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Ryszard S. Romaniuk

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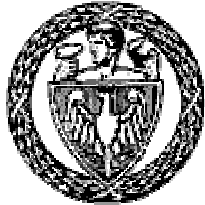
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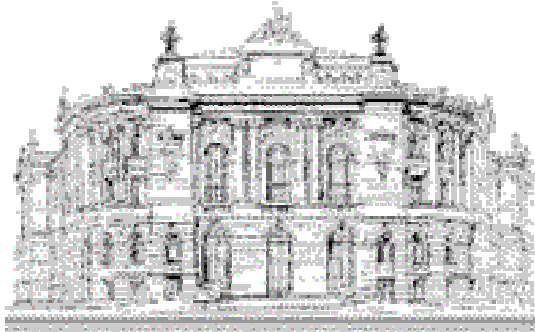
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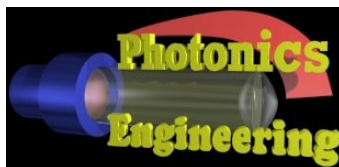
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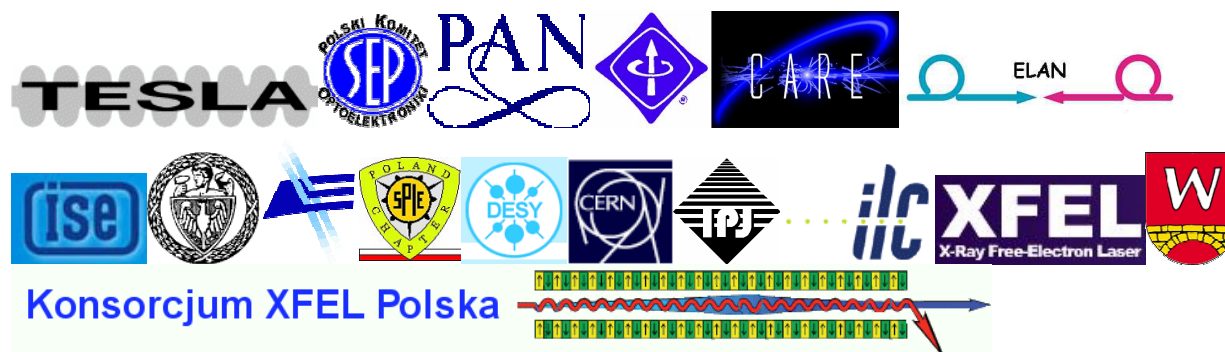
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Introduction

XXth Jubilee Joint SPIE - IEEE Symposium on Photonics and Electronics for High Energy Physics Experiments, Astronomy, Accelerator Technology and Free Electron Lasers WILGA 2007, 21-27 May (<http://wilga.ise.pw.edu.pl>)



AIMS AND TOPICAL AREA OF SPIE-IEEE WILGA SYMPOSIUM

During the week of 21–27 May, in the WILGA village near Warsaw, a woodland resort owned by the Warsaw University of Technology was a jubilee XXth joint SPIE - IEEE Symposium WILGA 2007. The WILGA Symposium is an international meeting, embracing Poland, neighboring countries and IEEE R8, which is composed of several narrow-subject conferences. The major aim of the Symposium, which has been organized since 10 years now, twice a year, alternately in WILGA (each year at the end of May) and at the Faculty of Electronics and Information Technologies, Warsaw University of Technology (second half of January), is the integration of national and international environment of Ph.D., M.Sc. students and young researchers, who work in the area of advanced applications of photonics and electronics, and particularly in these areas, which require the application of laborious and difficult modeling methods, simulation, identification, implementation and testing of components, devices and systems.



LEFT: CARE Annual Meeting in INFN Frascati; from left P. Strzyzewski, Prof. R. Romaniuk, Prof. A. Napieralski, Dr. R. Aleksan, Prof. M. Sadowski, Dr. M. Grecki; RIGHT: A visit from Prof. Abraham Katzir of Tel Aviv Univ. to SPIE Poland Chapter, from left: Prof. R. Romaniuk, Prof A. Katzir, and Prof A. Domanski.

The major topical track of the Symposium concerns the newest developmental trends of photonics, electronics and information technologies in their most demanding practical applications (such as military, astronomy, fundamental research). The aim of the Symposium is, not the presentation of inspiring engineering work (though a number of such presentations are included in the program as an illustration of the developmental processes) but, a strong emphasis on contemporary methods of generation of intellectual property values in the abovementioned subjects. This term IP – Intellectual Property – and combined area become more and more of an elementary foundation of the society basing on knowledge. Production and further development of a product is a separate subject. The main task here is creation of an advanced product consisting, in terms of an aggregated invested effort, in 80% from non-material values (software) and only in 20% from strictly material values (hardware). We assume here that the most interesting is undertaking big tasks, where the accumulated effort is above 10 person-years (PY) and sometimes is bigger than 100 PY or more. The costs of such tasks is very big, of the order of millions Euro. The results are also of considerable impact on current technologies.

One fundamental area of activity for the SPIE-IEEE WILGA Symposium are general questions of the following kind: "How to undertake such big and advanced projects, of a very big IP load, in a university environment? Projects of this kind are offered, especially within the frames of European Research Area (ERA). We have to reach for young scientists, a considerable number of them. The ability to efficiently manage and coordinate the effort, to generate IP, of tens of M.Sc. and Ph.D., students and young researchers, is a prerequisite for undertaking such big projects by university teams. These coordination efforts take place in typical university conditions under the continuous flow of research workers and exchange of students' generations through the research team involved in a concrete project. A core of the team are faculty members, external experts from research governmental institutions or industry and Ph.D. students, who were previously cooperating with the same group while realizing their M.Sc. theses, thus bound with this group for a longer period spanning even for 6–8 years. Additionally, in the case of small teams, which are not competent in the whole researched area of the project, it is necessary to create flat, sufficiently big, research structures of inter-laboratory, inter-departmental, inter-institutional, inter-university, and international character. Covering the whole area of the required competence is a target to create a flat research structure consisting mainly of young researchers. This target emphasizes that some university teams show considerable inertia against these integration and flexible reconfiguration processes.



LEFT: Members of the PERG/ELHEP WUT ISE Group in front of the CMS hall in CERN with Prof. Claudia-Elisabeth Wulz from the Institute of Physics, Austrian Academy of Sciences (in the middle); RIGHT: A group of initiators of Polish Consortium for Human Resources training for Nuclear Industries, Faculty of Physics, Warsaw Univ.

Traditionally debated applications of photonics, electronics and information technologies during WILGA, and relevant to the abovementioned problems are: algorithms of remote control for hardware, architecture and algorithms for large distributed measurement networks, simultaneous processing and multilevel triggering of large amounts of measurement data in algorithmically complex systems, modeling of phenomena, objects and systems, identification of objects and systems, algorithms for complex finite state machines, modeling of robotic management of experiments, etc. A unique feature of SPIE-IEEE WILGA Symposium are late night debate sessions, sponsored by IEEE, and devoted to management of large and long lasting research projects carried out by large and young university teams.

A research cycle in the large photonics and electronics systems under debate is the following: a proprietary, nonmaterial IP input of large value is being inbuilt into a material background. The hardware is composed of the following components: processors of the major three different types – CPU, FPGA and DSP, supplemented by memory resources, I/O buffers, data type converters and fast data links – internal and external. Optimal hardware structure of data processing is proportionally changing with the development of system components. However, the largest value of the system is attributed to successive programming layers: from the definition of hardware solution, via functionality modeling, object modeling, via intermediate software communications layers, middleware, to layers of the graphical user's interface.



Photographs of the participants of XX IEEE-SPIE WILGA Symposium on Photonics Applications taken during successive days. Professors participating in the XX WILGA Symposium: Prof. Zbigniew Jaroszewicz-Institute of Applied Optics, Warsaw; Prof. Małgorzata Suchańska – TUV of Kielce; Prof. Jan Domin – TUV of Rzeszów; Prof. Andrzej Filipkowski, Prof. Leszek Opalski, Prof. Jan Ogrodzki, Prof. Tomasz Woliński, Prof. Tadeusz Morawski, Prof. Antoni Grzanka, Prof. Tomasz Adamski, Prof. Ryszard Romaniuk–Warsaw Univ. of Technology; Prof. Jan Wójcik – UMCS Lublin; Prof. Leszek Jaroszewicz –WAT Warsaw; Prof. Marek Sadowski, Prof. Grzegorz Wrochna – IBJ Świerk; Prof. Sergio Tazzari – Tor Vergata Univ. Roma; Dr. Bhaskar Mukherjee – DESY Hamburg; Prof. Michał Różycka-CAMK Warsaw; Prof. Wojciech Plandowski- Warsaw University.

PARTICIPANTS, ORGANIZERS, PATRONS AND SPONSORS OF SPIE-IEEE WILGA SYMPOSIUM

For several years now, the Symposium has been gathering over 200 (and during the best years more than 300) M.Sc., D.Sc., students and young researchers from this country and internationally. Frequently enough, the Symposium hosts representatives of such research organizations like CERN, DESY, INFN, CEA, IN2P3, FNAL and European technical universities. Similarly to previous years, considerable delegations of technical universities attended topical

sessions organized by themselves. WILGA 2007 Symposium hosted, among others, representatives from: Warsaw, Poznań, Opole, Gdańsk, Bydgoszcz, Zielona Góra, Kraków, Kielce, Lublin, Białystok, Łódź, Rzeszów, Gliwice, Hamburg, Rome, Geneva, Sofia. There were presented more than 170 papers in WILGA sessions and over 50 in Jachranka sessions.

The WILGA Symposium is organized under the high patronage of international professional organizations IEEE [www.ieee.org] and SPIE [www.spie.org] and their Poland Sections [ieee.pl], [spie.pl], international institutions CERN in Geneva [www.cern.ch] and DESY in Hamburg [www.desy.de], and national institutes: Association of Polish Electrical Engineers – Polish Committee of Optoelectronics [www.sep.com.pl], Polish Academy of Sciences – Committee of Electronics and Communications [www.pan.pl], Warsaw University of Technology [www.pw.edu.pl] – Faculties of Physics [www.if.pw.edu.pl], Mechatronics [www.mech.pw.edu.pl] and Electronics and Information Technologies [www.elka.pw.edu.pl], Sołtan Institute of Nuclear Research in Świerk [www.ipj.gov.pl].

IEEE-SPIE WILGA Symposium is sponsored by the European FP6 programs run by the European Steering Committee of Accelerator Research and Development ESGARD [esgard.lal.in2p3.fr] – CARE – Coordinated Accelerator Research in Europe [care.lal.in2p3.fr] and ELAN – European Linear Accelerator Network [elan.desy.de]. Subject area of WILGA is combined with large research programs and the institutions which carry them: XFEL- European X-Ray Free Electron Laser [<http://xfel.desy.de/>] and Polish XFEL Consortium [<http://xfel.pl/>], ILC- International Linear Collider [linearcollider.org] and TESLA Consortium [<http://tesla-new.desy.de/>], LHC- Large Hadron Collider [cern.ch/lhc], CMS- Compact Muon Solenoid [cms.cern.ch]. The logos of abovementioned organizations and programs, together with WILGA Village and Commune crest, our host of WILGA meetings, were displayed in the heading of this report.



CERN, Geneva, 10, 2005, A meeting on cooperation. From right: Dr. Louis Rinolfi, Dr. Jean Pierre Delahaye, CLIC Collaboration, Prof. R. S. Romaniuk,

WILGA Symposium is organized by the PERG/ELHEP Laboratory [<http://tesla.desy.de/~elhep/>] of the Institute of Electronic Systems of Warsaw University of Technology (WUT) [www.ise.pw.edu.pl]. This year, the Chairmen of the WILGA 2007 Organizing Committee were Ph.D. students Mr.

Dominik Rybka and Jarosław Szewiński, supported by around 20 PERG/ELHEP Group students. The co organizers of the WILGA Symposium are all IEEE and SPIE Student Branches in this country.

The Patronage Committee of WILGA Symposium consists of chiefs of the patronage institutions: prof. Jan Dorosz-Director of Ph.D. Study of Białystok Univ. of Technology; Prof. Bogdan Galwas – Dean of the Faculty of Electronics and Information Technology, Warsaw Univ. of Technology; Prof. Henryk Fiedorowicz – Director of the Institute of Optoelectronics, Military Academy of Technology; Prof. Wiesław Woliński, member of PAS, Chair of The Committee of Electronics and Communications, PAS; Prof. Tomasz Woliński – President of Polish Chapter of SPIE; Prof. Andrzej Pacut – President of Poland Section of IEEE; Prof. Grzegorz Wrochna – Director of The Soltan Institute for Nuclear Problems in Świerk; Prof. Jerzy Szabatin – Director of the Institute of Electronic Systems, WUT; Prof. Marian P. Kaźmierkowski – Director of the Institute of Control and Industrial Electronics, WUT; Dr. Jacek Galas and Dr. Mariusz Litwin –vice-directors of the Institute of Applied Optics. The Patronage Committee guarantees the highest level of the research reports presented in WILGA. The Scientific Committee of WILGA consists of professors present personally at the Symposium. The Committee reviews the papers and accepts them for publishing. Members of WILGA 2007 Scientific Committee are named under the photos opening this report.

MEDIA PATRONAGE AND PUBLICATIONS OF WILGA SYMPOSIUM

Media patronage on the WILGA meetings of young researchers has a monthly research journal ELEKTRONIKA issued by the Association of Polish Electrical Engineers [<http://www.sigma-not.pl>]. Internationally, WILGA publishes its reports in IEEE Region 8 News [<http://www.ewh.ieee.org/reg/8/news/>].

The proceedings of WILGA are published in ELEKTRONIKA, Electronics and Telecommunication Quarterly by Polish Academy of Sciences. Several times these were special issues of the journals. Internationally, WILGA publishes in Proceedings of SPIE and in such journals like MST- Measurement Science and Technology [<http://www.iop.org/EJ/journal/MST>] and NIM- Nuclear Instrumentation Methods [www.elsevier.com/locate/nima]. A considerable success of WILGA 2006 was preparing almost 20 papers for a special issue of the MST Journal. With the works of WILGA there is combined an exceptional publication about the FLASH Laser. It was written by XFEL Consortium in co authorship of several persons from the PERG/ELHEP Laboratory and published in the June Issue 2007 of the NATURE Photonics [<http://www.nature.com/nphoton>].

Together with a dynamic development of the web, the publication methods of conference proceedings undergo a considerable evolution. SPIE resigns from the printed versions of the worldwide recognized, famous yellow photonics volumes, Proc. SPIE. Instead, similarly to other big international professional societies like IEEE (Explore web publication system), and OSA – Optical Society of America (Optics InfoBase web publication system), all SPIE Proceedings are published on a complex Internet technical publication database called SPIE Digital Library [<http://spiedl.org/>]. Publications in all these web based systems are fully indexed as they were in printed versions.

TOPICAL SESSIONS OF SPIE – IEEE WILGA SYMPOSIUM

The IEEE-SPIE WILGA Symposium lasts traditionally the whole week, from Monday in the morning till Sunday evening. It is always the last week of May. WILGA consists of topically adjacent research conferences, which are subdivided to topical sessions. Only exceptionally, there are organized parallel sessions. An organizer of a topical session is a recognized expert in this field. She or he invites young scientists to the session, who are obliged to prepare and present original

papers from their own work. WILGA 2007 consisted from the following topical tracks (called by us conferences): Web Engineering; Photonics Applications; Signal Processing and Radar Technology; Photonics and Electronics Systems in High Energy Physics Experiments, Astronomy and Accelerator Technology.

IEEE-SPIE WILGA 2007 was organized in the same time in two places: WILGA and Jachranka. A Conference on DSP and Radar Technology was organized in Jachranka by Dr. Krzysztof Kulpa from WUT. The remaining WILGA sessions were organized by the following persons: Col. Dr. Zbigniew Patron, WAT – Lasers and Applications; Prof. Antoni Grzanka, WUT – Biomedical Instrumentation; Dr. Ryszard Kisiel, WUT and IPJ – Packaging and Hybrid Integrated Circuit Technology; Dr. Michał Borecki, WUT – Optoelectronic Sensors; Dr. Jacek Galas and Dr. Dariusz Litwin, INOS – Applied Optics; Dr. Tomasz Starecki, WUT – Fast Pulse Electronics and Photoacoustics; Dr. Jerzy Weremczuk, WUT – Smart Sensors; Prof. Jan Domin, Rzeszów Univ. Technology – Spectrographic Techniques, Prof. Tomasz Woliński, Prof. Andrzej Domański, WUT – Photonic Optical Fibers; Dr. Stanisław Jankowski, WUT – Optimal Learning Systems; Prof. Leszek Opalski, WUT – European Programs SEWING and WARMER; Prof. Lech Mankiewicz, CTF PAS, Prof. Grzegorz Wrochna, IPJ – Program Pi-of-The-Sky; Dr. Ryszard Kisiel, WUT and IPJ – Linear Accelerators; Prof. Marek Sadowski, IPJ – Thin Film Technology; Prof. Jan Dorosz, Białystok Univ. Technology – Optoelectronics and Numerical Methods; mgr Aneta Michalkiewicz, Student Section of SPIE at WUT – Applied Optics; Prof. Tomasz Adamski, WUT – Information Safety; Dr. Bhaskar Mukherjee, DESY – European X-Ray FEL – A Light of the Future. Ph.D. Students of PERG/ELHEP IES Laboratory, under the guidance of Dr. Krzysztof Poźniak, Dr. Maciej Linczuk and Dr. Michał Ramotowski have organized a few sessions on photonic and electronic systems for the superconductive accelerator technology and free electron lasers.

A special ceremonial session was devoted to the memory of the late professor Bogdan Paczyński. This session was combined with a conference on mysterious GRB and optical flashes of all the sky. Prof. Bogdan Paczyński, member of the Polish Academy of Sciences, was a worldwide precursor of the evolution modeling of certain types of stars. A fascinating lecture about the life and work of Prof. B. Paczyński was delivered by Prof. Michał Różyczka from the Nicolas Copernicus Center of Astronomical Research. Prof. Paczyński was no doubt one of the most famous Polish scientists. He is a laureate of all the most important international astronomical research awards. He was a few times a candidate for the Nobel Prize in Astronomy. The paper In Memoriam of Prof. Bogdan Paczyński is published in Proc. SPIE WILGA 2007 (paper CID #693701).

Each WILGA Symposium organizes traditionally an artistic-humanistic session as a supplement to the dominating technical sessions. Previous sessions of this kind concerned, for example, sociology of the Internet. This year, second time in row, the subjects are palindromes, because of exceptional activity in this area by Prof. T. Morawski from WUT, usually an expert in the electromagnetic field theory. He has recently published third book on the subject and has written a collection of palindromes devoted to students and WILGA Symposium. The session consisted of two lectures: Palindromes in Mathematics by Prof. W. Plandowski from Warsaw University and History of Palindromes in Polish Fine Literature by Prof. T. Morawski [<http://www.palindromy.pl/>].

EUROPEAN X-RAY FREE ELECTRON LASER - XFEL

On 30th January, almost twenty national research institutions signed an agreement to establish the Polish Consortium of XFEL. The aim of the Consortium is to coordinate the research work and construction efforts as well as exploitation of the E-XFEL. XFEL Poland G.m.B.H. will be established soon to be a part of the E-XFEL G.m.B.H. enterprise. These firms will be the owners of the XFEL machine.

Signatories of the XFEL Consortium Poland

Institute of Physics,
Polish Academy of
Sciences



Niewodniczański
Institute of Nuclear
Physics, Polish Academy
of Sciences, Kraków



Institute of Plasma Physics
and Laser Microsynthesis,
Warsaw



Institute of High
Pressure, Polish
Academy of Sciences



Mechanical and
Energetics Faculty,
Wrocław University of
Technology



Wrocław Technological
Park



Andrzej Sołtan Institute
for Nuclear Research in
Świerk



Warsaw University of
Technology



Tele and Radio
electronics Institute,
Warsaw



Institute of Electron
Technology Materials,
Warsaw



Łódź University of
Technology



Military Academy of
Technology, Warsaw



Faculty of Physics,
Warsaw University



Szczecin University of
Technology



PREVAC sp. z o.o.
Enterprise in Rogów (Fine
and vacuum
technologies)



Institute of Electron
Technology, Warsaw



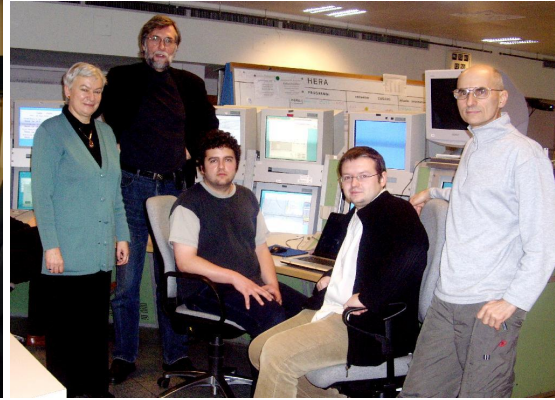
Faculties of Electrical Engineering, Automation, Information
Technology, Electronics and Physics and Applied Informatics,
Academy of Mining and Metallurgy, Kraków



The IEEE-SPIE WILGA Symposium is an official research meeting of the XFEL-Poland. Traditionally, since several years, one of the major topical subjects of WILGA create numerous papers on superconducting accelerator technology and on free electron lasers. A considerable number of researchers in Poland are engaged in building and tests of the FEL. A precursor to E-XFEL is FLASH, a laser currently under reconfiguration and tests. A considerable number of young researchers from Poland are participating in the construction of FLASH. These include representatives of the following institutions: Sołtan Institute for Nuclear Research in Świerk, Universities of Technology from Warsaw, Wrocław and Łódź and Warsaw University. These young authors submitted a few tens of contributed papers on this subject to WILGA 2007 Symposium. The papers from FLASH and XFEL sessions will be published in the Proc. SPIE volume from WILGA in the USA.



DESY, 5 June 2007: Official opening of the European X-Ray Free Electron Laser. Federal Minister of Research Ms Annette Schavan is speaking; from left DESY Director Prof. Albrecht Wagner, from right Director of XFEL Program Prof. Massimo Altarelli and European Research Commissioner Janez Potocnik. In the foreground there is a single cell niobium resonator (basic component for the SRF TESLA technology accelerator) in which there are positioned the flags of all countries participating in building of the E-XFEL machine: Germany, Denmark, France, Greece, Hungary, Italy, China, Poland, Russia, Spain, Sweden, Switzerland and England.



DESY, 15 December 2006: A visit to FLASH control facility in DESY by Prof. K. Jabłońska-Ławniczak, the Polish representative in Scientific and Technical Issues Working Group for XFEL. Beside: Prof. R. Romaniuk and Ph.D. students from Warsaw University of Technology and Łódź University of Technology - W. Jałmużna, W. Cichalewski, T. Czarski. The students are testing new control algorithms for the superconductive linac and FEL. Influence of various control conditions on the electron and photon beams is investigated.

Several days after WILGA Symposium, an official opening of the European XFEL program took place in DESY. A number of representatives from this country participated in this important meeting like representatives of the Ministry of Research (Dr. J. Gierliński) and Polish XFEL Consortium (Prof. K. Jabłońska, Prof G. Wrochna), in these a few participants of WILGA Symposium.



Warsaw, Institute of Physics PAS, 30.01.2007: Signatories of the Polish XFEL Consortium. Representatives of the institutions - members of XFEL Poland. Sitting in the middle are Prof. K. Jabłońska and Dr. J. Gierliński.



Warsaw, WUT, 28.02.2007: Visit of Dr. Oliver Napoly from CEA Saclay, a delegate of ESGARD and ECFA to prepare program SRF-FP7. From the left: Prof. J. Dobrowolski, Prof A. Napieralski, Dr. O. Napoly, Prof. R. Romaniuk.

POLAND CHAPTER OF SPIE AND POLAND SECTION OF IEEE

WILGA 2007 is the last Symposium organized under the patronage of SPIE Poland Chapter. The Chapter has been chaired very successfully from several years by Prof. Tomasz Woliński from WUT. Poland Chapter of SPIE has been acting during the period 1985-2007 as a Registered Society and had a legal personality. SPIE Headquarters, by the Board decision, liquidated regional Chapters from 01.01.2008. SPIE will cooperate directly with national associations of photonics. There were not liquidated regional SPIE Student Chapters. They are active at many universities around the world. Such a Chapter is located also at Warsaw University of Technology, and was one of the organizers of WILGA 2007 Symposium. In order to debate these changes, the Board of SPIE Poland Chapter gathered in WILGA during the Symposium. The continuation of SPIE Poland Chapter will be carried out by, just under organization by local researchers and engineers, the Photonics Society of Poland.

During the SPIE PL Board meeting, the writing these words, was honored by the 2007 Award of the President of SPIE Poland Chapter. The quotation from the award plaque is: "For a substantial contribution to integration of young Polish researchers, and in particular for organization of the jubilee XXth WILGA Symposium on Photonics Applications: Photonics and Web Engineering; Electronics for Astronomy and High Energy Physics Experiments".

The history of WILGA Symposium is an integral part of the history of SPIE Poland Chapter. WILGA has grown up from an exceptionally creative environment of the Chapter. The Chapter was run during the most difficult years by the late Prof. Maksymilian Pluta. The Chapter was undertaking, during these years, wide international initiatives, which seemed then impossible to be realized. Yet, all the dreams of this group of vigorous people were fulfilled. SPIE Poland Chapter in an unprecedented way has integrated nearly the whole national research people active in photonics around such big and brave projects. During the period of 1986-2007 the Chapter has issued alone and in cooperation nearly 200 volumes of the famous photonics series Proceedings of SPIE. These volumes contain around 10,000 research and technical papers, which are a sustained contribution of Polish science and technology into the world research resources. Without the SPIE Poland Chapter it would not have been possible. A spectacular success of the Chapter, not only research but also financial, was the organization of East and Middle European Congress on Optics and Photonics in September 2005. This Congress marked 50th Anniversary of SPIE. The President of SPIE was then Prof. Małgorzata Kujawińska. The cooperation with SPIE Headquarters on this Congress was exceptionally good.



Left: Wilga, 23 May 2007: Meeting of the Board of SPIE Poland Chapter. Prof. Tomasz Woliński hands to Prof. R. Romaniuk the 2007 Annual Award by SPIE Poland Chapter President. From left: Prof. Leszek Jaroszewicz, WAT, - vice-President of the Board, mgr Aneta Michalkiewicz – Chairwoman of SPIE Student Branch at WUT, Prof. Jan Wójcik, UMCS Lublin – Revision Committee of SPIE Poland Chapter. Right: Electrotechnical Institute, Warsaw, 14.06.2007, Prof. Jerzy Barglik, President of SEP-Association of Polish Electrical Engineers hands to Prof R. Romaniuk Professor Pozaryski Prize, besides Prof. Jerzy Klamka-Editor in Chief of ELEKTRONIKA Monthly, Prof. Mieczysław Hering, WUT, Chairman of The Professor Pozaryski Award Chapter.

Without a continuous and generous support from the IEEE Poland Section, the organization of such a big meeting like a multi-conference WILGA Symposium would have not been possible. The M.Sc and Ph.D. students. Organizers of WILGA Symposium, which is very important not only for them but for many young researchers in this country and in this geographical region, count on further support by IEEE Poland Section. The Symposium has to maintain its cyclic character without any interruptions. Students would like to extend their thanks for uninterrupted WILGA support to the successive Presidents of IEEE Poland Section, professors of WUT: Ryszard S. Jachowicz, Marian P. Kaźmierkowski and Andrzej Pacut.

WILGA 2008 SYMPOSIA

XXI Symposium will be held on 18-20 January 2008 at the Faculty of Electronics and Information Technologies, WUT. The January Symposium is strictly confined topically to the design, construction and testing of of photonic and electronic systems for superconductive RF accelerator technology and HEP experiments.

XXII IEEE WILGA 2008 Symposium will be held on 26 May – 1 June. The organizers, M.Sc. and Ph.D. students of WUT, as each year, warmly invite young researchers to present developments of their theses. In particular, young scientists are invited to share their experiences in now still widening participation in the European Research Framework Programs. The programs create new, young dimensions in the European Research Area (ERA). IEEE-SPIE WILGA Symposium is a unique possibility for Ph.D. students, not only to present their results in international conditions (WILGA is carried only in English, papers are doubly peer reviewed, they provide a considerable number of categorization points for their authors), but also enable comparison of methods and conditions of research work in different, national and international centers.

WILGA

Due to a round number jubilee of WILGA young researchers meetings series, below there are some considerations about different WILGAs. All Wilgas are a continuous inspiration to our Symposium.

WILGA – (Oriolus) Golden Oriole is a medium size migrant bird, belonging to passerine family, breeds in northern hemisphere, winters in tropics. The male is striking in the typical oriole black and yellow plumage. It spends Summer, among other places, in Poland. Usually resides high in the canopy. Very shy. Feeds on fruit and insects. The presence is revealed with beautiful fluting. Sings frequently just before the rain starts falling. WILGA Symposium participants listened frequently to Oriole concerts.



WILGA – (Wet River) a river in the Mazowia Voivodeship, length 67km, area 570km², right inflow to Vistula. The sources in vicinity of Żelechowa (where it is connected with Mała Bystrzyca river), flows through Garwolin and joins Vistula in WILGA Village. Wilga river is wild with numerable bends. After 1980 gains again clear water. The name of WILGA river (the word wilga in Polish) has the same core as moisture. WILGA river flows closely to WILGA Village resort owned by Warsaw Univ. Technology. Now, the clear waters of WILGA river invite one for swimming.

WILGA – a rural community in Mazowia Voivodeship, in Garwolin county. WILGA community has 5500 inhabitants, area 120 km², above 40% forests and around 40% fertile fields. During WILGA Symposium the number of WILGA Community inhabitants increased by 250-350 people.

WILGA – a village (site of WILGA Community) of historical names (since 1400): Wilka, Vilka, de Wilcza, Vylka. Name originates from WILGA river. A parish founded in 1407. During 1534-1650 WILGA possessed town rights. Between the WWI and WWII the natural resort values of WILGA were discovered. Since this time the WILGA Resort Village has been developed in the adjacent woods. In 1944 fights of warecko-magnuszewski foothold. Localization of WILGA Resort Village is shown on the map quoted from Google Earth. The resort has now a few thousand homes. Among them is a resort owned by WUT. It is situated a few hundred m from Vistula embankment. The road from N to S goes from Warsaw, via Dęblin to Puławy and Kazimierz upon Vistula. A branch road to E goes to Garwolin and a road Warszawa-Lublin. The left lower corner of the map shows the great, wild Vistula river.

CONCLUSIONS AND REASONS OF WILGA SYMPOSIUM SUCCESS

Speaking the truth, it is not quite understandable why WILGA gained such a big success among young researchers, in a relatively dense market of conferences. This success is really outstanding, taking into account the number of participating each year Ph.D. students and a relatively narrow topical scope of the WILGA meeting. Perhaps these reasons are: no conference fee at all; no typical conference formalities; meeting is organized by students for young researchers; the symposium is not a part of any "grown up" and thus more important event; the papers are presented only in English; papers are peer-reviewed – by the students' tutors, during the presentation by the listeners and before publication by external reviewers; all accepted papers are published internationally, either in IEEE or SPIE press; publications give a considerable number of categorization points to the authors.

The lack of any formalities and low costs enable young scientists for easy arrival, participation and direct presentation of own papers in WILGA. WILGA accepts only original work by young scientists. Review work may be only presented by tutors as an introduction to topical sessions filled with students' work. WILGA lasts the whole week, which gives a lot of flexibility to the active participants in planning a proper term for their topical sessions. Weakly formalized character of special research, late night sessions at a grill encourages young scientists to utter their real opinions of own worked out research methods, local work conditions and perspectives of research career in this country and abroad. A generous sponsor for these late night session is Poland Section of IEEE.

Professor Ryszard S. Romaniuk (*R.Romaniuk@spie.pl*)
Warsaw University of Technology, Faculty of Electronics and Information Technology
SPIE Poland Chapter, IEEE Poland Section, WILGA Symposium Chair

JACHRANKA CONFERENCE

It is the third time when **DSP and Radar Imaging Conference**, known also as **Signal Processing Symposium SPS-2007**, was organized in the frame of **SPIE-IEEE WILGA SYMPOSIUM**. The participants presented number of very high quality papers on very “hot” subjects such as high resolution radar imaging, image processing, feature extraction, signal processing, optical technology and radio-frequency technology. The conference was addressed to young scientist, PhD candidates and students. The experienced scientists were also invited to present the tutorial papers showing new achievements and trends in science and technology.

In 2003, 12th IEEE-SPIE Symposium was organized and for the first time within the frame of this symposium the Digital Signal Processing and Radar Signal Processing Conference (SPS-2003) took place. This conference was organized by Institute of Electronic Systems, Warsaw University of Technology. Almost the whole conference was organized by students from The Radiolocation and Digital Signal Processing Students' Research Group. In May 2004 for the first time the big international radar conference – International Radar Symposium IRS-2004 was organized in Poland. In 2005 for the second time the **DSP and Radar Imaging Conference (SPS-2005)** was organized as a part of the 16th IEEE-SPIE Symposium on Photonics, Electronics and Web Engineering. SPS-2005 gathered more than 100 participants from 4 countries. More than sixty high level papers were presented at oral and poster sessions. It has been assessed as a very successful event. In 2005 the Polish and German radar society decided that each second (even) year the International Radar Symposium would be organized in May in Poland in the frame of the Microwave and Radar Weeks in Poland. To avoid two radar conferences in Poland in May, it was decided that **DSP and Radar Imaging Conference (Signal Processing Symposia)** would also be organized in each second year (odd). So the third **DSP and Radar Imaging Conference (SPS-2007)** was organized on 24th-26th May 2007. Due to the increasing number of participants of **SPIE-IEEE WILGA SYMPOSIUM** it was not possible to share this some holiday camp in Wilga village so SPS-2007 had been shifted to Jachranka village – very nice holiday place placed at the bank of the artificial lake “Zalew Zegrzyński”, 30 km East-North from Warsaw. The conference gathered more than 70 participants from 8 countries.



The SPS-2007 was sponsored by Telecommunication Research Institute (Warsaw, Poland), RADWAR S.A. (Warsaw, Poland) and Foundation for development of Radio-communication and Multi-media Technology (Warsaw, Poland). Thanks to their Sponsorship there was no conference fee and about 30% of participants could attend conference without any costs.

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Warsaw University of Technology, Faculty of Electronics and Information Technology
SPS-2007 Conference Chair

Palindromes in mathematics

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ABSTRACT

The paper concerns palindromes in mathematics. Palindromes are structures which are the same when read forward and backward. There are debated basic properties of these data work structures in mathematics.

Keywords: Palindromes

1. INTRODUCTION

Everyone knows what a palindrome is. It is a text which is the same when reading forward and backward. One of the examples is the palindrome: "C is a basic". This palindrome can be extended to a palindrome of unbounded length: "C is a basic, is a basic, is a basic, ...".

Palindromes in mathematics have a little bit more precise definition. Namely, each letter including space is important. Lower-case and capital letters are considered as different letters. Using this definition "C is a basic" is not a palindrome because after the capital C is space while before the last c is not a space. Moreover, the first C is a capital letter while the last c is a lower-case letter. A palindrome in a mathematical sense is "cisabasic".

Palindromes in mathematical sense do not have to have a meaning, for instance the sequence of letters "abbabba" is a good palindrome. Palindromes are considered mainly in two branches of mathematics: combinatorics on words and text algorithms. They occur also in number theory and formal language theory. In combinatorics on words palindromes occur in several theorems dealing with Sturmian words. In text algorithms there are several algorithms which check properties of the input text – properties connected to palindromes. In number theory numbers which look like palindromes are studied. In formal language theory the set of palindromes is an example of a language which is context-free and which is not deterministic context-free. We will study one example of occurrence of palindromes in combinatorics on words and one in text algorithms.

2. PALINDROMES IN COMBINATORICS ON WORDS

Combinatorics on words studies properties of words including their structure and regularities which occur inside them. Palindrome is some kind of regularity. Palindromes in combinatorics on words occur in several theorems [2]. We will explain their relation to one of the most basic and important theorems in this branch of mathematics – Fine and Wilf's Theorem. To explain this theorem we have to introduce a few definitions.

A *letter* is either 'a' or 'b'. A *word* is any sequence of letters, for instance "abbabbabba". The number of letters in a word w is called *the length* of w and is denoted by $|w|$. The i -th letter of a word w is denoted by $w[i]$. We have $w = w[1]w[2] \dots w[|w|]$. A *period* of a word w is a number p such that $w[i] = w[i+p]$, for $1 \leq i \leq |w| - p$. If p is a period of w , then w is of the form $uu \dots uu$ where $u = w[1] \dots w[p]$ and $u' = w[1] \dots w[k]$, for some $k \leq p$. It is not difficult to see that if p is a period of w , then $2p$, $3p$ and all other multiples of p are periods of w .

Example. We have $abababa[2] = b$. The length of $abababa$ is 7. Numbers 2, 4, 6, 7 are periods of $abababa$. Since 4 is a period of $abababa$ the word $abababa$ is in form uu' where $u = abab$ and $u' = aba$.

Denote by $\gcd(p, q)$ the greatest number which divides both p and q . For instance, $\gcd(15, 25) = 5$. Then the Fine and Wilf Theorem can be formulated in the following way.

Fine and Wilf's Theorem. Let p and q be two periods of a word w . If $p + q - \gcd(p, q) \leq |w|$, then $\gcd(p, q)$ is also a period of w .

Observe here that if $\gcd(p, q)$ is a period of w , then p and q , as multiples of $\gcd(p, q)$, are also periods of w . For $\gcd(p, q) = 1$, the Fine and Wilf Theorem can be formulated in the following way.

Fine and Wilf's Theorem (case $\gcd(p,q)=1$). Let p and q are two periods of a word w . Let $\gcd(p,q)=1$. If $p+q-1 \leq |w|$, then w consists only of letters a or only of letters b .

An interesting question is: what happens if p and q are periods of w , $\gcd(p,q)=1$ and $|w|=p+q-2$? Does w has to consists only of letters a or only of letters b ? The answer is: No. For each p, q such that $\gcd(p,q)=1$ there is a word w of length $p+q-2$ which contains letters a and b and such that p and q are periods of w . This means that there is a sense of introducing the following definition. A word w is *central* if there are numbers p and q such that $|w|=p+q-2$ and p and q are periods of w . Such words are characterized by the following theorem.

Theorem A word w is central if and only if either consists only of letters a , or only of letters b , or w is a palindrome and w is of the form $uabv$ where u and v are palindromes.

3. PALINDROMES IN TEXT ALGORITHMS

Text algorithms are a part of algorithmics which works on words called here texts. Palindromes in text algorithms has been studied in contexts of sequential algorithms [2] and of parallel algorithms [1]. We will study one algorithmic problem which leads to a very useful data structure for sequential algorithms connected to palindromes. We start by introducing a useful notation. By $w[i..j]$ we mean the word $w[i]w[i+1]...w[j]$. The problem we are interested in is a basic one.

Problem: Given a word w . Design a data structure which allows, for a given two positions i and j of the word w , check whether $w[i..j]$ is a palindrome.

An obvious solution of our problem is to build a two-dimensional boolean array $p[i,j]$, for $1 \leq i \leq j \leq |w|$ such that $p[i,j]=\text{true}$ if and only if $w[i..j]$ is a palindrome. Using the array p we can answer the question whether $w[i..j]$ is a palindrome in constant time. However, this solution has one drawback: the size of a data structure p is quadratic with respect to the length of w so any algorithm which computes this data structure has to work in at least quadratic time.

A solution proposed by Manacher is more tricky. From this moment we assume that we are interested only in even palindromes, that is $j-i+1$ in our problem is even. Extension to all palindromes is not difficult task and is left to the reader. We compute an array of integers R such that $R[i]$ is the maximal number j such that $w[i-j..i+j-1]$ is a palindrome. Clearly, the size of the array is linear with respect to $|w|$.

$R[i]$ is just a radius of a maximal even palindrome which is centered between positions $i-1$ and i in w . If we want to check whether $w[i..j]$ is an even palindrome we just check whether $R[(j+i+1)/2] \geq (j-i+1)/2$, that is whether the radius of the maximal palindrome centered in the center of $w[i..j]$ is greater than half of the length of $w[i..j]$.

Example. Take a word $abbaa$. Then $R[3]=2$ since the largest even palindrome centered between positions 2 and 3 is $abba$ and $R[5]=1$ since the largest even palindrome centered between positions 4 and 5 is aa .

The computation of R in quadratic time is a very simple task. We leave it to the reader. Linear time algorithm is not simple and it requires some reasoning from combinatorics on words. The reader which is interested in it is encouraged to read [2].

Theorem The array R can be computed in linear time.

4. REFERENCES

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