PROCEEDINGS OF SPIE

SPIE – The International Society for Optical Engineering

Photonics Applications VII In Astronomy, Communications, Industry and High-Energy Physics Experiments

Ryszard S. Romaniuk Conference Chair/Editor

21 – 27 May 2007 Wilga, Poland

Organized by

PERG & ELHEP Laboratories, Institute of Electronic Systems Warsaw University of Technology (Poland)Student Branch, SPIE Poland ChapterStudent Branch, IEEE Poland Section

Sponsored by

IEEE Poland Section & SPIE Poland Chapter Faculty of Electronics and Information Technologies, Warsaw University of Technology Institute of Electronic Systems, Warsaw University of Technology (Poland) Committee of Electronics and Telecommunications, Polish Academy of Sciences Polish Committee of Optoelectronics, Association of Polish Electrical Engineers Industrial Institute of Telecommunications (Poland) Sołtan Institute for Nuclear Studies, Świerk (Poland)

In Cooperation with CERN, Geneva, Switzerland DESY, Hamburg, Germany TTC, TESLA Technology Collaboration CARE, Coordinated Accelerator Research in Europe ELAN, European Linear Accelerator Network CEA, DAPNIA, Saclay, France XFEL, Poland Consortium

SPIE Proceedings Series Volume 6937 The papers published in thie volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or any outcomes resulting from reliance thereon.

Please use the following format to cite material from this boiok:

Author(s), "Title of Paper" in Photonics Applications in Astronomy, Industry and High Energy Physics Experiments, edited by Ryszard S.Romaniuk, Proceedings of SPIE Vol 6937 (SPIE, Bellingham, WA, 2007) Article CID Number

The volume is in two parts and contains 151 papers.

ISSN 0277-786X ISBN 9780819471246

Published by **SPIE – The International Society for Optical Engineering** P.O.Box. 10, Bellingham, Washington 98227-0010 USA Telephone 1 360/676-3290 (Pacific Time) Fax 1 360/647-1445 http://www.spie.org

Copyright ® 2007, The Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$15.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at http://www.copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-768X.

Printed in the United States of America.

Contents

Patronage Committee Symposium Committee Conference Organizing Committees Conference Organizers, Sponsors and Cooperating Organizations Introduction and Foreword Palindromes in Mathematics (Plenary Paper), W. Plandowski, Warsaw University (Poland)

PART ONE OF TWO PARTS

SESSION 1 APPARATUS FOR OPTICAL AND GAMMA-RAY ASTROPHYSICAL OBSERVATIONS

In memory of Bohdan Paczynski (Invited Paper) [6937-01]

M.Rozyczka, Nicolaus Copernicus Astronomical Research Center, Warsaw (Poland)

Full "Pi of the Sky" system and simulation" (Invited Paper) [6937-02]

J.Uzycki, Warsaw Univ. of Technology (Poland), M.Cwiok, Warsaw Univ. (Poland), L.Mankiewicz, Center of Theoretical Physics, Warsaw (Poland), K.Nawrocki, M.Sokolowski, W.Tlaczala, G.Wrochna, Soltan Institute for Nuclear Studies, Swierk (Poland)

Period and variability type determination for the stars in the Pi of the Sky data [6937-03]

A.Majczyna, Andrzej Soltan Institute for Nuclear Studies, Swierk (Poland), M.Nalezyty, Warsaw Univ. Observatory (Poland), M.Biskup, Warsaw University (Poland), M.Sokolowski, K.Nawrocki, G.Wrochna, Andrzej Soltan Institute for Nuclear Studies, Swierk (Poland), L.Mankiewicz, Center for Theoretical Physics, Polish Academy of Science, Warsaw (Poland)

Providing on-line access to the "Pi of the Sky" data [6937-04]

M.Biskup, Univ. of Warsaw (Poland), K.Malek, L.Mankiewicz, Center for Theoretical Physics PAS, Warsaw (Poland), L.W.Piotrowski, Univ. of Warsaw (Poland), M.Sokolowski, G.Wrochna, Soltan Institute for Nuclear Studeis, Swierk (Poland), A.F.Zarnecki, Warsaw Univ. (Poland)

Web interface for star databases of the Pi of the Sky experiment [6937-05]

M.Biskup, Univ. of Warsaw (Poland), K.Malek, L.Mankiewicz, Center for Theoretical Physics PAS, Warsaw (Poland), M.Sokolowski, G.Wrochna, Soltan Institute for Nuclear Studies, Swierk (Poland)

Algorithm for automatic estimation of quality of Pi of the Sky data [6937-06]

J.Falzman, Cardinal Stefan Wyszynksi Univ., Warsaw (Poland), L.Mankiewicz, Center of Theoretical Physics, Polish Academy of Sciences, Warsaw (Poland)

Mechanical structure Pi of the Sky robotic telescope [6937-07]

R.Pietrzak, P.Wawer, R.Wawrzaszek, J.Grygorczuk, J.Juchniewicz, Space Research Centre, Warsaw (Poland), L.Mankiewicz, Center for Theoretical Physics PAS, Warsaw (Poland), G.Wrochna, Soltan Institute for Nuclear Studies, Swierk (Poland)

Hardware emulator of the high-resolution CCD sensor for the "Pi of the Sky" experiment [6937-08] G.Kasprowicz, Warsaw Univ. of Technology (Poland), L.Mankiewicz, Center for Theoretical Physics PAS, Warsaw (Poland), K.T.Pozniek, R.S.Romaniuk, S.Stankiewicz, Warsaw Univ. of Technology (Poland), G.Wrochna, Soltan Institute for Nuclear Studies, Swierk (Poland)

NIOS II implementation in CCD camera for "Pi-of-the-Sky" experiment" [6937-09] M.Kwiatkowski, G.Kasprowicz, D.Rybka, R.S.Romaniuk, K.T.Pozniak, Warsaw Uni. of Technology (Poland)

Integrated extension board for on-board computer (OBDH) of SSETI ESEO satellite [6937-10] A.Cichocki, R.Graczyk, Warsaw Univ. of Technology (Poland)

Performance comparison and selection criteria – an assessment for choosing the best flight detector for the SIR-2 NIR-spectrometer on Chandrayaan-1 [6937-11]

P.Sitek, Warsaw Univ. of Technology (Poland) and Max-Planck Institute for Solar Research, Kaltenberg-Lindau (Germany), E.Vilenius, U.Mall, Max-Planck Institute for Solar Research, Kaltenberg-Lindau (Germany)

SESSION 2 FLASH LASER and EUROPEAN X-RAY LASER DEVELOPMENT

Distributed TRIDAQ systems for large HEP experiments; part I – system architecture (Invited Paper) [6937-12]

K.T.Pozniak, Warsaw Univ. of Technology (Poland)

Distributed TRIDAQ systems for large HEP experiments; part II – implementation for BAC (ZEUS at HERA) and RPC (CMS at LHC) detectors (Invited Paper) [6937-13] K.T.Pozniak, Warsaw Univ. of Technology (Poland)

Measurement and control of field in RF GUN at FLASH [6937-14]

A.Brandt, M.Hoffman, DESY, Hamburg (Germany), W.Koprek, P.Pucyk, DESY, Hamburg (Germany) and Warsaw Univ. of Technology (Poland), K.T.Pozniak, R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

Calibration procedure of extreme ultraviolet detectors [6937-15]

J.Mikolajczyk, Z.Bielecki, Military Academy of Technology, Warsaw (Poland), W.Kolosowski, E.Sedek, Telecommunications Research Institute, Warsaw (Poland)

Multi-cavity complex controller with vector simulator for TESLA technology linear accelerator [6937-16]

T.Czarski, K.T.Pozniak, R.S.Romaniuk, J.Szewinski, Warsaw Univ. of Technology (Poland)

Versatile LLRF platform for FLASH laser [6937-17]

P.Strzalkowski, W.Koprek, K.T.Pozniak, R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

FPGA based PCI mezzanine card with digital interfaces [6937-18]

K.Lewandowski, R.Graczyk, K.T.Pozniak, R.S.Romaniuk, Warsaw Univ. Technology (Poland)

Data acquisition module implemented on PCI mezzanine card [6937-19]

L.Dymanowski, L.Graczyk, K.T.Pozniak, R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

Vector modulator board for X-FEL LLRF system [6937-20]

M.Smelkowki, P.Strzałkowski, K.T.Pozniak, Warsaw Univ. of Technology (Poland), M.Hoffman, DESY, Hamburg (Germany)

FPGA system development based on universal control module [6937-21]

R.Graczyk, K.T.Pozniak, R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

DSP algorithms in FPGA – proposition of a new architecture [6937-22] P.Kolasinski, W.Zabolotny, Warsaw Univ. of Technology (Poland)

Matlab script to C code converter for embedded processors; Application in LLRF system for FLASH laser [6937-23] K.Bujnowski, A.Siemionczyk, P.Pucyk, J.Szewinski, K.T.Poźniak, R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

Decomposition of Matlab script for FPGA implementation of real time simulation algorithms for the LLRF system in the European XFEL [6937-24]

K.Bujnowski, P.Pucyk, K.T.Pozniak, R.S.Romaniuk, Warsaw Univ. of Technology (Poland) and DESY, Hamburg (Germany)

FPGA control utility in Java [6937-25]

P.Drabik, K.T.Pozniak, Warsaw Univ. of Technology (Poland)

SUPERCONDUCTIVE ACCELERATOR TECHNOLOGY FOR FREE SESSION 3 ELECTRON LASER AND HIGH ENERGY PHOTON PHYSICS

Recent achievements in ultra-high vacuum arc deposition of superconducting Nb layers [6937-26] L.Catani, A.Cianci, D.DiGiovanale, INFN Roma TorVergata (Italy), R.Polini, S.Tazzari Universita di Roma Tor Vergata (Italy), J.Lorkiewicz, M.J.Sadowski, P.Strzyzewski, The Andrzej SOLTAN Institute for Nuclear Studies, Swierk (Poland), B.Ruggiero, R.Russo, Instituto di Cibernetcia del CNR and INFN (Italy)

Copper TESLA structure – measurement and control [6937-27]

J.Glowka, M.Macias, Warsaw Univ. of Technology (Poland)

Pd nanocrystalline films for electron sources [6937-28]

E.Czerwosz, Swietokrzyska Academy, Kielce (Poland), R.Diduszko, Industrial Institute of Electronics, P.Dluzewski, Institute of Physics, Polish Academy of Sciences, Warsaw (Poland), J.Keczkowska, Kielce Univ. of Technology (Poland), M.Kozlowski, Industrial Institute of Electronics, Warsaw (Poland), M.Suchanska, Kielce Univ. of Technology (Poland)

Copper electropolishing versus electrodes modifying electric field in the electro-crystallization process [6937-29]

A.Bialostocka, L.Zaniewski, Bialystok Univ. of Technology (Poland)

FPGA based triggers in the Pierre Auger Observatory [6937-30]

Z.Szadkowski, Pierre Auger Collaboration and Univ. of Lodz (Poland)

Data acquisition card for CERN Proton Synchrotron beam current transformers [6937-31] G.Kasprowicz, Warsaw Univ. of Technology (Poland) and CERN, Geneva (Switzerland)

Direct digital modulation system for LLRF [6937-32] S.Tarnowski, A.Piotrowski, A.Napieralski, Lodz Univ. of Technology (Poland)

AVR microcontroller simulator for a software implemented hardware fault tolerance algorithms research [6937-33] A.Piotrowski, S.Tarnowski, A.Napieralski, Lodz Univ. of Technology (Poland)

Partial reconfiguration-oriented design of logic controllers [6937-34] M.Doligalski, M.Wegrzyn, Univ. of Zielona Gora (Poland)

SESSION 4 PHOTOACOUSTICS AND ULTRASHORT PULSE TECHNOLOGY

Comparison of FFT and LMS applied to photo acoustic signal detection [6937-35] T.Starecki, T.Owczarek, Warsaw Univ. of Technology (Poland)

Comparizon of photoacoustic Helmholtz resonator models [6937-36] M.Suchenek, Warsaw Univ. of Technology 0(Poland)

A pulser with inverted microstrip line for time-domain reflectometry [6937-37] K.Opalska, S.Misiaszek, Warsaw Univ. Technology (Poland)

Low-cost trigger circuit for sampling oscilloscope [6937-38] A.Burd, K.Opalska, Warsaw Univ. of Technology (Poland)

Statistical method of evaluation of flip-flop dynamical parameters [6937-39] P.Z.Wieczorek, L.J.Opalski, Warsaw Univ. of Technology (Poland)

Design of two-channel oscilloscope and basic circuit simulations in LabView [6937-40] P.Balzhiev, Sofia Univ. of Technology (Bulgaria), J.Makal, Białystok Univ. of Technology (Poland)

SESSION 5 OPTICAL FIBER TECHNOLOGY AND MEASUREMENTS

Nonlinear optical glasses for photonics – a review; part I – nonlinear electrical susceptibility and refractive index (Invited Paper) [6937-41] R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

Nonlinear optical glasses for photonics – a review; part II – Kerr nonlinearity and metaglasses of positive and negative refraction (Invited Paper) [6937-42] R.S.Romaniuk, Warsaw Univ. of Technology (Poland)

Pulse generation, spectroscopy and transitions dynamics of Er³⁺ in YAG host [6937-43] P.Konieczny, J.Swiderski, A.Zajac, Military Academy of Technology, Warsaw (Poland)

UV-violet optical transitions and excitation schemes in Ho³⁺:ZBLAN fibers [6937-44]

M.Klimczak, M.Cieslik, M.Kaczkan, P.Witonski, Warsaw Univ. of Technology (Poland), R.Piramidowicz, Warsaw Univ. of Technology (Poland) and Telekomunikacja Polska Research and Development Centre (Poland)

Erbium doped glasses for optical fiber amplifiers [6937-45]

J.Wojcik, D.Dorosz, Bialystok Univ. of Technology (Poland)

Measurement of relaxation time of fiber amplifiers [6937-46]

A.Splawska, Poznan Univ. of Technology (Poland)

Analysis of the work of non-uniform fiber Bragg grating as a transducer of impulsive strains [6937-47] A.Sikora, Kielce Univ. of Technology (Poland)

Fiber Bragg grating reconstruction by using of the genetic algorithm [6937-48] W.Wojcik, P.Kisala, S.Cieszczyk, Lublin Univ. of Technology (Poland)

The manufacturing of polarization optical fibres [6937-49] A.Zadykowicz, D.Dorosz, Białystok Univ. of Technology (Poland)

The properties of polarization fibres [6937-50] A.Zadykowicz, D.Dorosz, Białystok Univ. of Technology (Poland)

The manufacturing and properties of double-clad optical fibres [6937-51] M.Kochanowicz, D.Dorosz, Białystok Univ. of Technology (Poland)

SESSION 6 OPTICAL FIBER APPLICATIONS

A proposition of multi-parameter photonic method for nano-liter samples examination of liquids with short sections of optical capillaries [6937-52]

M.Borecki, Warsaw Uni. of Technology (Poland), M.L.Korwin-Pawlowski, Univ. du Quebec (Canada), M.Beblowska, P.Wrzosek, Warsaw Uni.of Technology (Poland)

Multimode fiber refractive index profile considerations for mode group diversity multiplexing [6937-53]

G.Stepniak, Warsaw Univ. of Technology, Katowice (Poland)

Incremental optical fibre transmission and reflection sensors [6937-54] J.Kusznier, Bialystok Univ. of Technology (Poland)

The temperature sensor based on capillary waveguide [6937-55] P.Miluski, D.Dorosz, Bialystok Univ. of Technology (Poland)

Optical transmission of the active power filter cooperating with battery energy storage system [6937-56]

A.Kuzma, M.Zajkowski, Bialystok Univ. of Technology (Poland)

Using the CCD camera to record the radiation emitted by a LED matrix [6937-57] J.Parzych, Poznan Univ. of Technology (Poland)

Low electric power supply via optical fibre [6937-58]

W.Wojcik, A.Smolarz, T.Zyska, Z.Lach, Lublin Univ. of Technology (Poland)

Guiding of Rb atoms by capillary optical fibres [6937-59] A.Iwaniuk, J.Dorosz, Bialystok Univ. of Technology (Poland)

Measurement and analysis of polarization mode dispersion [6937-60] S.A.Torbus, Technical Telematic School, Bydgoszcz (Poland)

SESSION 7 NANOMATERIALS AND MATERIAL RESEARCH FOR PHOTONICS AND ELECTRONICS

X-ray diffraction as a tool of ORMOSIL gels structure investigation [6937-61]

E.M.Chodkowska, J.Rayss, Maria Curie-Sklodowska Univ., Lublin, (Poland)

Hybrid microstructures for capillary electrophoresis with micro-channel in photosensitive layer [6937-62]

I.Wyzkiewicz, Institute of Electronic Material Technology, Warsaw (Poland), N.Gorniak, Warsaw Uni. of Technology (Poland), M.Jakubowska, Institute of Electronic Material Technology, Warsaw (Poland), Z.Brzozka, A.Dybko, Warsaw Uni. of Technology (Poland)

High density packing and interconnections for hybrid microelectronics – New trends in material development (Invited Paper) [6937-63]

M.Jakubowska, Institute of Electronic Materials Technology, Warsaw (Poland) and Warsaw Univ. of Technology (Poland)

Thick-film gold and platinum conducting paths for high temperature electronics [6937-64]

M.Jakubowska, Institute of Electronic Materials Technology, Warsaw (Poland), J.Kalenik, Warsaw Univ. of Technology (Poland), K.Kielbasinski, A.Mlozniak, E.Zwierkowska, Institute of Electronic Materials Technology, Warsaw (Poland)

Quality estimation of thick-film resistor terminations based on electrical parameters extraction [6937-65]

K.Kielbasinski, M.Jakubowska, Institute of Electronic Materials Technology, Warsaw (Poland), J.Kalenik, Warsaw Univ. of Technology (Poland), A.Mlozniak, Institute of Electronic Materials Technology, Warsaw (Poland)

Efficient defect structure analysis in semi-insulating materials by support vector machine and relevance vector machine [6937-66]

S.Jankowski, J.Bedkowski, P.Danilewicz, Z.Szymanski, Warsaw Univ. of Technology (Poland)

Application of local cluster neural network to detect structure analysis of semi-insulating GaAs [6937-67]

S.Jankowski, T.P.Pichlak, Warsaw Univ. of Technology (Poland)

Recognition of defect structure of Si(A4) by on-line support vector [6937-68]

T.Dziedzic, J.Bedkowski, S.Jankowski, Warsaw Univ. of Technology (Poland)

Secection of significative samples to reduce the complexity of least-squares supprot vector machine [6937-69]

G.Di Salvo, Univ. degli studi di Catania (Italy), S.Jankowski, E.Piatkowska_Janko, Warsaw Univ. of

Technology (Poland), P.Arena, Univ. degli studi di Catania (Italy)

Multiwalled carbon nanotubes deposition in thick fim silver conductor [6937-70] M.Sloma, Warsaw Univ. of Technology (Poland), M.Jakubowska, A.Mlozniak, Institute of Electronic Materials Technology, Warsaw (Poland)

The observed perturbations in v'=11 of A¹II state of ¹³**C**¹⁶**O molecule** [6937-71] J.Domin, P.Malita, D.Rylska, Rzeszow Univ. of Technology (Poland)

Evaluation of elasticity modulus for textiles filaments [6937-72] T.Wiecek, L.Pekala, A.Podkoscielny, A.Wasilewski, Rzeszow Univ. of Technology (Poland)

Determination of Poisson's ratio for auxetic materials [6937-73] T.Wiecek, A.Belczyk, M.Pucher, A.Wasilewski, Rzeszow Univ. of Technology (Poland)

SESSION 8 TOWARDS OPTICAL AND QUANTUM CRYPTOGRAPHY

Introduction to optical quantum cryptography (Invited Paper) [6937-74] T.Adamski, Warsaw Univ. of Technology (Poland)

Searching for hard instances of CVP problem-cryptographic perspective [6937-75] J.Pardyak, Warsaw Univ. of Technology (Poland)

Analysis of simple current sources and sinks for differential current mode technology [6937-76] K.Golofit, Warsaw Univ. of Technology (Poland)

Improving hard disk data security using a hardware encryptor [6937-77] A.Walewski, Warsaw Uni. Of Technology (Poland)

PART TWO OF TWO PARTS

SESSION 9 MEDICAL X-RAY ACCELERATORS AND BIOMEDICAL APPLICATIONS

Numerical solution of tissue laser welding problem [6937-78] L.Urbanski, D.Podniesinski, A.Zajac, Military Univ. of Technology, Warsaw (Poland)

Multileaf collimator for Coline medical accelerators [6937-79] J.Harasimowicz, G.Plebanski, K.Sajna, Soltan Institute for Nuclear Studies, Swierk (Poland)

Control systems for Coline accelerators [6937-80] A.Baczewski, A.Latala, K.Ceglinska, M.Andrasiak, Soltan Institute for Nuclear Studies, Swierk (Poland)

Parallel computation of the SAR distribution in a 3D human head model [6937-81] W.Walendziuk, Bialystok Univ. of Technology (Poland)

Wireless platform for smart networks [6937-82] M.Kowalska, J.Weremczuk, Warsaw Univ. of Technology (Poland)

Graphical user interface for wireless sensor networks simulator [6937-83] T.Paczesny, D.Paczesny, J.Weremczuk, Warsaw Univ. of Technology (Poland)

Electronic control unit for two stream humidity generator [6937-84] R.Iwaszko, J.Weremczuk, Warsaw Univ. of Technology (Poland)

Electronic rhinological thermometer for three-point air temperature measurement in nasal cavity [6937-85]

M.Snieg, D.Paczesny, J.Weremczuk, Warsaw Univ. of Technology (Poland)

Application of neural classifier to risk recognition of sustained ventricular tachycardia and flicker in patients after myocardial infarction based on high-resolution electroradiography [6937-86] J.Wydrzynski, S.Jankowski, E.Piatkowska-Janko, Warsaw Univ. of Technology (Poland)

<u>SESSION 10</u> WARMER PROGRAM - SENSORY NETWORKS FOR WATER <u>MANAGEMENT/PRESERVATION AND ENVIRONMENTAL PROTECTION</u>

Towards a web enabled multi-sensor monitoring system – the EU FP6 WARMER project (Invited Paper) [6937-87] A.Filipkowski, L.J.Opalski, Warsaw Univ. of Technology (Poland)

System architecture and sensor probes for the WARMER project [6937-88] H.S.Drabczyk, L.J.Opalski, Warsaw Univ. of Technology (Poland)

OGC SWE in WARMER project [6937-89] H.S.Drabczyk, Warsaw Univ. of Technology (Poland)

Modeling of potentiometric sensors sensitive to ions of valency one and two for possible applications in WARMER project (Invited Paper) [6937-90] J.Ogrodzki, Warsaw Univ. of Technology (Poland)

Electrical properties of potentiometric sensors – an empirical study [6937-91] P.Z.Wieczorek, L.J.Opalski, J.Ogrodzki, Warsaw Univ. of Technology (Poland)

SESSION 11 IMAGE PROCESSING

Fuzzy description of image processing [6937-92] B.S.Butkiewicz, Warsaw Univ. of Technology (Poland)

Parametric approach to the retrieval of lossy compressed color images [6937-93] M.Łuszczkiewicz, B.Smołka, The Silesian Univ. of Technology (Poland)

Visual analysis of multidimensional data using fast MDS algorithm [6937-94] P.Pawliczek, W.Dzwinel, AGH Univ. of Science and Technology (Poland)

Application of algebraic graph descriptors for clustering of real-world structures [6937-95] W.Czech, AGH Univ. of Science and Technology (Poland)

Text localization in natural scene images using multiple classifiers [6937-96] A.Kozłowski, P.Strumiłło, Technical Univ. of Lodz (Poland)

Statistical properties of human images obtained by the generalized portrait method [6937-97] L.Kolchenko, R.Sinitsyn, National Aviation Univ. (Ukraine)

A method for verification of dense disparity maps computed from the matching algorithm implemented in the stereovision system [6937-98]

D.Rzeszotarski, P.Skulimowski, P.Strumiłło, Technical Univ. of Lodz (Poland)

Digital image colorization using distance transformation [6937-99] P.Łagodziński, B.Smołka, The Silesian Univ. of Technology (Poland)

Color calibration and detection for 3D object modeling with color structured light [6937-100] A.Ołdak, W.Skarbek, Warsaw Univ. of Technology (Poland)

Code domain steganography in video tracks [6937-101] S.Rymaszewski, Warsaw Univ. of Technology (Poland)

Zonal compression of greyscale images using Walsh nd PWL transforms [6937-102] D.Wiraszka, R.Spadlo, Kielce Univ. of Technology (Poland)

Minutiae matching using local pattern features [6937-103] M.Jedryka, Z.Wawrzyniak, Warsaw Uni. Of Technology (Poland)

SESSION 12 PASSIVE AND ACTIVE RADAR IMAGING

Ka-band bistatic ground-based SAR using noise signals (Invited Paper) [6937-104] K.Lukin, A.Mogyla, P.Vyplavin, V.Palamarchuk, O.Zemlyaniy, V.Tarasenko, N.Zaets, V.Skretsanov, A.Shubniy, V.Glamazdin, M.Natarov, O.Nechayev, Institute of Radiophysics and Electronics of NAS of

Antenna Array with synthetic aperture [6937-105]

Ukraine (Ukraine)

K.Lukin, A.Mogyla, P.Vyplavin, Institute of Radiophysics and Electronics of NAS of Ukraine (Ukraine)

Implementation of the Phase Gradient Autofocus algorithm for Spotlight SAR [6937-106] M.Kuzniak, M.Malanowski, Warsaw Univ. of Technology (Poland)

Influence of Integration Time Length on Tracking Performance in PCL Radar [6937-107] M.Malanowski, Warsaw Univ. of Technology (Poland)

Increasing the classification-performance of a classifier via sub-space based classifications [6937-108] K.Rosenbach, J. Schiller, FGAN (Germany)

Passive radar prototypes for multifrequency target detection [6937-109] C.Bongioanni, F.Colone, S.Bernardini, L.Lelli, A.Stavolo, P.Lombardo, Univ. of Rome La Sapienza (Italy)

Multilook colour mapping in SAR iImages [6937-110]

A.Gadoś, A.Gorzelańczyk, M.Mordzonek, P.Samczyński, M.Smolarczyk, Telecommunications Research Institute, (Poland), K.Kulpa, Warsaw Univ. of Technology (Poland)

Resampling methods for stretch processing in PCL radars [6937-111] J.Misiurewicz, Warsaw Univ. of Technology (Poland)

Noise radar target detection in the presence of alpha-stable noise [6937-112] Z.Gajo, M. Malanowski, Warsaw Univ. of Technology (Poland)

Simple SAR demonstrator [6937-113] K.Kulpa, J.Misiurewicz, Warsaw Univ. of Technology (Poland)

SESSION 13 SIGNAL PROCESSING

Fuzzy analog and discrete time invariant systems (Invited Paper) [6937-114] B.S.Butkiewicz, Warsaw Univ. of Technology (Poland)

Synthesizing a 3D auditory scene for use in an electronic travel aid for the blind [6937-115] M.Bujacz, P.Strumiłło, Technical Univ. of Lodz (Poland)

Storing digital data using zero-compression method [6937-116] Abdel-Rahman Al-Qawasmi, Philadelphia Univ. (Jordan), Aiman Al-Lawamaa, Mutah Univ. (Jordan)

Kernel estimate of the spoken language sound multivariate probability density function [6937-117] Z.Bokal, R.Sinitsyn, National Aviational Univ. (Ukraine)

Precision matrix as a construction tool of linear estimators [6937-118] J.Karwatka, Telecommunications Research Institute, (Poland)

Comparison of eyeblink monitoring and EEG signal analysis for mental fatigue assessment [6937-119] A.Królak, P. Strumiłło, Technical Univ. of Lodz (Poland)

Head Related Transfer Function measurement and processing for the purpose of creating a spatial sound environment [6937-120] M. Pec, M. Bujacz, P. Strumiłło, Technical Univ. of Lodz (Poland)

Support Vector Machines: Heuristic of alternatives [6937-121]

M.Orchel, AGH Univ. of Science and Technology (Poland)

Method for Edge Detection in Images Using Fuzzy Relation [6937-122] G.Nieradka, Warsaw Univ. of Technology (Poland)

Voice Activity Detection for Speaker Verification Systems [6937-123] F.Borowski, Warsaw Univ. of Technology (Poland)

SESSION 14 RADAR TECHNOLOGY

Reflections from Raindrops in Case of Turbulence: Phenomenological Analysis and Signal Processing (Invited Paper) [6937-124] Y.S.H.Khraisat, Al_Balqa Applied Univ. / Al-huson Univ. College (Jordan), F.Yanovsky, National Aviation Univ. (Ukraine),

Situation Analysis for Automotive Pre-Crash Systems (Invited paper) [6937-125]

M.Boehning, H.Ritter, H.Rohling, Hamburg University of Technology (Germany)

Through the Wall Seeing in the ELF Band [6937-126] Jaroslav Cechak, University of Defence, Brno (Czech Republic)

Two Dirac-Deltas Detector Analysis for Target Detection in Non-Gaussian Sea Clutter [6937-127] T.Górski, A.Kawalec, W.Czarnecki, Military Univ. of Technology (Poland), J. M. Le Caillec, L. Lecornu, GET- École Nationale Supérieure des Télécommunications de Bretagne (France)

Influence of a non-Gaussian state model on the position estimation in the nonlinear filtration [6937-128] S.Konatowski, B.Pudlak, Military Univ. of Technology (Poland)

LFM radar signal detection in the joint time-frequency domain [6937-129] Y.Grishin, W.Niczyporuk, Bialystok Technical Univ. (Poland)

Correction of Radar Signal on Elevation Angle when Reflecting from Turbulent Zone [6937-130] Y.Averyanova, A.Averyanov, F.Yanovsky, National Aviation University (Ukraine)

Computer-aided methods of the LPI radar signal detection and classification [6937-131] Y.Grishin, D.Jańczak, Bialystok Technical Univ. (Poland)

Time-frequency Zadeh filtering in estimation of radar signals embedded in non-gaussian disturbances [6937-132]

E.Świercz, Bialystok Technical Univ. (Poland)

The digital electronic intelligence ELINT receiver [6937-133] P.Hubáček, J.Veselý, University of Defence (Czech Republic)

An extreme value theory approach to correlated radar clutter [6937-134] M.Piotrkowski, Warsaw Univ. of Technology (Poland)

SESSION 15 OPTICAL AND RADIOFREQUENCY TECHNOLOGY

Scanning nanojet lithograph and microscope [6937-135] I.Timoshchenko, Belarusian State Univ. (Belarus)

Computer aided designing of microwave frequency discriminator [6937-136] P.Kaczmarek, Military Univ. of Technology (Poland)

Just Noticeable Difference level estimation in real-time Digital Signal Processing [6937-137] Z.Piotrowski, W.Rudkowski, Military Univ. of Technology (Poland)

Phase Drift effect minimization in HF/VHF radio links using Phase Drift Scanner method [6937-138] Z.Piotrowski, P.Gajewski, Military Univ. of Technology (Poland)

Smart dust technology for detection and Identification of persons [6937-139] J.Cechak, University of Defence (Czech Republic)

Code-Division Multiple-Access Protocol for Active RFID systems [6937-140] G.Mazurek, J.Szabatin, Warsaw Univ. of Technology (Poland)

Flexible Hardware Platform for Software Radio Experiments [6937-141]

G.Mazurek, MM.lanowski, K.Kulpa, Warsaw Univ. of Technology (Poland)

SESSION 16 OPTICAL MEASUREMENTS

Optical measurements technology and systems in the Institute of Applied Optics [6937-142] J.Galas, D.Litwin, Institute of Applied Optics, Warsaw (Poland)

Present design of lens axicons and their history [6937-143]

K.Kolacz, Institute of Applied Optics, Warsaw (Poland), A.Burvall, A.Goncharov, Applied Optics Dept., Nat. Univ. of Ireland, Galway (Ireland), Z.Jaroszew3icz, Institute of Applied Optics and, National Institute of Telecommunications, Warsaw (Poland), Ch Dainty, National Univ. of Ireland, Galway (Ireland), A.T.Frieberg, Royal Inst. of Technology, Kista (Sweden)

Silicon wafers for scanning helium microscopy [6937-144]

D.Litwin, J.Galas, S.Sitarek, Institute of Applied Optics, Warsaw (Poland)

A method of measurement of gradient-index elements [6937-145]

M.Wychowaniec, Institute of Applied Optics, Warsaw (Poland)

Optical properties of the grating with 1300 lines/mm at PGS-2 spectrograph [6937-146] J.Domin, J.Fal, A.Kadziolka, L.Tylski, Rzeszoe Univ. of Technology (Poland)

SESSION 17 ALGORITHMS FOR DATA PROCESSING

Algorithms for data processing in FSCW systems [6937-147]

K.Korszen, National Institute of Telecommunications, Warsaw (Poland), J.Dawidczyk, Warsaw Univ. of Technology (Poland)

The algorithm of optimal linearization of non-linear state equation [6937-148] J.Forenc, Bialystok Univ. of Technology (Poland)

The selected aspects of the global linearization of non-linear state equation [6937-149] P.Myszkowski, Białystok Univ. of Technology (Poland)

The use of parallel computations in a 2-D numerical simulation of non-stationary thermal field in a cylindrical wire [6937-150] J.Golebiowski, R.P.Bycul Tecnical Univ. of Bialystok (Poland)

A bridge-circuit for experimental simulation of quasi-static bending tests [6937-151] A.Idzkowski, W.Walendziuk Białystok Univ. of Technology (Poland)

Simulation of the voltage transformer metrological characteristics [6937-152] M.Kaczmarek, R.Chmielewski, Lodz Univ. of Technology (Poland)

Author Index

Wilga Symposia Permanent Patronage Committee

Prof. Jan Dorosz, WILGA Symposium Program Committee Chair, Faculty of Electrical Engineering, Bialystok Univ. of Technology (Poland) (doroszjan@pb.bialystok.pl)

Prof. Henryk Fiedorowicz, Director of Institute of Optoelectronics, Military Academy of Technology, Warsaw (Poland)

(hfiedorowicz@wat.edu.pl)

Dr Jacek Galas, vice-Director of Institute of Applied Optics, Warsaw (Poland) (galas@inos.pl)

Prof. Bogdan Galwas, Dean of the Faculty of Electronics and Information Technologies, Institute of Telecommunication, Warsaw University of Technology (Poland) (b.galwas@elka.pw.edu.pl)

Prof. Marian P.Kaźmierkowski, Past Chair of IEEE Poland Section, Director of Institute of Control and Industrial Electronics, Faculty of Electrical Engineering, Warsaw University of Technology (Poland) (mpk@isep.pw.edu.pl)

Prof. Jerzy Klamka, Association of Polish Electrical Engineers, Editor-in-Chief of Elektronika Monthly (Poland)

(elektronika@red.pl.pl)

Dr Dariusz Litwin, vice-Director of Institute of Applied Optics, Warsaw (Poland) (dlitwin@inos.pl)

Prof. Andrzej Pacut, Chair of IEEE Poland Section, Institute of Control and Computation Engineering, Faculty of Electronics and Information Technologies, Warsaw University of Technology (Poland) (a.pacut@ia.pw.edu.pl)

Prof. Ryszard S.Romaniuk, WILGA Symposium Chair, Chair of PERG/ELHEP Laboratory, Institute of Electronic Systems, FE&IT, Warsaw University of Technology, (Poland) (r.romaniuk@spie.pl)

Prof. Jerzy Szabatin, Director of Institute of Electronic Systems, Faculty of Electronics and Information Technologies, Warsaw University of Technology (Poland) (j.szabatin@ise.pw.edu.pl)

Prof. Tomasz R.Woliński, Chair of SPIE Poland Chapter, Director of Optics Division, Faculty of Physics, Warsaw University of Technology, (Poland) (wolinski@if.pw.edu.pl)

Prof. Wiesław L.Woliński, Corresponding Member of Polish Academy of Sciences, Chair of Electronics and Telecommunications Committee of Polish Academy of Sciences, Chair of Polish Optoelectronics Committee, Association of Polish Electrical Engineers, Institute of Micro and Optoelectronics, FE&IT, Warsaw University of Technology (Poland) (w.wolinski@elka.pw.edu.pl)

Prof. Grzegorz Wrochna, Director of Soltan Institute for Nuclear Studies, Warsaw (Poland) and CERN, Geneva (Switzerland) (wrochna@fuw.edu.pl)

Prof. Andrzej Zając, Institute of Optoelectronics, Military Academy of Technology, Warsaw (Poland) (A.zajac@pb.bialystok.pl)

Wilga 2007 Symposium Committees

- Conference on Photonics and Electronics for Astronomy and High Energy Physics Experiments (21 May and 25-27 May); Chairs: R.S.Romaniuk and G.Wrochna
- Conference on Photonics and Web Engineering (22 -24 May); Chair: J.Dorosz
- Conference on Photonics Technologies (22 24 May); Chairs: R.Kisiel, M.Borecki, K.T.Pozniak
- Conference on DSP and Radar Imaging, (SPS-2007, Jachranka, 24-26 May); Chair K. Kulpa

Members

Tomasz Adamski Warsaw University of Technology (Poland)

Chris Baker University College London, London (GB)

Marek Banaszkiewicz Space Research Center of Polish Academy of Sciences, Warszawa (Poland)

Michał Borecki Warsaw University of Technology (Poland)

Zbigniew Czekała RADWAR S.A., Warsaw, (Poland)

Jan Domin

Rzeszów University of Technology (Poland)

Jan Dorosz

Białystok University of Technology (Poland) - CHAIRMAN of WILGA Program Committee

Andrzej Domański Warsaw University of Technolo

Warsaw University of Technology (Poland)

Antoni Grzanka

Warsaw University of Technology (Poland)

Krzysztof Holejko

Warsaw University of Technology (Poland)

Stanisław Jankowski

Warsaw University of Technology (Poland)

Leszek Jaroszewicz

Military Academy of Technology, Warsaw (Poland)

Zbigniew Jaroszewicz

Institute of Applied Optics, Warsaw (Poland)

Kazimierz P. Jedrzejewski

Warsaw University of Technology (Poland)

Military University of Technology, Warsaw (Poland) **Ryszard Kisiel** Warsaw University of Technology (Poland) Wiesław Klembowski Telecommunication Research Institute, Warsaw (Poland) **Krzysztof Kulpa** Warsaw University of Technology (Poland) **Konstantin Lukin** Institute of Radiophysics & Electronics, Kharkov (Ukraine) Lech Mankiewicz Center of Theoretical Physics, Polish Academy of Sciences, Warsaw (Poland) **Bhaskar Mukherjee** DESY, Hamburg (Germany) Jan Ogrodzki Warsaw University of Technology (Poland) Leszek Opalski Warsaw University of Technology (Poland) Jerzy Pietrasiński

Military University of Technology, Warsaw (Poland) Krzysztof T.Poźniak

Warsaw University of Technology (Poland)

Michal Ramotowski Warsaw University of Technology (Poland)

ELHEP Group Coordinator

Ryszard S.Romaniuk

Warsaw University of Technology (Poland), General Chair of WILGA Symposium

Marek Sadowski

Adam Kawalec

Sołtan Institute for Nuclear Studies, Świerk (Poland)

Jacek Sekutowicz DESY, Hamburg (Germany)

Edward Sędek Industrial Institute of Telecommunications, Warsaw (Poland)

Stefan N. Simrock DESY, Hamburg (Germany)

Tomasz Starecki Warsaw University of Technology (Poland)

Małgorzata Suchańska Kielce University of Technology (Poland)

Mirosław Świercz

Białystok University of Technology (Poland)

Sergio Tazzari

University of Rome, Tor Vergata (Italy)

Jerzy Weremczuk

Warsaw University of Technology (Poland)

Tomasz R.Wolinski WarsawUniversity of Technology (Poland)

Jan Wójcik University of Maria Curie-Skłodowska, Lublin (Poland)

Waldemar Wójcik Lublin University of Technology (Poland)

Grzegorz Wrochna

Soltan Institute for Nuclear Studies, Warsaw (Poland) and CERN, Geneva (Switzerland)

Felix Yanovsky National Aviation University, Kiev (Ukraine)

Wilga-Jachranka 2007 Session Chairs/Editors

Apparatus for optical and gamma-ray astrophysical observations Grzegorz Wrochna, Soltan Institute for Nuclear Studies, Swierk (Poland) and CERN Geneva (Switzerland) Lech Mankiewicz, Center for Theoretical Physics, Polish Academy of Sciences, Warsaw (Poland)

2. FLASH Laser and European X-Ray Laser Development Ryszard S.Romaniuk, Warsaw Univ. of Technology (Poland) Krzysztof T.Poźniak, Warsaw Univ. of Technology (Poland)

3. Superconductive accelerator technology for free electron laser and high energy photon physics Ryszard S.Romaniuk, Warsaw Univ. of Technology (Poland) Marek Sadowski, Soltan Institute for Nuclear Studies, Swierk (Poland) Sergio Tazzari, University of Rome, Tor Vergata (Italy)

Bhaskar Mukherjee, DESY, Hamburg (Germany)4. Photoacoustics and ultrashort pulse technology

Tomasz Starecki, Warsaw Univ. of Technology (Poland)

- 5. Optical fiber technology and measurements Dominik Dorosz, Bialystok Univ. of Technology (Poland)
- 6. Optical fiber applications Michal Borecki, Warsaw University of Technology (Poland)

- 7. Nanomaterials and material research for photonics and electronic Stanislaw Jankowski, Warsaw University of Technology (Poland)
- 8. Towards optical and quantum cryptography Tomasz Adamski, Warsaw University of Technology (Poland)
- 9. Medical X-ray accelerators and biomedical applications
 Antoni Grzanka, Warsaw University of Technology (Poland)
 Ryszard Kisiel, Soltan Institute for Nuclear Research, Swierk (Poland) and WUT
- 10. WARMER Program Sensory networks for water management/preservation and environmental protection

Leszek Opalski, Warsaw University of Technology (Poland) Andrzej Filipkowski, Warsaw University of Technology (Poland)

11. Image Processing

Bohdan Butkiewicz, Warsaw University of Technology (Poland) Jaroslav Cechak, University of Defense, Brno (Czech Republic)

- 12. Passive and Active Radar Imaging Krzysztof S. Kulpa, Warsaw University of Technology (Poland) Joachim Schiller, FGAN (Germany)
- 13. Signal Processing

Mirosław Świercz, Białystok University Of Technology (Poland) Abdel-Rahman Kamel Al-Qawasami, Philadelphia University (Jordan)

14. Radar Technology

Cezary Szczepański, Telecommunications Research Institute, Warsaw (Poland) Felix Yanovsky, National Aviation University, Kiev (Ukraine)

15. Optical and Radiofrequency Technology

Adam Kawalec, Military University of Technology, Warsaw (Poland) Anna Dzvonkovskaya, Hamburg University of Technology, Hamburg (Germany)

16. Optical measurements

Dariusz Litwin, Institute of Applied Optics, Warsaw (Poland) **Jacek Galas**, Institute of Applied Optics, Warsaw (Poland)

17. Algorithms for data processing

Tomasz Wolinski, Warsaw University of Technology, Warsaw (Poland) **Malgorzata Suchanska**, Kilece University of Technology (Poland)

Wilga – Jachranka 2007 Conference Organizing Committee

Dominik Rybka, PERG-ELHEP Laboratory, IES, Warsaw University of Technology (drybka@elka.pw.edu.pl), CHAIR of the Organizing Committee

Jarosław Szewiński, PERG-ELHEP Laboratory, IES, Warsaw University of Technology (j.szewinski@elka.pw.edu.pl)

Krzysztof S. Kulpa, DSP and Radar Imaging Laboratory, IES, Warsaw University of Technology, Committee Staff Coordinator for Jachranka Conference (K.Kulpa@ise.pw.edu.pl)

Jacek Misiurewicz, DSP and Radar Imaging Laboratory, IES, Warsaw University of Technology, (jmisiure@elka.pw.edu.pl)

Maciej Linczuk, PERG-ELHEP Laboratory, IES, Warsaw University of Technology (m/linczuk@elka.pw.edu.pl)

Kamil Maj, PERG-ELHEP Laboratory, IES, Warsaw University of Technology (k.maj@elka.pw.edu.pl)

Piotr Samczyński, Telecommunication Research Institute (psamczynski@pit.edu.pl) **Marcin Smelkowski**, PERG-ELHEP Laboratory, IES, Warsaw University of Technology (m.smelkowski@elka.pw.edu.pl)

Maria Piłka, Director of WUT WILGA Resort

Krzysztof T.Poźniak, PERG-ELHEP Laboratory, IES, Warsaw University of Technology, Committee Staff Coordinator (pozniak@ise.pw.edu.pl)

Michał Ramotowski, PERG-ELHEP Laboratory, IES, Warsaw University of Technology, Student Mentor, PERG-ELHEP Research Group Majordomo (mira@op.pl),

PERG-ELHEP ISE PW Laboratory Graduated Students

Lukasz Dymanowski, Kamil Lewandowski, Tomasz Grzywna, Pawel Drabik, Marek Wilczewski, Tomasz Stanislawski, Jakub Glowka, Mateusz Macias, Tomasz Klonowski, Michal Ladno, Michal Wlodarczyk, Robert Piotrkowicz, Piotr Sitek, Lukasz Koniusz, Piotr Obroslak, Andrzej Cichocki, Stefan Korolczuk, Janusz Majnert, Grzegorz Kasprowicz

DSP ISE PW Laboratory Students

Magda Purchla, Marek Kuźniak, Wojtek Kulka, Mateusz Malanowski, Bartek Dawidowicz

Wilga 2007 Conference Organizers

 \bigcirc



Warsaw University of Technology



PERG/ELHEP Laboratory (http://www.ise.pw.edu.pl/~rrom), Institute of Electronic Systems, (http://www.ise.pw.edu.pl), Faculty of Electronics and Information Technologies (http://www.elka.pw.edu.pl), Warsaw University of Technology (http://www.pw.edu.pl)



IEEE Student Branch of WUT IEEE Poland Section (http://www.ee.pw.edu.pl/ieee) (http://ieee.pl)

Wilga Symposium Sponsors



Wilga Symposium – Cooperating Institutions



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 (<u>http://wilga.ise.pw.edu.pl</u>)



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 hosting 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. Major aim of the Symposium, which has been organized since 10 years now, twice a year, conversely in WILGA (each year end of May) and at the Faculty of Electronics and Information Technologies, Warsaw University of Technology (second half of January), is 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 of prof. Abraham Katzir of Tel Aviv Univ. to SPIE Poland Chapter, from left: prof. R.Romaniuk, prof A.Katzir, 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 is 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 get more and more a elementary foundation of the society basing on knowledge. Production and further

development of a product is a separate subject. The main task is here 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.

A fundamental area of activities 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 here a target to create a flat research structure consisting mainly of young researchers. It is to emphasize 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 participants of XX IEEE-SPIE WILGA Symposium on Photonics Applications done 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 Różyczka-CAMK Warsaw; prof. Wojciech Plandowski- Warsaw University.

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

Since several years now, the Symposium has been gathering each time above 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], Soltan Institue 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 Electonic 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 Uni. 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 Sołtan 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.p]. 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) a complex Internet technical publication database is under development 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 i 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 – 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 Michałkiewicz, 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. Professor 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. Professor 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 professor Bogdan Paczyński will be published in Proc.SPIE WILGA 2007.

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.



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: Soltan 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 liniac 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 progam 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 professor 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 10000 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 interrupts. Students would like to forward 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 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. Summer spends, 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 raining starts. 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 increases 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 possesed 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, on 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 own 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, what 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 ware 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.

Dr Krzysztof S. Kulpa (KKulpa@ieee.org)

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

Palindromes in mathematics

Wojciech Plandowski Department of Mathematics Warsaw University, Poland

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. Lowercase 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 lowercase 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 are 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 checks properties of the input text – properties connected to palindromes. In number theory numbers which looks 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 o 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 they 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 "abbabbabbabbab". 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]...w[|w|]. A period of a word w is a number p such that w[i]=w[i+p], for $1\le i\le |w|$ -p. If p is a period of w, then w is of the form uuu.uu' where u=w[1]...w[p] and u'=w[1]...w[k], for some $k\le p$. 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 are two periods of a word w. If $p+q-gcd(p,q) \le |w|$, then gcd(p,q) is also a period of w.

Observe here that if gcd(p,q) is 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 $p+q-1 \le |w|$, 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 uaby 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 $1 \le i \le |j| \le |w|$ such that p[i,j]=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 $R[(j+i+1)/2] \ge (j-i+1)/2$, 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

- 1. A. Apostolico, D. Breslauer, Z. Galil, "Parallel detection of all palindromes in a string".
- 2. L. Banachowski, A. Kreczmar, W. Rytter, Sprawdzanie własności syntaktycznych tekstów związanych z palindromami", Chapter 3.3 in "Analiza Algorytmów i Struktur Danych", WNT 1989 (in Polish), p. 176-188.
 M. Lothaire, "Sturmian words", Chapter 2 in "Algebraic Combinatorics on Words", Cambridge University Press 2002,
- p.45-110.