Advanced Photonic and Electronic Systems WILGA 2010

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Abstract—SPIE – PSP WILGA Symposium gathers two times a year in January and in May new adepts of advanced photonic and electronic systems. The event is oriented on components and applications. WILGA Symposium on Photonics and Web Engineering is well known on the web for its devotion to "young research" promotion under the eminent sponsorship of international engineering associations like SPIE and IEEE. WILGA is supported by the most important national organizations like KEiT PAN and PSP-Photonics Society of Poland. The Symposium is organized since 1998 twice a year. It has gathered over 4000 young researchers and published over 2000 papers mainly internationally, including more than 1000 in 10 published so far volumes of Proc. SPIE. This paper is a digest of WILGA Symposium Series and WILGA 2010 summary.

Keywords—WILGA Symposium, SPIE Student Chapters, Photonics and Web Engineering, advanced electronic and photonic systems, Photonics Society of Poland, IEEE.

I. WILGA SYMPOSIA ON PHOTONICS AND WEB ENGINEERING

D URING the last years WILGA Symposium on Photonics Applications has gained a considerable success in Poland and in this geographical region only by its positive attitude and persistence, high quality of research work, involvement of young organizers, focusing on and strong promotion of 'young science'. The main measure of this success are participating crowds of young researchers every year, since more than a decade, and publishing eagerly the results of their work in WILGA SPIE Proceedings. For many of them, now counted in thousands, WILGA was the first presentation and publication experience ever in their research career. WILGA is, in a sense, a diamond cutting factory where the diamonds are gifted young researchers. Summarizing WILGA to a single sentence one may say that it is a kind of very vivid international Forum of Young Science in Photonics, Advanced Electronics and Internet Engineering.

The Joint SPIE – IEEE WILGA Symposium has been organized since 1998 by the B.Sc., M.Sc. and Ph.D. student research group PERG-ELHEP from ISE PW. Most of these young researchers, WILGA organizers, are also active members of PSP, SEP, SPIE and IEEE. The symposium is diligently done by young researchers for young fellow researchers and the aim is to have a lot of fun and to learn a lot. Usually the January edition of WILGA Symposium gathers around 60–100 participants, while the May Symposium gathers around 150–300 participants. XXVth and XXVIth Symposia has gathered

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more than 200 persons and over 150 presentations. Usually the mainstream subjects of the recent WILGA Symposia are: design, fabrication and tests of advanced electronic and photonic systems in hardware and software aspects. The participants of the January Symposium are B.Sc., M.Sc., and Ph.D. students and young researchers from Warsaw University of Technology (WUT) and cooperating institutions like Faculty of Physics – Warsaw University, Sołtan Institute of Nuclear Research in Świerk (IPJ), Niewodniczański Institute of Nuclear Physics in Kraków (IFJ), M.Kopernik Center of Space Research in Warsaw (CBK), Astronomical Observatory of Warsaw University, Center of Theoretical Physics – Polish Academy of Sciences, CERN in Geneva, DESY in Hamburg, etc. The cooperation is realized at common grants and research projects. The students are sometimes accompanied by their tutors and mentors who give invited and keynote presentations. Some tutors bring a few students and organize topical sessions. The participation of the May Symposium is much wider including a number of international guests from Europe and IEEE R8. The whole last week of May in WILGA with young devoted researchers from all over Poland and Europe is an unforgettable experience for everybody.

The SPIE Poland meetings in 2005 were very special because then the Polish Chapter of SPIE (predecessor of Photonics Society of Poland) hosted together with SPIE and some other regional SPIE Chapters and optical organizations, the SPIE Warsaw Congress on Optics and Optoelectronics – SPIE COO Warsaw 2005. WILGA 2005 Symposium was split to two parts – one held usually in WILGA and the second held jointly with the SPIE Warsaw COO'05.

A decade in the future from now, a hypothetical Symposium Wilga 2020 will take place in a completely rebuilt WUT Resort and Conference Centre in WILGA. Rector of the WUT, prof. W. Kurnik, met in WILGA just after WILGA2010 Symposium, on occasion of the 40-tieth anniversary conference of his mother Institute of Fundamentals of Machines Construction (held also in Wilga) [http://ipbm.simr.pw.edu.pl/] expressed his intention to invest in Wilga and make it a modern and convenient country research, leisure and meeting centre. Such large investments require a consensus at the university and formal agreement of the Senate. The path is long and difficult but not impossible. WILGA Symposium will hopefully last and we will see the development of this idea.

II. PARTICIPANTS, INSTITUTIONS, TOPISC, COVERAGE

Official language of the Symposium is English. Peer reviewed papers are published in a renowned, world wide

recognized series Proceedings of SPIE in USA. Symposium is designed mainly for for Ph.D., M.Sc., and B.Sc. students (from physics, electronics and mechatronics, as well as material research) and their tutors/mentors. WILGA has a number of main topical tracks. Historically, the first one was Photonics and Web Engineering. Generally, WILGA embraces advanced photonic, mechatronic and electronic systems, in the following aspects: theory, modeling, algorithms, simulations, emulations, design, hardware, software, hardware-software interaction and integration, measurements, testing, commissioning and exploitation. WILGA also addresses new research tendencies like 3D photonics and electronics design, micro and nanosystems, material engineering including meta-materials. Topical sessions are organized by leading experts. Sessions usually begin with current tutorials and are filled with contributed papers by students and young researchers. One of the most important session tracks in WILGA are photonics applications and systems for superconductive accelerator (and free electron laser) technology and high energy physics experiments. We invite warmly students, young researchers and their tutors to participate in WILGA actively by organizing one of such topical sessions.

WILGA has grown steadily from a 1998 local symposium to much wider extent as it is covering now. The publications statistics not only in Proc. SPIE but also in technical and peer-reviewed journals show frequent (however oscillating) participation of several tens of laboratories all over this country and a few laboratories from abroad. The majority of technical universities were represented in WILGA, naming a few like: Rzeszów, Lublin, Białystok, Gdańsk, Szczecin, Wrocław, Poznań, Kraków, Bydgoszcz, Łódź, Kielce, Częstochowa, Siedlce, Warszawa, etc. WILGA covers also the neighboring geographical region, and especially R8 of IEEE. Frequent guests are from Germany, France, Russia, Ukraine and Belarus, Italy and Spain, USA, Arab and Maghreb Countries. On the average 20% of Wilga participants are from abroad. Sometimes WILGA greets young researchers from such distant countries like Mexico.

The biggest contributors to WILGA Symposium are young research teams from WUT. They originate from several major faculties: Electronics and Information Technology, Physics, Mechatronics, Electrical Engineering, Mechanical and Power Engineering and Aviation, Chemistry. The Faculty of E&IT is represented most frequently by young researchers from the Institute of Electronic Systems (ISE), Institute of Micro and Optoelectronics (IMIO), Institute of Telecommunications (IT) and Institute of Radioelectronics (IR). Other technical universities of the biggest contribution are from Białystok and Lublin. The research in HEP and astronomy is covered in WILGA mostly by young representatives from Warsaw University, Faculty of Physics. The research in astronomy is frequently presented by young representatives of the Mikołaj Kopernik Space Research Center in Warsaw.

EU FP are designed to build and consolidate European Research Area – ERA. During the term 2004-2008 the Symposium was supported by the EU FP6 CARE – Coordinated Accelerator Research in Europe. During the term 2009-2013 the Symposium is additionally supported by the EU 7th FP Project

EuCARD – European Coordination for Accelerator Research and Development – coordinated by CERN [cern.ch/eucard]. A special session on EuCARD is organized during WILGA during this project realization (2009-2013). Previously, during the period of 2004-2008, a session was organized in WILGA on CARE Project. Participation of local research communities with strong participation of young researchers in European projects of global extent is of utmost importance as it opens the doors for them to travel, exchange, learn and study, and finally creatively contribute and generate precious knowledge. WILGA gives a lot of examples of such situations in these above mentioned EU FPs. WILGA sessions on EuCARD usually concern progress in superconducting RF technology (SRF) for accelerators, construction of free electron laser, novel accelerator schemes using laser induced plasma wake, building of FEL network across Europe.

EOP are realized in Poland during the period of 2007-2013 and are intended for equalization purposes. Two projects realized inside EOP are of concern to WILGA. Some of EOP projects are realized at WUT and Faculty of E&IT. These are ROBAL and FOTEH. Both concern the development of photonics research infrastructure at the Faculty of E&IT at WUT. A number of photonics laboratories are upgraded and newly established as a result of these projects. These laboratories are: Instrumental and Integrated Photonics; Laser Spectroscopy of Photonic Materials; Image Photonics; Material Research in GHz and THz Spectrum; Design and Prototyping of Information Processing Circuits in Photonic and Electronic Programmable Structures; Robotics; Biometry and Machine Learning; Test bed for Optical Communications Networks; Image Data Analysis and Data Visualization; THz Technology; Photonic Measurement and Telemetric Networks; THz Antenna Echo-Less Chamber; IT Support for Photonics Research.

A few research projects sponsored by the European Defense Agency are realized in ISE WUT. These concern security problems in the area of terahertz, remote sensing and radar technologies. The projects are realized by the Ph.D student research group led by prof. K. Kulpa. Some of the papers resulting from this research are included in this volume and the previous one. Realized EDA projects are complimentary to NATO projects.

Since its beginning in 1998 Wilga was closely related with a number of large international research projects concerning high energy physics experiments. Special relations were always kept with CERN in Geneva – and in particular the following projects LHC, PS, SPS, LINAC4, CMS, White Rabbit, Interlocks and Safety Systems. Close relations were established with DESY in Hamburg at the projects related to superconducting linear accelerators and free electron lasers: TESLA Collaboration, TTF, FLASH, European XFEL. WILGA also reported developments at, then during the nineties the leading, ring accelerator HERA and one of its large detectors ZEUS (including BAC calorimeter) and Veto Wall. WILGA young researchers participate in experiments performed at GSI in Darmstadt. One of the reported experiments is CBM – compressed baryonic matter. In CERN WILGA young researchers participate in building a new generation of

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photonic and electronic systems for PS – proton synchrotron, SPS, Liniac4, CMS, Atlas, Alice and LHC. The research teams are always international, what results in international authorship of papers and young international guests in WILGA. One of Ph.D. students participates in the development of the White Rabbit project of building a new generation of the dependable transmission network of wideband optical Internet class, with very high degree of QoS (like synchronous systems have, in opposite to Best Effort systems). A group of young researchers work on the new generation of the Safety Interlock system for the LHC. Together WILGA has published more than 200 papers on the participation of young researchers in these large and important HEP technical and scientific experiments.

WILGA Symposium is a place where papers on the development of POLFEL and European XFEL projects used to be presented by involved young researchers. POLFEL is a project to build a Free Electron Laser in IPJ Świerk based on TESLA RF superconducting cavities technology. POLFEL machine, a fourth generation light source, designed for CW and pulsed operation is expected to be a sister partner to the European E-XFEL and will belong to a network of European medium size FEL network like SPARC, FLASH, etc. The mission of POLFEL is development of modern science and novel technologies which require large research infrastructures.

Wilga Symposium is one of the major publishing sites of the results from the Pi-of-the-Sky project [grb.fuw.edu.pl/pi]. Several tens of papers were published since the beginning of the project. The scientific goals of the project are: search for short optical transients of astronomical origin, in particular search for optical flashes accompanying GRB (Gamma Ray Bursts), study fast variable stars, participation in multi-wavelength observing campaigns, monitoring activity of blasars and other AGNs. The modes of operation of the observatory is: self-trigger flash recognition in real-time; following Swift, Integral and Glast FoV; reaction to other GCN alerts; observing some objects from GTN and WEBT lists; all sky survey – twice a night. The system is located in ASAS site, Las Campanas Observatory in Chile (ESO – European Southern Observatory) and is in regular operation since July 2004. The system parameters are as follows: 2×16 CCD cameras $2k\times2k$ pixels; 5-10s exposures; optics: f=85mm, f/d=1.2, FOV$\sim 22^0 \times 22^0$, data stream 128MBps, 5TB/night, on-line analysis due to multilevel trigger, fast reaction to CGN triggers via motorized mount which goes to any point in < 1min., off-line next-day analysis up to 14magnitudo.

Involvement of industry in WILGA Symposium varies from year to year and depends on participation of young research representatives of particular institutions. The following research centers and firms were represented in WILGA: ITR – Institute of Tele and Radioelectronics, ITME – Institute of Electronic Materials, IPJ – Institute of Nuclear Studies in Świerk, IFJ – Institute of Nuclear Physics in Kraków, PIT – Industrial Institute of Telecommunications, IŁ – Institute of Communications, WIŁ – Military Institute of Communications, PIAP – Industrial Institute of Automation and Control, Tektronix, Tespol, and many others. Industrial presentations are of special interest to students as they use the measuring systems in the university laboratories, they are potential

employees of these institutions in the near future, they are potential customers of the presented products. Each year WILGA sees different presentations and small exhibitions by the industry, dedicated for students and young researchers.

WILGA Symposium gave birth to a few topical meetings and conferences which then struck out on their own. These include students regional meetings (Opole, Wrocław, Kielce, Białystok, Lublin, Toruń and other), of SPIE student chapters, IEEE student branches, but also standalone conferences. Some of these meetings are still held periodically with Wilga, while some of them gained complete independence. WILGA is very proud of this sort of parentship, since the very good idea of WILGA is proliferating elsewhere. One of such meetings is, now fully nondependent, SPS – Signal Processing Symposium which started at Wilga in 2003.

III. PUBLICATIONS

WILGA Symposium is a unique meeting showing clearly the continuous progress in realization of dozens of Ph.D theses in photonics and advanced electronics and constant integration and advancement of these technologies in the theses. WILGA Symposium publishes its works in the following proceedings series, technical and peer-reviewed journals: Proceedings of SPIE since 2002, IEEE eXplore, PSP Photonics Letters of Poland since 2009, Elektronika Journal by SEP since 1998, JET – International Journal of Electronics and Telecommunications by PAS (previously Electronics and Telecommunications Quarterly by PAS).

There has been now quite a long tradition of WILGA publishing its works in the worldwide series Proc. SPIE. This volume of Proc. SPIE in the 10th published with WILGA papers. All of the WILGA – SPIE volumes contain more than 900 papers. It is not excluded that WILGA 2011 Proc. SPIE will cross over the 1000th paper. All WILGA Symposiums have published now more than 2000 papers with around 4000 participants. This is an extraordinary achievement for a modest symposium, organized nearly without costs, oriented solely on young researchers. No one event of similar character could compare to this achievement. This success was only possible due to a big involvement of young researchers on behalf of their fellows. WILGA Proceedings of SPIE carry a common title: Photonics Applications in Astronomy, Communications, Industry and High Energy Physics Experiments.

IV. FUTURE

It has to be remembered that WILGA is very different from any typical 'grown up' conference, having young researchers only during a side 'Young Researcher Session' being of not the top interest to the event participants. Frequently this is only a poster session which contain young researchers' presentations. To assess the near term perspectives of WILGA one has to ask a question to young researchers if this sort of introductory to intermediate level meeting is of aid and still of any important meaning to them. Times change and so does Wilga. A tendency is observed that particular university teams arriving at Wilga come only for their and adjacent sessions and then go, not staying longer as it used to be. This small change

means a lot to Wilga. There were famous night research sessions and discussions around the grill – sponsored by IEEE, which grouped large crowd of young scientists from different university centers. Now the late night groups are mainly from a single or at most two or three universities. The participation of young researchers in Wilga is now statistically smaller than it was several years ago (350:150). Also the status of Proc. SPIE (and any other conference proceedings like IEEE and OSA) has changed. The research funding agencies do not fully accept publications in the proceedings preferring papers from peer-reviewed journals as attachments to periodic technical reports – justifying the expenditures. This strongly influences the decisions, where to publish and in what events to participate, of young researchers and mainly their tutors. WILGA gave birth to several other meetings of young researchers. The local research communities sometimes prefer to participate in the local event (less travel and less money and time) organized in the style taken after WILGA.

WILGA Symposium perspectives seem to be bright, despite all of the above discussed positive and less positive development tendencies. WILGA organizers observe it constantly during the annual nice meetings in the country, far from the participants' home laboratories, that the need in young researchers to meet with alike fellow scientists is so strong that the demand for such a meeting will hopefully not cease.

WILGA has a quite strong attracting power for people, institutions and events. It used to obtain proposals to join forces with other initiatives. It never refuses to organize common sessions, open new topics, undertake new presentation methods and ways, and realize new ideas. WILGA tries not to dissipate this positive energy buy rather to accumulate it and use it for good purposes of young research development. WILGA openly offers cooperation to postgraduate student research clubs and chapters at technical universities in the country. This offer results frequently in organizing very interesting topical research sessions and late night events under the auspices of SPIE, PSP and/or IEEE.

V. SPIE-IEEE-PSP WILGA 2010 Symposium

WILGA 2010, January edition was held on 29-30.01 at WUT's FE&IT. WILGA 2010, May edition was held on 24-29.05 traditionally in a resort owned by Warsaw University of Technology. There were delivered nearly 200 presentations during both 2010 editions of Wilga, covering a broad area of photonics applications and web engineering. Nearly 250 persons participated. An exceptionally efficient chair of the Organization Committee of WILGA 2010 was dr Maciek Linczuk [M.Linczuk@elka.pw.edu.pl] usually supported by a team of students. An additional series of WILGA sessions on signal processing was held during the 2010 Microwave and Radar Week in Vilnius.

The working research Sessions of 26th WILGA 2010 were: photonics, photonic and refractive optical fibers, optoelectronics, applications of optical fibers, integration of electronics, photonics and mechatronics, distributed measurement systems, LHC and CMS at CERN, optics and optoelectronics for astronomy, fundamentals of FPGA-DSP systems, object ori-

ented design of hardware, terabit optical data links, software-hardware co-design, biomedical engineering, computational intelligence of advanced systems, signal processing, radar imaging, laser ranging, photonic telemetry, photonic sensing, photonic computing, future photonic architectures, etc. Below there is presented a short digest of some of the WILGA 2010 sessions. Some of these presentations are published in this volume. Some of the papers were submitted to the previously mentioned journals. A few papers were submitted in Polish to the domestic professional journals while their English versions are published here.

VI. Photonic and Refractive Optical Fibers

An extended session on photonic and refractive optical fibers contained papers on fiber modeling, fundamental optical effects, fiber manufacturing, physical and optical characterization. Several teams were presenting their achievements. A number of essential works on nonlinear holey optical fibers impregnated with liquid crystals in done at the Faculty of Physics, WUT. Ten Ph.D. students from this group presented papers on all aspects of liquid crystal filled optical fibers. There were shown new constructions of photonic liquid crystal fibers with inbuilt either optical and/or optical tunability. The fibers were used for construction of various sensors like: fiber loop sensor for vibration monitoring, hollow core Bragg fiber for bio sensing, liquid crystal fiber interferometers and polarimeters, hybrid fiber sensors for measuring of thermal and mechanical stress. Some of these liquid crystal fibers were manufactured at Fiber Optics Laboratory of UMCS University in Lublin, under the leadership of the late prof. Jan Rayss and dr Jan Wójcik. The biggest laboratories doing research on complex photonic liquid fibers including classical ones, soft glass, non-silica glass, liquid crystal, nonolinear, perturbed, etc are at Faculty of Physics, WUT under the leadership of prof. A.Domanski and prof.T.Wolinski, also at Wrocław Univ. of Technology – prof.K.Abramski, prof.W.Urbańczyk. Strong technological laboratories of optical fibers are also located at Białystok Univ. of Technology and at ITME in Warsaw. Glasses for optical fibers are researched at AGH in Kraków – prof. Jan Wasylak.

VII. Optoelectronics Applications

Optoelectronic applications is one of the main subjects of WILGA. Recently, to research, test, environmental and industrial applications, there were added biomedical ones. A team under the leadership of dr M. Borecki from IMIO WUT presented fiber optical and physical-chemical analysis system of organic and biological fluids like milk, oils, alcohols, etc. A very interesting on-line real-time measurement system was build, basing on optical fiber capillary, checking the fertility in cows.

Optical tomography of female breasts versus X-ray tomography was performed on breasts phantoms with implanted optical inhomogeneities. A paper on this subject was presented from prof. A. Domanski's team of young researchers.

VIII. COMPUTATIONAL INTELLIGENCE OF COMPLEX SYSTEMS

Complex systems are potentially a very rich field of novel applications of photonics, electronics and IT systems. A rich session on the subject was organized by prof. S. Jankowski of WUT and his Ph.D. students. The major research concern of this group is data classification using diversified theoretical models like mutual information, support vector machine, complex statistics, focused correlations, etc. Such embedded intelligence is of essential meaning for the complex system functionality. A number of such systems either rely on large data sets from data bases or they collect on-line data from large sensory networks including optical networks and photonic sensors.

IX. BIOMEDICAL INFORMATION TECHNOLOGY

The Biomedical and environmental session was devoted to the problems of environmental sensor fusion (a presentation by prof. L. Opalski – Warmer Project) and knowledge discovery from massive medical measurement data bases. The sine qua non condition of knowledge discovery is data quality in big sets. Such sets of good quality are rare. Data bases from the past hardly fulfill these conditions. They are not full. This interesting research direction is frequently associated with building of such data bases from the scratch. This in turn enters even more general problems of organization and administration of health services in particular countries and regions in the near future.

X. OBJECT ORIENTED DESIGN OF ELECTRONIC SYSTEMS

A session devoted to object design of hardware and software concerned optimization of interaction, and task sharing between these two system layers. New questions were asked associated with object approach to hardware design in such a way as to obtain the best fit between the corresponding object structures in both layers. Automation of optimal complex code generation was considered in C++, VHDL and MatLab script. A few Ph.D. theses is under preparation in this relatively new topical area. The area embraces such research as: integration of hardware and software, functions sharing between hardware and software, functions exchange, configurability, optimization of available physical system resource usage. This session embraces also architectures for novel, efficient FPGA-DSP solutions.

XI. ELECTRONIC SYSTEMS FOR HIGH ENERGY PHYSICS EXPERIMENTS

The session on electronics for HEP experiments, was associated with the EuCARD Project and concerned the following subjects: building of TOTEM detector for research of internal three layered bag structure of the proton; CMS spectrometer designed for Higgs boson search; European free electron laser E-XFEL; safety Interlock system for LHC accelerator; modernization of the PS and SPS accelerators in CERN, etc. The electronic systems for HEP have very special properties. They usually are constructed as distributed measurement and measurement-control systems with numerable measuring and large amount of data acquisition channels. Most of these data are not useful, thus they have to be triggered at several levels. These systems are synchronous with precise data stamping to enable reconstruction of the physically interesting event. The HEP apparatus has large dimensions and very precise time distribution is necessary to all parts of the measuring network. A paper on synchronization issues was presented by dr K. Poźniak.

XII. PHOTONIC AND ELECTRONIC SYSTEMS FOR ASTRONOMY AND SPACE TECHNOLOGY

Photonics, optics and optoelectronic applications is astronomy and space technologies originate in WILGA from several main sources. These are: Pi-of-the-Sky project which recently extends widely beyond strict observations of the consequences of the GRB effects, Mikołaj Kopernik Space Research Center where several Ph.D. students work on new satellite projects, and Students Research Group on Space Technologies at WUT – working on international projects to build small students satellites, attached additionally to larger projects.

A number of M.Sc. and Ph.D. theses is realized in cooperation with WUT and CBK as well as IPJ. The conducted research concerned new solutions to CCD converters and building of ultra low noise cameras for astronomical research applications. A number of papers were presented on next generation CCD cameras for Pi-of-the-Sky project to observe optical counterparts to GRB effects. Now the prevailing theories say that GRB is a signature of a birth of a black hole. A generated jet of relativistic matter along the axis of the rotation of collapsing celestial body is a source of ultra strong synchrotron radiation. This radiation is detected on Earth or by the satellites. The role of the Pi-of-the-Sky telescopes is a wide angle observations of the whole sky, for relatively not big values of the 'magnitudo', but with the possibility to generate a negative observation time from a particular event – designated as zero time. The work on Pi-of-the-Sky cameras lead the team to design really ultimately low-noise CCD based apparatus. The cameras are now applied also in quite different fields like research and industry.

XIII. FUNCTIONAL APPLICATIONS OF ELECTRONIC SYSTEMS

A session on applications contained nearly twenty papers on the following subjects: building of a miniature quadrocopter; control system development in robotics; minimal-energy functional systems combined with energy harvesting technology; image recognition for the purpose of road traffic analysis, safety and protection (including registration tables recognition); safe, reliable and ultrastable power mains for biomedicine; power supplies for photomultipliers; 3D laser scanners; and other. The electronic systems with energy harvesting capability use all possibilities to recover energy from the environments they reside i.e. temperature differences, optical illumination, etc.

Fig. 1. WILGA 2010 SPIE-PSP Award Ceremony for the best student paper presentation, Faculty of Physics WUT, 18.06.2010. The Winners are: Ph.D. students – 1. Grzegorz Kasprowicz, 2. Piotr Makowski, 3. Katarzyna Ławniczuk, Konrad Futera; M.Sc. students – 1. Piotr Obroślak, 2. Piotr Florczyk, 3.Anna Manerowska, 4. Piotr Więckowski, 5. Agnieszka Zagoździńska

XIV. DIGITAL SIGNAL PROCESSING AND RADARS

The session on digital signal processing and high performance computing (HPC) contained works on design and software for DSP processor cluster and PC cluster. Cluster calculations embrace also the research on computing problem decomposition to parallel streams of tasks. Cluster based HPC are used for factorization of large numbers, inversion of large matrixes, speeding of floating number calculations, solving complex problems, etc. There were considered hardware issues of efficient microprocessor clustering, and software ones concerning parallelization of the computation tasks. The analysis included also on-line data provision in large amounts, including photonic methods, to the processing node.

Radar, including optical and THz radar, as well as passive radar, and RF technologies are developing rapidly due to the demand generated by mobility, safety, localization and remote sensing capabilities. A few sessions were organized on these subjects. Weak GSM signal was reconstructed with MLSE detection. OFDM transmission system was used for research experiments in RF and optical domains. Software radio solutions were used for building seeded sensory networks for environment monitoring, safety and other purposes. Several remote sensing solutions were presented for research and measurement purposes. RF and optical techniques were compared.

XV. NANOMATERIALS AND METAMATERIALS TECHNOLOGY

Nanomaterials and metamaterials are said to be the future of photonics and electronics alike. A session on novel materials and material engineering was organized by representatives of several institutes including ITR and ITME in Warsaw, and IMIO WUT. A class of nanomaterials bases on silver nanopowders. These nanopowders may be dispersed in support matrices like glass, ceramics or low-loss polymers to build metamaterials of predesigned parameters in the time, frequency or wavelength domains. The nanopowders are added to nano-inks for printing flexible photonic and electronic circuits. Among other research directions, metamaterials (metaglasses) are searched for which have negative refraction for optical frequencies. A special direction in material research create photonic crystals (in other terms – photonic structural materials), which are a sort of ultra low-loss photonic semiconductors. Several papers on the above mentioned subjects are published in WILGA 2010 proceedings.

XVI. INTERNET AND WEB ENGINEERING

Web and Internet engineering embraces many hardware and software problems. The hardware layer contains for example embedded web micro-servers in all kinds of appliances and user devices like in cars, homes, but also communications between the machines (M2M). The software layer and mixed layer contains a diversity of web access via the PC and without the usage of a PC.

XVII. CONCLUSION

WILGA Symposium on Photonics Applications and Web Engineering, now in its 26th edition and 13 years of existence is a mature, high quality event oriented at young researchers. They value in WILGA its openness, high demands, friendliness, international atmosphere, very interesting and very current topics, etc. WILGA hopes to continue its modest mission to help young researchers to further develop their own professional career. WILGA hopes to be a memorable event in their lives at the beginning of their professional careers, one which is not to be ever forgotten.

WILGA 2011 Symposium program and plans for the joint SPIE-PSP-IEEE $XXVII^{th}$ meeting at the Faculty of Electronics and Information Technologies WUT on 28-30 January 2011 and $XXVIII^{th}$ meeting in WILGA on 23-29 May 2011 are accessible on the web http://wilga.ise.pw.edu.pl. The communications with WILGA organizers, registration and paper submissions are open at photonics@ise.pw.edu.pl.

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