, and the IEEE IDAACS Conference in 2011 – Czech Republic, 2013 – Germany, 2015 – Poland.

The main advantages of IEEE membership include: access to IEEE electronic resources, IEEE subscription in the scientific magazines and popular scientific literature “Spectrum”, “Computer”, “IEEE Transaction on Instrumentation and Measurement”; assistance and discounts for participation at international conferences, for example, as IEEE member scientist could win a travel grant to the conference in the country region (Ukraine, along with Europe, Middle East and Africa, belongs to region 8). Almost all conferences sponsored by IEEE give discount to students for registration fee, participation in competitions organized by IEEE in the region.

Overall, IEEE supports scientific activities of students and young scientists, supporting them in the development of their scientific career, increases collaboration between scientists from different universities and international scientific – educational organizations. For example, IEEE members have access to a digital library of articles Hplore IEEE conferences, are printed journals IEEE, have the opportunity to join the scientific communities in different scientific fields can win grants for travel to academic conferences and receive a discount when registering them. Also between branches and regions contests for the best scientific article or website and racing robots. Each of these competitions are accompanied by cash prizes.

## Other Research Activities

### [Org 1] **Sergey Bushuyev**

- Reviewing the 10 papers for international and national conferences.
- Reviewing the 15 articles in international and national scientific journals.
- Member of the organizing / program committee:
  - Kyiv, May 2015, Project Management in the Development of Society,
  - Mykolaiv, September 2015, Practical Aspects of Project Management
  - Bukovel, February 2015, Strategic Project Management

### [Org 2] **Volodymyr Kochan**

- Member of the Editorial Board at International Journal of Computing
- Reviewing the 14 papers at International Conference IDAACS'2015
- 3 reviews for PhD Thesis’;
- Member of the Organizing Committee IDAACS'2015, 24 – September 26 2015, Warsaw (Poland);
- Member of the Specialized Scientific Council K58.082.02 at TNEU.
- Participation in application for grant on program HORIZON2020.

### [Org 3] **Vasyl Koval**

- Reviewing the one paper in international journal;
- Member of the Specialized Scientific Council K58.082.02 at TNEU;
- Member of Organization Committee of Workshop of Young Scientists and Students “Advanced Computer Information Technologies”.

### [Org 4] **Yaroslav Nykolaychuk**

- Reviewing papers for international and national conferences.
- Reviewing the 2 PhD Theses.
- The official opponent of Ruslan Novitsky PhD thesis “Parallel Optic-electronic Methods and Tools for Image Comparison Focused on Modern Technologies”, specialty 05.13.05 – Computer Systems and Components.
- Member of the Program Committee of V Workshop of Young Scientists and Students “Advanced Computer Information Technologies”, 22-23 May 2015, Ternopil.
- Member and a Vice-Chairman of the Specialized Scientific Council K.58.082.02 at TNEU.

### [Org 5] **Roman Pasichnyk**

- Reviewing the 2 papers in international and national journals
- Member of the Specialized Scientific Council K58.082.02 at TNEU.

### [Org 6] **Sergey Rippa**

- Reviewing the 12 papers for international and national conferences.
- Reviewing the 7 articles in international and national scientific journals.
- Reviewing the 6 PhD Thesis’.
- Member of the International Program Committee of IDAACS'2015, 24-25 September 2015, Warsaw (Poland);
- A member of specialized academic council K 27.855.01 at NUSTA.

### [Org 7] **Anatoliy Sachenko**

- Chairman of the Specialized Scientific Council K58.082.02 at TNEU.
- Member of Specialized Scientific Council D35.052.08 at National University “Lviv

Polytechnics”

- Editor-in-Chief, International Journal of Computing.
- Official opponent of Jaakko Talonen PhD thesis entitled “Advances in Methods of Anomaly Detection and Visualization of Multivariate Data”, supervisor Prof. Olli Simula, advisors Dr Miki Sirola and Dr Mika Sulkava.
- Reviewing the 26 papers for national and international conferences.
- Reviewing the four Doctor of Science Theses
- Reviewing the ten PhD Theses
- Co-Chair of 8th IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems, Warsaw, Poland, 24-26 September 2015.
- Member of the Program Committee of International Conference (Research Conference-2015), Dortmund University of Applied Sciences and Arts, Dortmund, Germany

**[Org 8] Volodymyr Turchenko**

- Deputy Editor at International Journal of Computing, participated in preparing the four issues of the Journal, reviewed the two articles
- Member of the Program Committee at 8th IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems, Warsaw, Poland, 24-26 September 2015

**[Org 9] Vasyl Yatskiv**

- Reviewing the 2 papers for International Conference IDAACS’2015;
- Reviewing the 2 PhD Theses;
- Member of the Organizing Committee: V All-Ukrainian Seminar of Young Scientists and Students “Advanced Computer Information Technologies”, Ternopil.
- Scientific Secretary of the Specialized Scientific Council K58.082.02 at TNEU.

## 5. ACADEMIC ACTIVITIES

### Cooperation Agreements with Universities and Companies

- [Agreement 1] Belarus State University of Informatics and Radioelectronics, Minsk, Belarus.
- [Agreement 2] Brest State Technical University, Belarus.
- [Agreement 3] Donetsk National Technical University, Ukraine.
- [Agreement 4] Zaporizhya National Technical University, Ukraine.
- [Agreement 5] Institute for Cybernetics, National Academy of Sciences of Ukraine, Kyiv, Ukraine.
- [Agreement 6] Institute of Space Research, National Academy of Sciences of Ukraine and NCAO, Kyiv, Ukraine.
- [Agreement 7] Institute of Control, Russian Academy of Sciences, Moscow, Russia.
- [Agreement 8] Institute of Artificial Intelligence, Donetsk.
- [Agreement 9] Odessa National Polytechnic University, Ukraine.
- [Agreement 10] Technical University of Sofia, Bulgaria.
- [Agreement 11] University of Calabria, Italy.
- [Agreement 12] Tsinghua University, China.
- [Agreement 13] University of Maine, USA.
- [Agreement 14] University of New Hampshire, USA
- [Agreement 15] University of South Carolina, USA.
- [Agreement 16] Physics-Mechanics Institute of G. Karpenko, National Academy of Sciences of Ukraine, Lviv, Ukraine.
- [Agreement 17] University of Siegen, Germany
- [Agreement 18] Chernivtsi National University by Yu.Fedkovich, Chernivtsi, Ukraine
- [Agreement 19] Wuhan University of Technologies, Wuhan, Hubei, China
- [Agreement 20] Kaunas University of Technology, Lithuania
- [Agreement 21] Hochschule für Technik und Wirtschaft Berlin, University of Applied Sciences, Germany
- [Agreement 22] Fachhochschule Dortmund, University of Applied Sciences, Germany
- [Agreement 23] Pre-Carpathian National University by Vasyl Stefanyk, Ivano-Frankivsk, Ukraine
- [Agreement 24] Silesian Technical University, Poland.
- [Agreement 25] Warsaw University of Technology, Poland
- [Agreement 26] National University of State Tax Service of Ukraine, Irpin, Kiev region.
- [Agreement 27] National University of Water and Environmental Engineering, Rivne, Ukraine.
- [Agreement 28] Kiev National University of Construction and Architecture, Ukraine.
- [Agreement 29] Lviv State University of Life Safety, Lviv, Ukraine
- [Agreement 30] Ivan Franko National University of Lviv, Lviv, Ukraine

### Defended Theses and Awarded Degrees

- [Def 1] Dmytro Burulava defended PhD thesis titled “Managing of Strategic Programs of Urban Development in Conditions of Turbulent Environment”, 05.13.22 – Project and Program Management, scientific consultant, Prof. Sergey Bushuyev.
- [Def 2] Natalia Gaidukova defended PhD thesis titled “Multi Parametric Portfolio Management Investment Projects of Steel Plant”, 05.13.22 – Project and Program Management, scientific consultant, Prof. Sergey Bushuyev.
- [Def 3] Yuriy Emets defended PhD thesis titled “Methods of Identification Based on Multifractal Parameters Upon Detection of Obstacles and Textures”, 05.13.23 — Systems and Means of Artificial Intelligence, scientific consultant, Prof. Viktor Krylov.
- [Def 4] Olena Kryvoruchko defended PhD thesis titled “Divergent Methodology of Harmonization for Decisions in Development Management of Universities Programs”, 05.13.22 – Project and Program Management, scientific consultant, Prof. Sergey Bushuyev.

- [Def 5] Valentyna Molokanova defended PhD thesis titled “Value-oriented Portfolio of Organizations Development Management”, 05.13.22 – Project and Program Management, scientific consultant, Prof. Sergey Bushuyev.
- [Def 6] Viktoria Rogozina defended PhD thesis titled “Mechanisms of Management Development of Project-oriented Organizations to Complementary Values Model”, 05.13.22 – Project and Program Management, scientific consultant, Prof. Sergey Bushuyev.
- [Def 7] Mykola Tsiutsiura defended PhD thesis titled “Information Technology Management Education Content Development Based on Sustainable Value Approach”, 05.13.06 – Information Technologies, scientific consultant, Prof. Sergey Bushuyev.

### **Defended Master Theses**

- [DefMas 1] Yuriy Ivanyshak, Project Management of Educational System Reengineering in University, Ninel Dobrovolska.
- [DefMas 2] Taras Lozovych, Project Management of Document Automation System Implementation in University, Assoc. Prof. Oleh Adamiv.
- [DefMas 3] Adjei Addo Simon Piter, Implementing AGILE Methodology for ICT Projects, Prof. Sergey Bushuyev.
- [DefMas 4] ENOMA Osaretin Samuel, Risk Evaluation Model of Bank Investment for Innovative Projects, Assoc. Prof. Grigoriy Gladiy.
- [DefMas 5] IKPEHAI Presious Ohimai, Project Management for Creating the ICT Excellence Center, Prof. Anatoly Sachenko.
- [DefMas 6] OYONUMO Eio Eio, Project Management of Loopholes in a Peer-to-Peer Networks, Ph.D. Zbyshek Dombrowsky.
- [DefMas 7] Dada Oluvahbemiha Samuel, Managing IT Project for Restaurants Network, Assoc. Prof. Igor Paliy.
- [DefMas 8] Muzari Paulsen Munetsi, Project Management of Security System Development for Small Industrial Enterprise, Assoc. Prof. Iryna Turchenko.
- [DefMas 9] Muhindo Mashozi Jean, Managing IT Company by Projects Values with SCRUM Methodology, Prof. Sergey Bushuev.
- [DefMas 10] Sotuminu Tolulope Kayode, Project Management of Creating the Mini-Bakery, Prof. Igor Dobrotvor.
- [DefMas 11] Pavlo Filipov, Project Management of Modernizing the Marketing Policy of Brewery, Prof. Igor Dobrotvor.
- [DefMas 12] Mykola Bodnar, Model Management Assessment of Project Managers, Assoc. Prof. Igor Paliy.
- [DefMas 13] Bogdan Buchynsky, Project Management, Improving Production Processes Manufacturing Products from Raw Flour, Prof. Igor Dobrotvor.
- [DefMas 14] Volodymyr Prus, Portfolio Management of Projects in Individual Services, Ph.D. Zbyshek Dombrowsky.
- [DefMas 15] Vladyslav Boychenko, Risk Management Projects Based on Risks Structural Decomposition, Assoc. Prof. Grigoriy Gladiy.
- [DefMas 16] Ruslan Klepach, Project Management of Creating High-performance Computing Systems for Research, Prof. Sergey Rippa.
- [DefMas 17] Denys Kozak, Project Management using GRID-technologies in Higher Education, Prof. Sergey Rippa.
- [DefMas 18] Valery Lototsky, Improvement of Personnel Management based on the Portfolio of IT Projects, Ph.D. Zbyshek Dombrowsky.
- [DefMas 19] Denys Malinin, Project Management of IT Infrastructure Modernization Chemical Industry, Assoc. Prof. Iryna Turchenko.
- [DefMas 20] Sergiy Nychyporuk, Project Management Model Creating a Wireless System to Monitor Complex Technical Facilities, Prof. Anatoliy Sachenko.
- [DefMas 21] Dmytro Pavlovych, Project Management through the Creation Center Consulting

Services, Ph.D. Zbyshek Dombrowsky.

- [DefMas 22] Taras Skumin, Managing IT project "Young Professionals Foundation" for the Business Incubator, Assoc. Prof. Grygoriy Gladiy.
- [DefMas 23] Vitaly Stetsyna, Resource Management of Agro Investment Project, Ph.D. Nadia Vasylykiv.
- [DefMas 24] Zoriana Grytsiv, Models of Credit and Deposit Activities of Commercial Banks to the Cost of Business Reputation, Prof. Dmytro Bodnar.
- [DefMas 25] Marian Dyakivnych, Tools Profitability Assessment of Business Processes to Manage, Assoc. Prof. Roman Pasichnyk.
- [DefMas 26] Victor Kuzenkov, Tool Management for Production Sales, Assoc. Prof. Roman Pasichnyk.
- [DefMas 27] Mariana Ehnovska, Mathematical Model of Optimization of Resource Provision of Construction, Prof. Dmytro Bodnar.
- [DefMas 28] Svitlana Petrushchak, Process Model of Organizational Structure of Industrial Enterprises, Prof. Dmytro Bodnar.
- [DefMas 29] Yulia Pylypchuk, Mechanism of Information-analytical Activities in International Relations, Prof. Oksana Lyashenko.
- [DefMas 30] Olexandr Samoyliuk, Informational resources of world economic development, Prof. Oksana Lyashenko.
- [DefMas 31] Iryna Smolij, The Global Network Economy and Accession Ukraine to it, Prof. Oksana Lyashenko.
- [DefMas 32] Nadia Savytska, Information Support Management of Processes in the Company, Prof. Oksana Lyashenko.
- [DefMas 33] Natalia Fedushchak, Consolidation of Large Data Arrays in the Enterprise, Prof. Oksana Lyashenko.
- [DefMas 34] Volodymyr Bashutsky, The Wireless Sensor Network Systems for Monitoring Forest Fires, Assoc. Prof. Vasyl Yatskiv.
- [DefMas 35] Andriy Bodyo, Special Processors of Factorization of Numbers in Krestenson Theoretical Basis, Prof. Yaroslav Nykolaichuk.
- [DefMas 36] Bohdan Bondarchuk, The Process of Scheduling in Computer Systems, Prof. Yaroslav Nykolaichuk.
- [DefMas 37] Sergiy Bulygin, The Mobile Adapter with Synthetic Keyboard, Assoc. Prof. Natalia Vozna.
- [DefMas 38] Yuriy Matiyishyn, Network Coding Data in the System of Residual Classes, Assoc. Prof. Vasyl Yatskiv
- [DefMas 39] Pavlo Syberiak, Improving the Reliability of Data Transmission Based on Modified Correcting Codes, Prof. Yaroslav Nykolaichuk.
- [DefMas 40] Tamara Snigur, The Models of Databases in Positional and Not Positional Number Systems, Assoc. Prof. Natalia Vozna.
- [DefMas 41] Volodymyr Sovyak, Protection System of Manipulated Data from Errors in Galois Basis, Prof. Yaroslav Nykolaichuk.
- [DefMas 42] Mykola Striletsky, Tools for Evaluating the Reliability of the Supplier, Assoc. Prof. Roman Pasichnyk.
- [DefMas 43] Andriy Gorokhivsky, Tool Support Fleet Renewal Process, Assoc. Prof. Roman Pasichnyk.
- [DefMas 44] Yuriy Melnyk, Web-based Model of Macroeconomic Impacts on the Automotive Market, Assoc. Prof. Roman Pasichnyk.
- [DefMas 45] Igor Antonyk, Management Innovation Project Creation Pizzerias, Assoc. Prof. Grygoriy Gladiy.
- [DefMas 46] Vasyl Golets, Portfolio Management Project Launch of New Products, Assoc. Prof. Grygoriy Gladiy.
- [DefMas 47] Vasyl Kozlovsky, Project Management of Clustered Data Networks, Prof. Sergey Rippa.
- [DefMas 48] Ruslan Koroliuk, Management Model Enterprise Financing Investment Projects,

- Ph.D. Nadia Vasylykiv.
- [DefMas 49] Oleg Kuryk, Information Management in Investment Projects, Ninel Dobrovolska.
- [DefMas 50] Mykhailo Lopushansky, Creating Project Management Decision Support System to Evaluate the Creditworthiness of Individuals, Ph.D. Myroslav Komar.
- [DefMas 51] Khrystyna Novak, Management Strategy Form the Project Team with Limited Human Resources, Assoc. Prof. Igor Paliy.
- [DefMas 52] Olexandr Panchoha, Project Management, Creating a Wireless Network Monitoring Complex Technical Systems, Assoc. Prof. Volodymyr Kochan.
- [DefMas 53] Mykola Petrenchuk, Project Management, Implementation of e-library Fund, Prof. Sergey Rippa.
- [DefMas 54] Maksym Sedlyar, Project Management of Web Site Construction Company, Ph.D. Nadia Vasylykiv.
- [DefMas 55] Anastasia Sydoruk, Project Management, Creating a Center to Provide Medical and Psychological Services, Prof. Anatoliy Sachenko.
- [DefMas 56] Lesia Solyak, Managing Making Design Decisions in the Provision of Utility Services, Ph.D. Zbyshek Dombrowsky.
- [DefMas 57] Andriy Flyak, Improving Project Management Model Creating Open Source Software, Ph.D. Myroslav Komar.
- [DefMas 58] Pavlo Tsvetkov, Project Management Interaction of Quadcopters a Monitoring Group of Complex Technical Systems, Assoc. Prof. Volodymyr Kochan.
- [DefMas 59] Ostap Shevchuk, Project Portfolio Management Strategy of Innovative Development Company, Ph.D. Zbyshek Dombrowsky.
- [DefMas 60] Vasyl Kryukov, Creating Project Management Decision Support System for Competitive Selection of the Project Team, Prof. Anatoliy Sachenko.

### **Defended Diploma Projects**

- [DefDipl 1] Nsanhou Ianini Jean Jules, Hardware-Software Module for Controlling the Air-Ventilation System, Ph.D. Igor Maykiv.
- [DefDipl 2] Ikhide Victor Musa, Software Module for Mobile Robot Sensor Data Acquisition Subsystem, Assoc. Prof. Vasyl Koval.
- [DefDipl 3] Adeie Nafiu Ishola, Prediction Software Module Based on Multi-Layer Perceptron in Matlab, Assoc. Prof. Volodymyr Turchenko.
- [DefDipl 4] Akokha Emmanuel Oshoke, Navigation Software Module of Mobile Robot without Collision, Assoc. Prof. Vasyl Koval.
- [DefDipl 5] Anota Uche Darlington, Software Module of Multi-Layer Perceptron for Recognition Tasks in Matlab, Assoc. Prof. Volodymyr Turchenko.
- [DefDipl 6] Bassei Prudence Essiena, Web-Based Software System for Rental Apartments, Assoc. Prof. Iryna Turchenko.
- [DefDipl 7] Eshilama Nelson, Error Detection Software Module Based on Modular Arithmetics, Assoc. Prof. Natalia Yatskiv.
- [DefDipl 8] Isa Sadik Akanni, Network Coding Software Module in the Residue Number System, Assoc. Prof. Natalia Yatskiv.
- [DefDipl 9] NGOYE Banze Cynthia, Web-Based Software System for Integrated Library Catalogue in University, Assoc. Prof. Iryna Turchenko.
- [DefDipl 10] Ohbechie Anthony Osemeke, Developing the Intelligent Human Resource Management System Using Bayesian Network, Assoc. Prof. Igor Paliy.
- [DefDipl 11] Salami Osas Innosent, Hardware Module for Boost Charging the Lithium-Ion Cells, Ph.D. Igor Maykiv.
- [DefDipl 12] Udin Gabriel, Software Module for Estimating the Probability of Intruder's Penetration, Ph.D. Pavlo Bykovyy.
- [DefDipl 13] Aikinomioria Endurans Osamudiamhen, Software Module for Product Price Comparison of Online Shops, Ph.D. Pavlo Bykovyy.
- [DefDipl 14] Bakare Abdulrahman Olavale, Development of Appointment and Prescription

- Modules for Hospital Database Management System, Prof. Anatoliy Sachenko.
- [DefDipl 15] Basma Sadallah Saifullah, Software-Hardware Module for Searching the Prime Numbers on Krestenson's Theoretic Numerical Basis, Ph.D. Orest Volynsky.
- [DefDipl 16] Roman Babiak, Mobile Navigation Software Module Work in an Environment with Dynamic Obstacles, Assoc. Prof. Vasyl Koval.
- [DefDipl 17] Vitaliy Gavrylyuk, Software Project Management Module of the Enterprise, Assoc. Prof. G. Gladiy.
- [DefDipl 18] Bogdan Hischynskyy, Hardware and Software Module for Detecting of Moving Objects, Ph.D. Igor Maykiv.
- [DefDipl 19] Oksana Dunets, Software Module Parallel Recurrent Neural Network System in Matlab, Assoc. Prof. Volodymyr Turchenko.
- [DefDipl 20] Roman Zozulia, Software Module of Data Protection in the Information System, Ph.D. Vasylykiv.
- [DefDipl 21] Valentyn Kalashnyuk, Hardware and Software Module Forming the Remainder of Random Numbers on the Module, Ph.D. Orest Volynsky.
- [DefDipl 22] Nikita Lyubutsin, Software Module Forecasting of Computer Network, Assoc. Prof. Grigoriy Gladiy.
- [DefDipl 23] Volodymyr Neyzzhaly, Web-base Software Database Management System Component of Security Systems, Ph.D. Pavlo Bykovyy.
- [DefDipl 24] Oleg Parkhomchuk, Temperature Monitoring Software Module Based on a Set of Debug ez430-Chronos, Ph.D. Pavlo Bykovyy.
- [DefDipl 25] Vasyl Fedko, Hardware-software Module Calibration of Analog-to-Digital Converters Information and Measurement Systems, Assoc. Prof. Volodymyr Kochan.
- [DefDipl 26] Andriy Halimon, Hardware-software Module Calibration Amplifiers in Information-measuring System, Assoc. Prof. Volodymyr Kochan.
- [DefDipl 27] Chak Zoriana, Hardware and Software Encryption Module in Theoretical and Numerical Basis Krestenson, Ph.D. Orest Volynsky.
- [DefDipl 28] Alena Yutovets, Hardware and Software Module Comparing Numbers in the System of Residual Classes, Ph.D. Orest Volynsky.
- [DefDipl 29] Andriy Lutsyk, Software Module Mobile Robot Moving on a Given Path, Assoc. Prof. Vasyl Koval.
- [DefDipl 30] Grygoriy Nikolaichuk, Accounting Software Module and Realization of Inventories Elevator Companies, Ph.D., Igor Maykiv.
- [DefDipl 31] Olexandr Teleshko, Software Module for Network Traffic Capture Systems Detect Computer Attacks, Ph.D. Myroslav Komar.
- [DefDipl 32] Vasyl Choplak, A Software Protection System Against Spam e-mail Messages, Ph.D., Myroslav Komar.
- [DefDipl 33] Oleg Turchyn, Software Module Monitoring Computer System Reliability, Ph.D., Nadia Vasylykiv.
- [DefDipl 34] Vitaliy Melnychenko, Software System Parameters Forecasting Business Processes, Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 35] Mykhailo Pitsan, Program System of Pharmacy Computerization, Ph.D., Nadia Vasylykiv.
- [DefDipl 36] Miroslava Vatazhynska, Software System of Multi-agent Hotel Search, Prof. Anatoliy Sachenko.
- [DefDipl 37] Igor Vynnychuk, Hardware-software Module Voltage Measurement in Information-Measuring System, Assoc. Prof. Volodymyr Kochan.
- [DefDipl 38] Ivan Hrementa, Software Module Management Turnover Trading Company, Diana Zahorodnia.
- [DefDipl 39] Oleg Monastyrsky, Web-based Management Software System of Printing Company, Ph.D., Pavlo Bykovyy.
- [DefDipl 40] Nazar Suslyk, Software Security Module of Computer Network Company, Ph.D., Nadia Vasylykiv.



- [DefDipl 41] Roman Tyshkovets, Software Module Planning Promotional Activities of the Enterprise, Oksana Rymar.
- [DefDipl 42] Oksana Loboyko, Image Coding Software Module Based on a Component Approach, Assoc. Prof. Igor Paliy.
- [DefDipl 43] Oleksiy Melnyk, Obstacle Detection Software Module for Video Navigation Mobile Robot, Assoc. Prof. Vasyl Koval.
- [DefDipl 44] Denys Yakymchuk, Web-based Software System Orders from Photo and Photo Services, Ph.D., Pavlo Bykovyy.
- [DefDipl 45] Ruslan Yatsyshyn, A Software System for Identifying Human Face Image Using of Neural Networks, Assoc. Prof. Igor Paliy.
- [DefDipl 46] Roman Andriyiv, Remote Administration Software of Module Operating System, Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 47] Nazar Voytsihovsky, Software Module Pricing for Plastic Window Design, Assoc. Prof. Grigoriy Sapozhnyk.
- [DefDipl 48] Oleg Kvychola, Software Module to Determine the Optimal Value of the Telecommunications Network, Assoc. Prof. Grigoriy Sapozhnyk.
- [DefDipl 49] Maksym Korinets, A Software System to Track the Human in the Video Sequence, Assoc. Prof. Igor Paliy.
- [DefDipl 50] Olga Lyashenko, Hardware and Software Module Sample Primes for Processors in the System of Residual Classes, Ph.D. Orest Volynsky.
- [DefDipl 51] Sergey Marinin, Software Module "Dietfeeding" Information Management System Sanatorium, Oksana Rymar.
- [DefDipl 52] Maksym Samoyil, Reservation Software System of Private Property, Prof. Anatoliy Sachenko.
- [DefDipl 53] Oleksiy Shepel, Software Module Detecting Characteristic Points of the Image in Matlab Environment, Diana Zahorodnia.
- [DefDipl 54] Myroslav Lyulchak, Software Detection of Abnormal Activity of Computer Systems Users, Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 55] Ivan Bereza, Software Module Protecting Computer Systems from Unauthorized Access, Ph.D. Myroslav Komar.
- [DefDipl 56] Volodymyr Zhovnirchuk, Accounting Software Modules and Implementation of Fuel and Lubricants at the Plant, Assoc. Prof. Andriy Karachka.
- [DefDipl 57] Ivan Zvarych, Hardware-software Module Measuring Resistance in Information-measuring System, Assoc. Prof. Volodymyr Kochan.
- [DefDipl 58] Natalia Myhaskiv, Software Module Analysis and Management of Customer Orders Enterprise, Assoc. Prof. Grygoriy Sapozhnyk.
- [DefDipl 59] Vasyl Nadzhak, Accounting Software Module Catalog and Repair Services of Computer Equipment, Assoc. Prof. Andriy Karachka.
- [DefDipl 60] Maria Nebelyak, Software Module Account Management Utility "Drohobychteploenerho", Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 61] Oleg Tarnavsky, Postage Accounting Software Module Operations in Enterprises "Ukrposhta", Assoc. Prof. Andriy Karachka.
- [DefDipl 62] Galina Kozlovska, Web-base Software System Introduction Describing Perimeter of the Object, Ph.D., Pavlo Bykovyy.
- [DefDipl 63] Taras Shmihelsky, Software Module Allocation Contour of the Face in the Picture, Prof. Viktor Krylov.
- [DefDipl 64] Mariana Hasunka, Educational Hardware and Software Module for Monitoring and Control of Airflow Thermal Parameters, Ph.D., Igor Maykiv.
- [DefDipl 65] Galyna Andrushko, Software System Calculate the Length of Channels Leading Safety Systems, Ph.D., Pavlo Bykovyy.
- [DefDipl 66] Oleg Bykiv, Software Module Perimeter Firewall in Enterprise Information Systems, Assoc. Prof. Grygoriy Sapozhnyk.
- [DefDipl 67] Ivan Boykovych, A Software System for Collecting and Processing Data on a Local Area Network, Assoc. Prof. Mykhailo Chyrka.

- [DefDipl 68] Taras Volosetsky, Hardware and Software Plug-in Computer with Remote Objects via Serial Interface, Assoc. Prof. Andriy Karachka.
- [DefDipl 69] Yuriy Drok, Controller with Hardware and Software Module Programming PPZP and PLA, Assoc. Prof. Andriy Karachka.
- [DefDipl 70] Ivanna Dyudyuk, Accounting Software Modules and Implementation of Auto Parts, Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 71] Sofia Kit, Software Module Customer Service "E-plus", Assoc. Prof. Grygoriy Sapozhnyk.
- [DefDipl 72] Victoria Klymko, Software Module Accounting of Medicines in Health Centers, Diana Zahorodnia.
- [DefDipl 73] Andriy Kravtsov, Encryption Software Module in a Computer System, Assoc. Prof. Grygoriy Sapozhnyk.
- [DefDipl 74] Nazar Kulenych, Hardware and Software Module Input-Output Analog Information into a Computer, Assoc. Prof. Andriy Karachka.
- [DefDipl 75] Mykola Marecky, A Software Module Coding Image Based on Vector Quantization, Assoc. Prof. Igor Paliy.
- [DefDipl 76] Dmytro Nikolishin, Software Module Detecting Characteristic Points of the Image Using the Library OpenCV, Prof. Viktor Krylov.
- [DefDipl 77] Vasyl Synyshyn, Software Security Module Channel of Virtual Computer Network, Ph.D., Myroslav Komar.
- [DefDipl 78] Roman Siryy, Hardware and Software Module for Managing the Process of Rapid Charging Lithium-Ion Batteries, Ph.D., Igor Maykiv.
- [DefDipl 79] Natalia Skrypuh, Accounting Software Module Production Printing Company, Oksana Rymar.
- [DefDipl 80] Oleg Khomyn, Software Module for Managing Database Drivers Based ODBC, Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 81] Denys Shcherban, Authentication Software Module Access Channels in Computer Networks, Assoc. Prof. Mykhailo Chyrka.
- [DefDipl 82] Rostyslav Zubko, Software Implementation of Raid Arrays, Serhiy Wozniak.
- [DefDipl 83] Olexandr Cherpak, HDL-model Component Encryption Algorithm IDEA, Ph.D., Lesia Dubchak.
- [DefDipl 84] Yaroslav Babychuk, Configuring Confederations Routing Protocols Limit Global Networks, Serhiy Wozniak.
- [DefDipl 85] Volodymyr Blyschak, Configuring Routers, Reflectors Autonomous Systems, Serhiy Wozniak.
- [DefDipl 86] Olexandr Dumych, Stack Switches The Second Level Of Local Networks, Serhiy Wozniak.
- [DefDipl 87] Bogdan Grigorishin, Configuring of Switch Ports in a Logically-combined Channels, Serhiy Wozniak.
- [DefDipl 88] Lilia Grinkevich, HDL-model Core Symmetric Encryption Cryptographic Algorithm DES, Ph.D. Lesia Dubchak.
- [DefDipl 89] Vadym Zhezhko, HDL-model Pseudorandom Number Generator Algorithm Geffe, Ph.D., Lesia Dubchak.
- [DefDipl 90] Mariya Velhun, System Detectors Choice of Optimal Parameters of Computer Attacks, Ph.D., Myroslav Komar.
- [DefDipl 91] Andrew Drozd, Accounting System and Order of Formation of Computer Equipment Based Architecture "Client-Server", Ph.D., Myroslav Komar.
- [DefDipl 92] Igor Lysyy, Program Complex Connection of Electronic Documents with a Database of Corporate Information Systems, Ph.D., Myroslav Komar.
- [DefDipl 93] Mykola Mamonchuk, Tool Distribution Network Access Environment Simulink, Ph.D., Lesia Dubchak.
- [DefDipl 94] Adrian-Mykola Prystai, Training Stand for Simulation of Control Systems Based on Microcontrollers, Ph.D. Igor Maykiv.
- [DefDipl 95] Pavlo Rakivsky, Bloc of Rapid Charging Lithium-Ion Batteries Based

- Microcontroller, Ph.D., Igor Maykiv.
- [DefDipl 96] Evgen Dobrovolsky, A Software System for Modeling Processes Brewery, Prof. Igor Dobrotvor.
- [DefDipl 97] Nadia Zoriy, Online store food, Assoc. Prof. Roman Pasichnyk.
- [DefDipl 98] Volodymyr Mihnenko, Web System Fitness Facility, Prof. Igor Dobrotvor.
- [DefDipl 99] Volodymyr Rak, A Software System to Optimize Traffic Websites, Assoc. Prof. Roman Pasichnyk.
- [DefDipl 100] Olga Slymak, Avtotestы complex for GUI, Ph.D., Prof. Igor Dobrotvor.
- [DefDipl 101] Taras Fedysiv, Interactive Learning Software System of Discipline "Functional Analysis", Assoc. Prof. Grygoriy Gladiy.
- [DefDipl 102] Larysa Shcherbak, A Software Application for Modeling as Drywall, Prof. Igor Dobrotvor.
- [DefDipl 103] Roman Yakymiv, System International Scientific Exchange of Developed Countries, Prof. Oksana Lyashenko.
- [DefDipl 104] Oksana Vasylyuk, International Think Tanks as a Producer of Knowledge in the Global Economy, Prof. Oksana Lyashenko.
- [DefDipl 105] Anna Hutenyuk, Formation of the European Information Space, Prof. Oksana Lyashenko.
- [DefDipl 106] Mariana Oliynyk, International Advocacy in Shaping the Image of the Country, Prof. Oksana Lyashenko.
- [DefDipl 107] Valentina Tsap, International Scientific Information Exchange, Prof. Oksana Lyashenko.
- [DefDipl 108] Vitaliy Harkavyi, Metrics Development of International Trade, Prof. Oksana Lyashenko.
- [DefDipl 109] Valeria Arbuzova, Information Security International Relations of Ukraine, Prof. Oksana Lyashenko.
- [DefDipl 110] Natalia Dziadyk, Information Policy, Prof. Oksana Lyashenko.
- [DefDipl 111] Taras Ambryk, Load Simulation Model for Call-center Company, Assoc. Prof. Roman Pasichnyk.
- [DefDipl 112] Mykhailo Fedevych, Clustering Model Regions for Indexes and Indicators of Sustainable Development, Assoc. Prof. Roman Pasichnyk.
- [DefDipl 113] Andriy Bilous, Neuroprocesors of Square-pulse Signal Conversion, Prof. Yaroslav Nykolaichuk.
- [DefDipl 114] Nazar Vintonyak, Multiplier Codes Based on Galois Field, Prof. Yaroslav Nykolaichuk.
- [DefDipl 115] Taras Hrub'yak, Management of Interfaces in Multi-specialized Computer Systems, Assoc. Prof. Natalia Vozna.
- [DefDipl 116] Myroslav Pich, Holter Telemonitoring Device, Assoc. Prof. O. Zastavnyy.
- [DefDipl 117] Olga Ostapovych, Device Processing Digital Data in the System of Residual Classes, Assoc. Prof. Vasyl Yatskiv.
- [DefDipl 118] Volodymyr Tymets, CCTV Facilities on the base of Radio Channel, Assoc. Prof. Vasyl Yatskiv.
- [DefDipl 119] Taras Bendyk, Secure Corporate Network Management System Based on MS Windows, Assoc. Prof. Natalia Vozna.
- [DefDipl 120] Vitaliy Bilinsky-Yaroshovych, Controller of Self-Washing, Assoc. Prof. O. Zastavnyy.
- [DefDipl 121] Denys Korostil, Entropy Algorithm Signals Given Analytically, Assoc. Prof. Natalia Vozna.
- [DefDipl 122] Ivan Kohut, Encoder Codes Basis Rademacher Basis of Galois, Assoc. Prof. Natalia Vozna.
- [DefDipl 123] Eugen Martyniuk, Object Data Acquisition System, Assoc. Prof. O. Zastavnyy.
- [DefDipl 124] Vasyl Huzik, Means of Computer Diagnostics of Quasi-stationary Objects, Assoc. Prof. Natalia Vozna.

## Internship of Staff, PhD Students and Students

### *Staff Internship*

- [Internship 1] Grygoriy Gladiy, Assistant Professor, Department for Information Computer Systems and Control, Ternopil National Economic Unitevsity, Lviv State University of Life Safety, March 2015.
- [Internship 2] Andriy Karachka, Associated Professor, Department for Information Computer Systems and Control, Ternopil National Economic Unitevsity, Department of Computer Science, April-May 2015.
- [Internship 3] Oksana Rymar, Assistant Professor, Department for Information Computer Systems and Control, Ternopil National Economic Unitevsity, Lviv State University of Life Safety, March 2015.

### *Student Internship*

- [Internship 4] Vitaliy Bec, Andromeda Ltd., Khmelnytsky region, Kamianets Podilsky, Assoc. Prof. Volodymyr Kochan.
- [Internship 5] Nazariy Kikalo, Department of Culture of Ternopil District State Administration, Ternopil, Assoc. Prof., Natalia Yatskiv.
- [Internship 6] Vladyslav Lysak, FOP Alexander S. Grigoriev "the Web", Khmelnytsky, Professor, Aantoliy Sachenko.
- [Internship 7] Stasyshyn Ruslan, Subsidiary Branch of "SAVSERVICE Carpathians" in Ternopil, Ternopil region, Ternopil district, v. Ostriv, Assoc. Prof., Myroslav Komar.
- [Internship 8] Volodymyr Bashutsky, PJSC "Good Water" Ternopil region, Zboriv district, v. Mlynivtsi, Professor Yaroslav Nykolaichuk.
- [Internship 9] Andriy Bodyo, Volodymyr Hnatyuk Ternopil National Pedagogical University, Ternopil, Professor Yaroslav Nykolaichuk.
- [Internship 10] Bogdan Bondarchuk, LLC "Prom energy consulting", Rivne, Professor, Yaroslav Nykolaichuk.
- [Internship 11] Sergiy Bulygin, FOP Snitynsky T.V., Ternopil, Professor, Yaroslav Nykolaichuk.
- [Internship 12] Yuriy Matiyishyn, LLC "Agricultural company" Druzhba, Ternopil region, Terebovlya district, v. Rizdvyany, Professor, Yaroslav Nykolaichuk.
- [Internship 13] Oleg Prokin, Dipartment of Education, Youth and Sports, Teofipolske RDA, Khmelnitsky region, Teofipol, Professor Yaroslav Nykolaichuk.
- [Internship 14] Pavlo Sybiriak, Ltd. "Onlib", Ternopil, Professor, Yaroslav Nykolaichuk.
- [Internship 15] Tamara Snigur, TNEU FCIT, educational laboratory of SCS department, Ternopil, Professor, Yaroslav Nykolaichuk.
- [Internship 16] Volodymyr Sovyak, Ltd. "Agropolis", Ternopil region, Chortkiv district, Zavodske, Professor Yaroslav Nykolaichuk.

## 6. PUBLICATIONS

### Monographs (Parts of Monographs), Books (Parts of Books)

- [Publ 1]. S.D. Bushuyev et al. Management of Innovative Projects and Programs P2M. – St. Petersburg, Professional Literature, 2015, 319 p
- [Publ 2]. A.F. Karachka, M.P.Komar, I.M. Maykiv. Computer Circuitry and Architecture of Computers. Part II. Computer Architecture: Ternopil: TNEU, 2015. – 210 p.
- [Publ 3]. Volynskyy O. and others. Computer technologies in information security. Orest Volynskyy and others: Monograph / edited by Valeriy Zadiraka, Yaroslav Nykolaichuk. - Ternopil: "Kart-blansh", 2015. – 387 p.
- [Publ 4]. S.D. Bushuyev. Distributed Resource Management of Projects and Programs. – Nikolaev, NUK, 2015. – 385 p.
- [Publ 5]. I.G. Dobrotvor, A.V. Buketov. Educational English-Ukrainian Dictionary of Mathematical Terms. – Ternopil, Economichna Dumka, 2014. – 86 p.
- [Publ 6]. I.G. Dobrotvor, A.V. Buketov. Teaching English-Ukrainian Dictionary of Computer Science and Computer Engineering. – Ternopil, Economichna Dumka, 2014. – 82 p.
- [Publ 7]. V.A. Golovko, A.A. Dudkin, L.P. Matyushkov. Fundamentals of computer technology, Brest Publisher EE "BrGTU", Belarussian Ministry of Education. 2015. – 180 p.

### Journal Papers

- [Publ 8]. Su J., Nakonechnyi M., Ivakhiv O., Sachenko A. Developing the Automatic Control System Based on Neural Controller, Information Technology and Control, Vol. 44, No. 3, 2015, pp. 262-270.
- [Publ 9]. Hu Zhengbing, Vasyl Yatskiv, Anatoliy Sachenko. Increasing the Data Transmission Robustness in Wsn Using the Modified Error Correction Codes on Residue Number System, Elektronika ir Elektrotechnika, vol. 21, no. 1, 2015, pp. 76-81.
- [Publ 10]. Su Jun, Orest Kochan, Volodymyr Kochan, Chunzhi Wang. Development and Investigation of the Method for Compensating Thermoelectric Inhomogeneity Error, International journal of Thermophysics, vol. 6, issue 5, 2015, pp. 66-71.
- [Publ 11]. Su Jun, O. V. Kochan, V. S. Jotsov. Methods of Reducing the Effect of the Acquired Thermoelectric Inhomogeneity of Thermocouples on Temperature Measurement Error, Measurement Techniques, vol. 58, issue 3, 2015, pp. 327-330.
- [Publ 12]. O. Kochan. The Study of Classical Polynomial Regression Models Without a Constant Term. Building Empirically Effective Estimates of the Parameters of Regression Models, Sensors & Transducers journal, 2015, Vol. 187, Issue 4, pp. 82-93.
- [Publ 13]. A.K. Shaikhanova, A.D. Zolotov, O.A. Stepanova, M.P. Karpinski, L.O. Dubchak, Fuzzy System of Access Distribution within a Computer Network, Journal of Theoretical and Applied Information Technology, 2015, Vol. 80, No. 1, pp. 105-113.
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### **Patents**

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## **7. PARTICIPATION IN CONFERENCES, SYMPOSIUMS AND WORKSHOPS, AND RESEARCH VISITS**

### **Conferences**

- [Visit 1] **14th International Conference “The Experience of Designing and Application of CAD Systems in Microelectronics» - CADSM'2015, 24-27 February 2015, Lviv, Ukraine**  
– Orest Volynsky
- [Visit 2] **XXXV IEEE International Conference “Electronics and Nanotechnology ELNANO-2015”, 21-24 April 2016, National Technical University of Ukraine “Kiev Polytechnical Institute”, Kyiv, Ukraine**  
– Volodymyr Kochan  
– Oleksiy Roshchupkin  
– Anatoly Sachenko
- [Visit 3] **International IEEE Conference “Instrumental and Measurement Technical Conference” (IMTC’2015) and IEEE IMS Chapter Chair Summit, 11-13 May 2015, Pisa, Italy**  
– Anatoly Sachenko
- [Visit 4] **XII International Conference “Project Management in the Development of Society” (PM Kiev'15), 22-23 May 2015, Kyiv, Ukraine**  
– Sergey Bushuyev  
– Zbyshek Dombrowsky  
– Oleg Sachenko
- [Visit 5] **V National School-Seminar for Young Scientists and Students “Advanced Computer Information Systems” ACIT’15, 22-23 May 2015, Ternopil, Ukraine**  
– Nadia Vasylykiv  
– Igor Dobrotvor  
– Diana Zahorodnia  
– Vasyl Koval  
– Volodymyr Kochan  
– Olexandr Osolinsky  
– Iryna Turchenko  
– Vasyl Yatskiv  
– Natalia Yatskiv
- [Visit 6] **10th International Conference on Measurement, 25-28 May 2015, Smolenice castle, Slovakia**  
– Orest Kochan  
– Roman Kochan
- [Visit 7] **XVI International Conference “Modern Information and Electronic Technologies”, 25-29 May 2015, Odesa, Ukraine**  
– Viktor Krylov  
– Kostiantyn Kovalok  
– Diana Zahorodnia
- [Visit 8] **International Conference (Research Conference-2015), 26-27 June 2015, Dortmund University of Applied Sciences and Arts (Fachhochschule Dortmund, Germany).**  
– Anatoliy Sachenko  
– Taras Lozovych

- Pavlo Philipov
- Abdulrahman Bakare

- [Visit 9] XIV International Scientific Seminar “Modern Problems of Informatics in Management, Economy, Education”, 29 June – 3 July 2015, Kyiv – Svityaz, Ukraine**
- Taras Lendyuk
- [Visit 10] XI International Conference “Project Management: State and Perspectives”, 15-18 September 2016, Mykolaiv-Koblevo, Ukraine**
- Zbyshek Dombrovsky
  - Yuriy Ivanyshak
  - Anatoliy Sachenko
- [Visit 11] International Scientific School-Seminar “Questions of Calculations Optimization” (QCO-XLII), 21-25 September 2015, Kyiv-Chynadiyev, Ukraine**
- Orest Volynsky
- [Visit 12] 25th National scientific symposium with international participation “Metrology and Metrology Assurance”, 7-11 September 2015, Sozopol, Bulgaria**
- Viktor Krylov
- [Visit 13] VIII IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS’2015), 24-26 September 2015, Warsaw University of Technology, Warsaw, Poland**
- |                     |                       |
|---------------------|-----------------------|
| – Pavlo Bykovyy     | – Roman Kochan        |
| – Vitaliy Dorosh    | – Alex Nykorak        |
| – Diana Zahorodnia  | – Sergey Rippa        |
| – Mykola Karpinskyy | – Oleksiy Roshchupkin |
| – Kostantyn Kovalok | – Anatoliy Sachenko   |
| – Volodymyr Kochan  | – Robert Hiromoto     |
| – Orest Kochan      | – Vasyl Yatskiv       |
- [Visit 14] II International Conference “Informations Technologies and Interaction” (IT&I), 3-5 November 2015, Kyiv, Ukraine**
- Sergey Rippa
- [Visit 15] Autumn School on flexible robotics in surgery organized by the project STIFF-FLOP, 9-11 November 2015, Turin, Italy**
- Anatoliy Sachenko
- [Visit 16] IV International Conference of Young Scientists and Students “Actual tasks of Modern Technologies”, 25-26 November 2015, Ternopil, Ukraine**
- Pavlo Bykovyy
  - Diana Zahorodnia
- [Visit 17] II Conference of Students, Masters and PhD Students “Informatics, Control and Artificial Intelligence” (“ICAL-2015”), 26-27 November 2015, Kharkiv, Ukraine**
- Diana Zahorodnia

## Research Visits

### *ICS' staff visits*

- [Visit 18] Prof. Volodymyr Kochan and Dr. Pavlo Bykovyy on 22-24 January 2015 had a meeting with Prof. Wieslaw Winiiecki, Deputy Director of the Research Institute of Radio-Electronics at Warsaw University of Technology. The purpose of the meeting was discussion of issues about conducting 8th IEEE International Conference "Intelligent Data Acquisition and Advanced Computing Systems : Technology and Application» IDAACS'2015 at the Warsaw University of Technology, Warsaw, Poland. Prof. Wieslaw Winiiecki gave a brief tour of the Institute of Radio-Electronics and presented rooms for plenary session, regular sessions, coffee breaks and room for possible placement of the organizing committee. Also Prof. Wieslaw Winiiecki presented the new building of the Faculty of Mathematics and Information Science. Prof. Volodymyr Kochan and Dr. Pavlo Bykovyy have seen housing together with Prof. Wieslaw Winiiecki and decided to use this building for the main part of the IDAACS 2015 conference. There was also an oral agreement to sign an agreement on cooperation between universities.
- [Visit 19] Anatoly Sachenko on 28-31 January 2015 visited the Brest State Technical University as chairman of the State Examination Commission Year 5 students training in specialty "Artificial Intelligence". During the visit, they discussed the state of implementation of the joint cooperation agreement between BDTU and TNEU in the educational and scientific spheres.
- [Visit 20] Prof. Sachenko on 26-29 March 2015 visited Aalto University, Helsinki, Finland as an official opponent of Jaakko Talonen PhD thesis entitled "Advances in Methods of Anomaly Detection and Visualization of Multivariate Data", supervisor Prof. Olli Simula, advisors Dr Miki Sirola and Dr Mika Sulkava. The public defense of the Thesis has held on March 27, 2015, and defense procedure differed from Ukrainian standard, and even from those adopted in other European countries (such as Germany, Poland and Czech Republic). In particular, the opponent was the only one who asked questions (over 20 questions) and made a final decision. This decision based on the following criteria: a preliminary assessment of the candidate's doctoral thesis, and the quality of both presentation and discussion. At the end of protection opponent has read his statement taking into account the criteria above. A post-defense dinner at a cozy restaurant was very attractive, it brought together other than officials, friends, colleagues and family members of the candidate. I would like to mention a dressing-code for officials (supervisor, opponent, advisors and candidate) at both defense and restaurant. A form of dressing-code is managed by the candidate and it is a tradition in Finnish universities. There are arranged with Dr Miki Sirola than he will co-chair a Special Stream "Big Data" for the IEEE International Conference IDAACS'2015 in Warsaw on 24-26 September 2015. A number of discussions was made with Prof. Olli Simula, who has worked with world prominent Finnish scientist Teuvo Kohonen in artificial neural networks area (an author of Self-Organizing Maps). As a result, Prof. Olli Simula was invited to make a plenary talk at the Conference IDAACS'2015 in Warsaw. In addition, the possibility was discussed of holding the IDAACS'2019 Conference in Helsinki, at the Aalto University. Finnish colleagues have organized two tours on Aalto University and the city of Helsinki. Aalto University - one of the most famous in Finland - is a result of merging in 2010 of three universities: world-ranked Helsinki University of Technology, Helsinki School of Economics and Helsinki University of Art and Design. Aalto University has consists of about 20 thousand students and it's located in the charm town of Espoo which is touching Helsinki as well as nice forest and attractive coast of the Finnish Gulf. City of Helsinki has a huge port

and two airports, has many diverse churches, interesting monuments, historic sites and comfortable restaurants and cafes.

- [Visit 21] Prof. Anatoly Sachenko on 11-13 May 2015 participated in the International Conference on Instrumental and Measurement Society which was held in Pisa, Italy, as well as in IEEE IMS Chapter Chair Summit, where IEEE Chapter Chairs from regions all over the world were presented. Prof. Sachenko reported on work results of the IEEE I&M Chapter of the Ukrainian IEEE Section and exchanged experience with colleagues. Specifically, meetings were conducted: with the coordinator IEEE I&M Chapters Sergio Rapuano, head of the German Chapter - Olfa Kanoun, leader of the Polish Chapter - Grzegorz Pankanin, head of the Mexican Chapter - Juan Manuel Ramirez, head of the Shanghai Chapter - Ruqiang Yan and director of the Malaysian Chapter - Kushsairy Abdul Kadir.
- [Visit 22] Oksana Dunets and students on 10-17 May 2015 took part in the International German-Ukrainian seminar between BAYHOST, the University of Augsburg, Odessa Polytechnic University and with the participation of Ternopil National Economic University on "Transparency of Information-democracy IT and social modernization".
- [Visit 23] Anatoly Sachenko on 26-27 June 2015 took part and served session at International Conference (Research Conference-2015), Dortmund University of Applied Sciences and Arts (German: Fachhochschule Dortmund). The conference addressed issues relating to project management and computer science. The participants, representing European universities, presented their projects, exchanged their achievements, and discussed issues. Except the representatives of TNEU, the conference also attended by students of the Kyiv National University of Construction and Architecture.
- [Visit 24] Anatoly Sachenko on 28-30 June 2015 visited the Brest State Technical University as chairman of the State Examination Commission Year 5 students training in specialty "Artificial Intelligence". During the visit, they discussed the state of implementation of the joint cooperation agreement between BDTU and TNEU in the educational and scientific spheres. Agreed to exchange teaching materials and experience in preparing students in "Artificial Intelligence" with the focus on master's program, which is licensed to the Department for Information Computer Systems and Control TNEU.
- [Visit 25] With the participation of students of Ternopil National Economic University, Odessa Polytechnic University, Augsburg University of Applied Sciences and supported by the Bavarian Academic Center for Central, Eastern and Southern Europe was a second part of the German-Ukrainian seminar: "Information Transparency, Democracy and Social Modernization of the IT groups" from 4 to 12 August 2015 in Odesa. The event was attended by students TNEU faculty of computer information technologies: Dunets Oksana - student group KN-41, Galkin Igor - student group KNUAP-21, Zolotukhin Denis - student of KN-21 Zagorodnya Diana - a teacher, a graduate student, Bykovyy Paul - Lecturer, Ph.D. The seminar was held by some program that included not only training, work on projects, but also the rest. All participants were accommodated at the hotel Arcadia in Odessa, where we also held conferences and participants. The main results of the first part of the seminar was identified areas for further work of students in the second part in Ukraine. As a result, formed five groups: group Documentation (1), Open Slides (2), Open Street Maps (3), Internet (4), NFC (5). Member groups consisted of Ukrainian and German students as the main purpose of the seminar was international team work in groups, communication between students, the opportunity to share cultural features of, and the end result - the development team project that the students have chosen. Name of the group coincides with the direction of their development. For example, the Documentation group involved in the establishment and collection of all videos and photos and resources aimed to create a short film about the seminar by placing all the results of its work on a particular platform with access participants. Open Street Maps aim was to create an environment using open source navigation in multi-story buildings. NFC Group wanted to develop NFC cards for students and teachers for transparency exams through such cards do not indicate student name, but only a



reference number. Internet Group considered the problem of transparency and security of users on the Internet and decided to work on a forum for the Polytechnic University and the questionnaire «AskMe», which should work on TOR system which will ensure the anonymity of the user. Work in groups provide walking and city tours. In particular, all participants visited the city tour Odessa (1), visited the Bavarian House (2), the IT department of the regional council. Odessa (3), fortress Belgorod (4), the port of Odessa (5), Vorontsov Lighthouse Center (6), making "Shabo" (7). Sunday evening ended with a visit to the opera and drama theater dance ballet on the performance of "Swan Lake." After the presentation of projects, each participant handed certificates and badges with the logo of the Polytechnic University. The final dinner was held in the middle of a yacht off the coast of the Black Sea city of Odessa. A lot of emotions, experiences and knowledge to students of two countries - Ukraine and Germany. During the workshop, participants had overseas love Ukraine, its culture, traditions and opportunities almost every foreign student would visit again as the city of Odessa and see the whole Ukraine. Easy to sum up the seminar: projects have been developed, some of them have been fully implemented, while others have a good start to develop during the project work the students have time to make friends, to learn many interesting platform for creating and improving various projects, and most importantly - work in a team, in an international team.

- [Visit 26] On September 24-26 2015 on the base of Warsaw University of Technology, Warsaw, Poland was held 8th IEEE International Conference “Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications” IDAACS’2015. Totally were 150 participants from 24 countries. There were 5 trends and 9 Special Streams formed in 3 plenary sessions, 24 regular sessions and 3 poster sessions. Printed proceedings contains two volumes with 181 papers in about 1000 pages. Conference materials were be included in IEEE Xplore Digital Library database and Scopus (also is expecting indexing in Web of Science). More information about conference is available on the official conference website: <http://www.idaacs.net>.
- [Visit 27] Anatoly Sachenko had Internship at University of Siegent, Germany. Duration of the internship was 4 weeks from November 9 to December 5, 2015. Internships at the University of Siegen matched by TNEU order number 639 of 05/11/2015, in accordance with the invitation of the University. Siegen, Germany from 10.27.2015 year. Payment of expenses carried out at the expense of the host. Internship little two-step structure. In first phase (first week of training) participated in the fall school in Turin, Italy, on "Flexible Robotics in Surgery". The second phase - three weeks training at the University of Siegen. The third stage - a one-day visit to the University of Applied Sciences, Dortmund. Step 1: The project STIFF-FLOP organized Autumn School on flexible robotics in surgery, which took place in Turin, Italy, from 9 to 11 November 2015. In autumn school was attended by all members of the project team STIFF-FLOP (Germany, England, Spain, France, Poland). I have been presented a report «Method for improving the accuracy with a significant influence of non-informative factors». (summer school program attached). Step 2: A scientific seminar in the city. Siegen November 19, 2015 with the participation of graduate Christof Hille, Erwin Gerz. Me made a presentation of research projects (Horizon 2020, NATO, bilateral Ukraine-German programs), educational programs (Erasmus + Programme EAC / A04 / 2015), DAAD Research Internship. I was also presented the results of the Research Institute of Intelligent Computer Systems. Step 3: November 24, 2015 a seminar was organized at the University of Applied Sciences and Arts in Dortmund. Subject: status and possible areas of cooperation between the University of Applied Sciences and Arts and TNEU.
- [Visit 28] Ihor Maykiv in 17-20 December 2015 visited Technical University of Moldova, Chişinău, Moldova within a joint bilateral project on Distributed Sensor Networks with Computing Nodes Reconfiguration.

***International and National Collaborators Visits***

- [Visit 29] In March 21'2015 Bjarne Rerup Schlichter delivered the invited lecture entitled "IT Public Value". Students in Computer Science and American-Ukrainian School., as well as instructors of Department for Information Computer Systems and Control attended this lecture.
- [Visit 30] On April 29th, Dr. Yves Demazeau from National Center for Scientific Research, France, and external professor at the Faculty of Science and Engineering at the University of South of Denmark, visited Ternopil National Economic University (TNEU) and Research Institute for Intelligent Computer Systems (ICS). The purpose of his visit was discussion of potential partnership between TNEU and ICS. On Wednesday, April 29th, Dr. Demazeau visited ICS, where its staff presented a different research groups, as well as parallel cluster. Afternoon, Yves gave a lecture for students of Ukrainian-American Program and lecturers of Department for Information Computer Systems and Control (ICSC) Department, titled "Practical User-Centered Multi-Agent Systems". On the next day, Thursday, a round table was gathered, where Dr. Demazeau, Prof. Sachenko, Dr. Adamiv with some other staff of ICS and ICSC discussed the possibilities of future cooperation.
- [Visit 31] On May 6-7, Prof. Dr. Wolfgang Tysiak representative from the Faculty of Business Studies, University of Applied Science and Arts), Dortmund, Germany has visited TNEU, ICS and ICSC department in particular. During the visit prof. B. Tysyak held a Master Program presentation Project Management (Master in Project Management Euro MPM - Master of Arts) for Ukrainian-American and Ukrainian Students of Computer Science course, as well a series of interviews with candidates to participate in this program. Also Prof. Tysiak held a lecture on "Risk Management in Projects" for students of the Ternopil National Economic University (TNEU). Moreover during the visit, an agreement was signed on cooperation between and the TNEU and University of Applied Sciences and Arts. At the end Professor Tysiak met with scientific and pedagogical staff of the ICSC department and ICS, where research in the area of project management of is conducting.
- [Visit 32] On May 19, a delegation from University of Aarhus, Denmark visited ICSC department. Delegation included Master's students of "IT, communication and organization", Prof. Bjarne Rerup Schlichter and Prof. Sune Müller. During the visit, delegation was introduced to laboratories and personnel of ICSC department and ICS research institute. Also, foreign students presented their studies at university and the program "IT, communication and organization." Beside that, Prof. Mueller held a lecture on innovation processes.
- [Visit 33] From 13 to 16 December 2016 in TNEU delegation of Technical University of Moldova in the framework of the Ukraine-Moldova Joint Project "Distributive sensor network reconfiguration computing nodes". During the visit, summed up the joint research activities and caused further cooperation between universities.

## 8. AWARDS

- [Award 1]. **Anatoliy Sachenko** won a grant for attending the International Conference on Instrumental and Measurement Society and IEEE IMS Chapter Chair Summit which were held in Pisa, Italy.
- [Award 2]. **Anatoliy Sachenko** was awarded by grant for attending the International Conference (Research Conference-2015), Dortmund University of Applied Sciences and Arts, Dortmund, Germany.
- [Award 3]. **Three students (Taras Lozovych, Pavlo Philipov and Abdulrahman Bakare)** of Ternopil National Economic University won a grant to attend an International Conference (Research Conference-2015) at Dortmund University of Applied Sciences and Arts with a followed Summer School, Dortmund, Germany.
- [Award 4]. **Oksana Dunets** was awarded by grant to attend the symposium in Augsburg (Germany) and its second part in Odesa (Ukraine).
- [Award 5]. **Yaroslav Nykolaichuk** was recognized as the best inventor Ternopil region in 2015.

**9. STATISTICAL DATA**

Data	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of Senior Researches	9	15	18	19	20	22	27	30	34	<b>39</b>
Number of Junior Researches	14	17	15	18	18	15	13	11	14	<b>16</b>
Number of Active Research Projects	9	7	7	8	4	2	2	3	2	<b>3</b>
Publications	26	58	57	72	77	104	109	126	127	<b>113</b>
Participation in Conferences, Symposiums and Seminars	13	18	19	21	36	29	33	28	29	<b>33</b>
Number of Defended Ph.D. Thesis	–	3	3	2	0	3	3	3	1	<b>7</b>
Number of Defended Master Thesis	1	10	7	20	23	22	39	22	48	<b>60</b>
Number of Defended Specialist Thesis	1	26	28	20	19	24	21	13	179	<b>124</b>
Number of Received Awards	1	2	5	7	5	3	2	3	2	<b>5</b>

**Report preparation group:**

Taras Lendyuk  
Diana Zahorodnia  
Olexandr Osolinsky

**Research Institute for Intelligent Computer Systems****Ternopil National Economic University**

3 Peremoga Square  
46020, Ternopil  
Ukraine

**Administration of the Institute:**

Dr Volodymyr Kochan, a Director of the Institute  
Office Room 2012  
Phone. +380 (352) 475050 ext. 12-234, 12-315  
Fax +380 (352) 475053 (24 hours)