The 18th International Conference on Global Research and Education

In Engineering for Sustainable Future

inter-Academia 2019

4th September - 7th September 2019
Budapest and Balatonfüred, HUNGARY

Venue: Danubius Hotel Gellért and
Hotel Annabella Beach Resort Superior

PROGRAM AND BOOK OF ABSTRACTS

Honorary Committee

Prof. Dr. Levente Kovács, Óbuda University, Hungary
Kiyoshi Ishii, Shizuoka University
Karol Mičieta, Comenius University, Slovakia
János Józsa, Budapest University of Technology and Economics, Hungary
Jan Szmidt, Warsaw University of Technology, Poland
Lambert T. Koch, Wuppertal University, Germany
Tudorel Toader, Alexandru Ioan Cuza University, Romania
Eugenijus Valatka, Kaunas University of Technology, Lithuania
Andrey P. Shevchik, St. Petersburg State Technological Institute, Russ
Leonid V. Hubersky, Taras Shevchenko National University of Kyiv, Ukraine
Ivan Ilchev, Sofia University, Bulgaria
Leonids Ribickis, Riga Technical University, Latvia
Sergey A. Khakhomov , Gomel State University, Belarus

International Advisory Conference Committee

Annamária R. Várkonyi-Kóczy, Óbuda University, Hungary
Volodymyr Gnatyuk, National Academy of Sciences of Ukraine
Kazuhiko Hara, Shizuoka University, Japan
Małgorzata Kujawińska, Warsaw University of Technology, Poland
Lucel Sirghi, Alexandru Ioan Cuza University, Romania
Nicoleta Dumitrascu, Alexandru Ioan Cuza University, Romania
Sergiusz Łuczak, Warsaw University of Technology, Poland
Leonid Poperenko, Taras Shevchenko National University of Kyiv, Ukraine
Evgenia Benova, Sofia University, Bulgaria
Michiharu Tabe, Prof. Emeritus, Shizuoka University, Japan
Arturs Medvids, Riga Technical University, Latvia
Maxim M Sychov, Saint Petersburg State Institute of Technology, Russia
Valdis Kokars, Riga Technical University, Latvia
Noriko Matsuda, Shizuoka University, Japan
Nobuyuki Araki, Prof. Emeritus-Shizuoka University, Japan
Ryszard Jablonski, Warsaw University of Technology, Poland
Roman Szewczyk, Warsaw University of Technology, Poland
Kenji Murakami, Shizuoka University, Japan
Dumitru Luca, Prof-Emeritus, Alexandru Ioan Cuza University, Romania
Masashi Kando, Prof. Emeritus, Shizuoka University, Japan
Gheorghe Popa, Prof-Emeritus, Alexandru Ioan Cuza University, Romania
Jun Kondoh, Shizuoka University, Japan
Giedrius Laukaitis, Kaunas University of Technology, Lithuania
Yoshimasa Kawata, Shizuoka University, Japan
Adam Woźniak, Warsaw University of Technology, Poland
Jan Maciej Kościelny, Warsaw University of Technology, Poland
Stefan Matejcik, Comenius University, Slovakia
Masaaki Nagatsu, Shizuoka University, Japan
Hiroshi Mizuta, University of Southampton, England

Local Organizing Committee

Adrienn Dineva
József Kopják
Gabriella Simon-Nagy
Balázs Tusor

September 3, Tuesday

Afternoon / Early evening

Arrival to Budapest, Hungary

19:00 – 20:00 Registration – Hotel Gellért (1114 Budapest, Szent Gellért tér 2), first floor

20:00 Welcome cocktail – Hotel Gellért

September 4, Wednesday

8:00 – 8:30 Registration - Hotel Gellért (1114 Budapest, Szent Gellért tér 2), first floor

8:30-9:10 Opening

Invited Keynote talks – ROOM A

9:10-9:40 Integration of localized surface plasmon resonance and electrochemical sensors on interdigital electrode for liquid environmental monitoring - *(Jun Kondoh, Hikaru Sakata, and Teguh Handoyo)*

Chair: Annamária R. Várkonyi-Kóczy

Abstract. For developing a digital microfluidic system using a surface acoustic wave (SAW) device, it is necessary to fabricate several sensors on the SAW device. If a sensor to detect several properties of samples is realized, it is useful for the digital microfluidic system. In this paper, the integrated sensor for detecting the refractive index and impedance of the sample is described. The refractive index and impedance are obtained from an optical sensor and electrochemical sensor, respectively. In our previous research, the localized surface plasmon (LSPR) sensor was used to detect the refractive index. Also, the interdigital electrode (IDE), which is one of the electrochemical sensors, was used to measure the impedance. As the electrode material of the IDE was gold, we tried to fabricate the gold nanoparticles (AuNPs) on the IDE electrode to excite LSP. The thickness of the IDE electrode is thick compared with the AuNPs. In this paper, first, the AuNPs were fabricated using the thermal annealing method. The surface of the electrode was observed with a conventional atomic force microscope. The formation of the AuNPs was confirmed. Then, simultaneous measurements of the refractive index and impedance were carried out. The measured results suggest that the electrical and optical properties of samples are measurable by the integrated IDE.

9:40-10:10 About the size of photon (again) – *(Ryszard Jablonski)*

Chair: Hidenori Mimura

Abstract. Single photons are essential for development of modern technologies and there are still many fundamental features investigated now, related to the measurement of photons. Photons are often referred to as particles, but they are light quanta and depending on the situation, sometimes the particle aspect is useful and sometimes the wave aspect is. As a photon gets closer to measured object, the chance of it interacting becomes greater. The first step of our research was to generate a stable photon beam. This photon beam was used as a measuring tool for measuring photon transmission through micro-gaps and micro-bores versus their dimension. Photon' cross section varies depending on what it is interacting with, also depends upon the size of the object. Then, the experiments on the heterodyning the light beams were carried out. For the intensity of photon beam so low that the distance between photons exceeds wavelength, such photons should not overlap, but in fact beatings were recorded. This test allows assuming that actual length of photon is much larger than wavelength. The above considerations refer to 2D space, but real objects are 3D and usually of very compound character. All experiments on photons are of great value. Usually they are of very specialized character, but nevertheless, they always bring us closer to the general theory of interaction between photon and object.

10:10-10:40 coffee break

Parallel presentations

10:40-12:00 ROOM A
Chemical processes and materials 1
Chairs: Kenji Murakami and Leonid Poperenko

Color control of the mechanoluminescent material through a combination of color centers – *(K. Murakami, K. Suzuki, Y. Iwai, M. Okuya and M. Shimomura)*

Abstract. We have synthesized the new organic mechanoluminescent material based on a 1,10-phenanthroline and an acetyl acetone. The synthesized material shows both the photoluminescence and the mechanoluminescence with a green-color (main peak at 545 nm) by doping of a terbium (Tb). We have also investigated an effect of co-doping of Tb and europium (Eu) or dysprosium (Dy) on the luminescence property. Single doping gives a luminescence corresponding to each dopant with the main peak at 545, 612 or 573 nm for Tb, Eu or Dy, respectively, but the co-doping of Tb and Eu gives the luminescence corresponding to their doping amount ratio. As a result, the visual color can be controlled by the ratio. On the other hand, the co-doping of Tb and Dy keeps the luminescence corresponding to Tb single doping, but enhances its intensity. The results suggest that the electron transition process is different between the Tb-Eu and Tb-Dy co-doping. In the case of Tb/Eu co-doping, each dopant induced each own luminescence due to a significant difference in the electron energy state level between Tb and Eu. In centrally, the energy state of Dy becomes an extra electron supplier to Tb for the Tb/Dy co-doping. The results can expand application fields of the mechanoluminescence.

Graphene Phononic Crystals based on Nanopore/Nanopillar structures – *(Manoharan Muruganthan, Seiya Kubo, Haque Mayeesha, and Hiroshi Mizuta)*

Abstract. Three-dimensional finite element analysis of Graphene Phononic Crystals (GPnCs) was carried out with the nanopore/nanopillar structures to investigate the formation of complete and partial phonon bandgap (PnBG). The cross-shaped hole structure shows that the PnBG depends on the size of the pitch and neck of the GPnCs and exhibits higher frequency band gaps at a smaller pitch size and more PnBG with decreasing neck size. Furthermore, circular-hole and square-hole shaped structures did not exhibit any PnBG for 25 nm pitch size. In the case of nanopillar, flattening of phonon dispersion branches over wider frequency range were noticed rather than PnBGs.

Melting Threshold and Thermal Conductivity of CdTe under Pulsed Laser Irradiation – *(V.P. Veleschuk, V.A. Gnatyuk, T. Aoki, Z.K. Vlasenko, S.N. Levytskyi, A.V. Shefer, A.G. Kuzmich, K.V. Dubyk, V.V. Kuryliuk, and M.V. Isaiev)*

Abstract. The paper is devoted to the study of the features of CdTe surface treatment under laser irradiation with both different wavelengths (λ = 300–800 nm) and pulse durations (τ_p = 7 ns – 1 ms). The thermal conductivity of the semi-insulating *p*-like CdTe semiconductor crystals was evaluated using the photoacoustic gas-microphone method. Simulations of the melting threshold were performed based on the three stage model of the laser induced excitation and relaxation. In particular, the following processes were considered in frames of the model: (i) rapid interband thermalization, (ii) nonradiative interband and (iii) nonradiative surface recombination. It was revealed that in the range of pulse durations from 7 ns to 1 μs, the melting threshold of the CdTe mainly depended on the absorption coefficient $\alpha(\lambda)$. For pulse durations longer than 1 μs the threshold started to depend also on the spectra of the reflectivity coefficient $R(\lambda)$. The obtained results have been used for optimization of the laser-assisted techniques of surface processing and stimulated doping of CdTe crystals.

Synthesis of RE-Doped YAG Scintillators by Sol-Gel Method – *(S. A. Khakhomov, V.V. Sidsky, A.V. Semchenko, V.E. Gaishun, D.L. Kovalenko, V.V. Malyutina-Bronskaya, V.B. Zalesskiy, D. Hreniak, M.L. Saladino)*

Abstract. Sm-Y-Nb and Sm-Y YAG materials were synthesized by sol-gel method. Characterization of dependence of luminescence spectra on composition of the samples was carried out. It was established that luminescent emission increases twice with co-doping with niobium ions. The strongest fluorescence was observed in the 618 nm and was assigned to the 4G5/2→6H7/2 transition of Sm3+.

10:40-12:00 ROOM B

Measurement, monitoring, and identification

Chairs: Yukinori Ono and Amir Mosavi

Monitoring the environmental quality of marine waters through the analysis of biomineralization in bivalve shells – *(Iuliana MOTRESCU, Anca Elena CALISTRU, Gerard JITAREANU, and Liviu Dan MIRON)*

Abstract. Bivalve shells, such as *Mytilus*, offer great potential as environmental proxies. Analysis of the biomineralization process with determination of elemental composition gives information about the quality of environment and reflects the possible safety issues related to mollusk consumption because high pollutant quantities in shells indicate high pollutants presence in the consumed parts. In this work we study the biomineralization process in some bivalve shells and identify the presence of pollutants such as Pb, U, and other heavy metals using scanning electron microscopy (SEM) coupled with energy dispersive spectroscopy (EDAX). Through the obtained results, this methodology proved to be very reliable and fast for this purpose. We also show a correlation of the biomineralization results with the environmental conditions where the shells developed, such as estimation of water temperature by the Sr/Ca ratios, all the results proving the ability of bivalve shells of providing information about the environment quality.

Utilization of atmospheric plasmas for agricultural applications – *(Iuliana MOTRESCU, Manuela FILIP, Florin Petrian HERCIU and Gerard JITAREANU)*

Abstract. Atmospheric pressure plasma fit great in agricultural applications due to their reduced complexity and to their chemical reactivity, being produced in air. In this work we present some of our results regarding agricultural applications of plasmas, obtained with seeds and soil exposed in atmospheric pressure plasmas conditions. The treatment of seeds shown a non-linear behavior with the exposure time and voltage for seed germination and development. The effects are strongly dependent on the type of seeds. Radish seeds were stimulated with lower voltages plasma and shorter exposures as compared to broccoli. In some conditions plasma exposure inhibited the growth, with lower germination rates than un-exposed samples and smaller size of the sprouts. For soil treatment we found the possibility to increase the nitrogen content of soil when tuning plasma treatment conditions, and we believe it is due to the reaction between reactive nitrogen species produced in plasma and organic components in soil.

Numerical experiments to investigation the structure of the electromagnetic field on the surface of a small spherical conductive medium – *(N. Kh. Gomidze, M.R. Khajisvili, I.N. Jabnidze, K. A. Makharadze, A. Sliusareva)*

Abstract. Practice shows that compactly located electronic devices influence with each other and of course on some antenna system. The effective cross section (ECS) of the scattered radiation waves from source located in near zone to antenna system is increased. Electromagnetic waves carry information about the structure of the medium in which it propagates. Therefore, the determination of scattered parameters from obstacles are very importance for analyses the electromagnetic properties of the medium. The present paper proposed the results of numerical experiments based on the classical theory but it has practical importance in radiolocation and radio-spectroscopy at specific laboratorian and technological conditions.

There are investigations the structure of the scattered electromagnetic field of a linearly or circularly polarized incident wave with frequency ω on the surface of an ideal conductive sphere with radius a in the condition $\lambda \gg a$ $(ka \leq 1)$, where λ

is the wavelength of the incident wave. Analytically received the general equations for the scattered field and Poyting vector, both directly near the conductive sphere and in the far zone (Fraunhofer zone) from the scattered object.

Human sweat duct measurement using attenuated total reflection terahertz time domain spectroscopy – *(Saroj R. Tripathi and Shogo Takahashi)*

Abstract. It was reported that the sweat ducts in human skin act as a low-Q-factor helical antenna due to their helical structure and resonate in the sub-terahertz frequency region. We measured the sweat duct in human skin using attenuated total reflection terahertz time domain spectroscopy (ATR THz-TDS) and we observed the broad frequency of resonance of sweat duct at around 300 GHz.

12:00- 13:30 Lunch

13:30- 14:50 - ROOM A
Electronics and nanoelectronics 1
Chairs: Toru Aoki and Volodymyr Gnatyuk

Performance Limitations of Nanoscale Si Electron-Aspirator – *(Himma Firdaus, Manjakavahoaka Razanoelina, and Yukinori Ono)*

Abstract. Electron aspiration is a hydrodynamic effect due to the electron-electron (*e-e*) scattering in a 2DEG. Such a mechanism enables to enhance up to three times the output current of a nanometer Si MOS transistor without any additional power supply at 8 K [1]. In the ideal case, the initial momentum gained by injected electrons is fully used to generate secondary electrons
by means of *e-e* scattering. However, momentum non-conserving scatterings prevent it from achieving higher performance in low temperature or even lost the performance at elevated temperature. It strongly suggested that factor that limits the performance in the low temperature is surface roughness scattering and that at room temperature is phonon scattering. Regarding these limitations, we here investigate the possibility to enhance the performance of the nanoscale silicon electron aspirator.

Photon-coupled, two-state photoswitchable protein-based multiple-valued logic – *(Balázs Rakos)*

Abstract. Multi-valued logic can be applied in several areas, like robotics and artificial intelligence. It is utilized in various commercial applications, such as the StrataFlash, a NOR flash memory developed by Intel. Contemporary research focuses on the development of fast, nanometer-size, low power consuming electronic devices, therefore it is imperative to examine such concepts in the field of multiple-valued logic. We present a method by which simple, two-state, photon-coupled photoswitchable proteins can be utilized for multiple-valued computations. Its advantages are discussed, and an example, the ternary OR gate, using readily available fluorescent reversibly photoswitchable proteins is provided.

Single-electron tunneling percolation in dopant-atom networks formed in silicon nanoscale transistors *– (D. Moraru, M. Hasan, A. Debnath, A. Afiff, G. Prabhudesai)*

Abstract. For future generations of electronics, the ability to control electron transport one by one is of critical importance, in particular for achieving ultra-low power consumption and fundamental functionalities. Single-electron tunneling can be achieved even via dopant-atoms working as quantum dots in silicon nanoscale transistors. Here, we show a study of single-electron tunneling in dopant-atom networks and analyze the percolation paths in nanoscale channels containing such networks. This study provides some new insights from experiments and simulations for atomic-level computation using dopant-atoms in silicon.

Low-Temperature Transport Properties of SOI MOS Transistors – *(K. Zelenska, T. Watanabe, Y.Ono)*

Abstract. Low-temperature (6 K and 13 K) conductance characteristics of SOI MOSFETs with *n*-type long channels were investigated. In the SOI MOSFETs, a front channel, a back channel or both channels can be formed depending on the front- and back-gate voltages. Under certain voltage conditions, unusual charge carrier transport was revealed, and it was investigated for various front- and back-gate conditions.

15:00- 16:10 – ROOM A

Special Session: IA Young Researchers' (IAY) Poster Preentations

Chairs: Rychard Jablonskí and Yasunori Okano

Internal temperature estimation in microwave flow reactors – *(Akiko Kitagawa1, Kazuhiro Takeda)*

Abstract. Microwave irradiation is a very effective tool in the field of synthesis because of its rapid heating, etc., based on its energy savings and improvement of selectivity as compared to conventional external heating. In particular, flow-type microwave devices in organic synthesis are suitable for difficult synthesis processes in that the synthesis can be performed under rapid heating and cooling and pressurized conditions. On the other hand, estimating the internal temperature profile during chemical synthesis is important for proper synthesis control. However, it is difficult to directly measure the internal temperature in the target device. This paper focuses on Fischer indole synthesis. A dynamic equation was established from the heat energy balance of the reaction tube. The internal temperature profile was estimated taking into account the correlation between the microwave absorption and temperature. This method could accurately estimate the temperature profile within a relative error of 3.4% to 6.3% under low power microwave conditions. By clarifying the internal temperature profile, it can be used for future control of organic synthesis.

Ab initio study of the effect of electric field on a donor-acceptor pair in Si nanostructures *– (K. Yamaguchi G. Prabhudesai, M. Muruganathan, H. Mizuta, M. Tabe, D. Moraru)*

Abstract. Low-dimensional Si tunnel diodes show a transport behavior significantly different compared to conventional (large-scale) devices due to dopant individuality. In this research work, we aim to understand the role of energy states which can be induced in the bandgap by the interaction between a donor-atom and an acceptor-atom in Si nanostructures. By means of *ab*
initio simulations, we study co-doped Si nanoplates monitoring the effect of two main parameters: the inter-dopant distance and the external electric field. We find that, by alignment of the dopants' energy levels, the interaction between the dopants can be enhanced. This mechanism is discussed in this presentation.

Numerical Investigation of Gas-Liquid Two-Phase Flow in a stirred tank – *(Nao Ishida, Al Abri Mohammed, Atsushi Sekimoto, Yasunori Okano, Shinya Abe and Kosuke Tanaka)*

Abstract. Gas-liquid stirred tanks are widely used in various chemical engineering processes such as fermentation and pharmaceutical production. In the mixing process for fermentation, aerobic microbes produce high polymer compounds from oxygen and carbon sources which need to be supplied by agitation and aeration in a tank. It is essential to supply a sufficient and uniform amount of nutrients to provide high quality and quantity products, and hence, it is necessary to optimize the shape and operating conditions of the stirring tank to mix gas and materials in the liquid sufficiently and uniformly. However, it is difficult to obtain a guideline for the design of plant-scale tanks from laboratory-scale experiments because experimental measurements cannot provide the detailed distribution of materials. The present study aims to obtain a guideline for an optimized design by developing computational fluid dynamics (CFD) simulation of the gas-liquid two-phase flow in the stirred tank and investigating the mass transfer inside the stirred tank in detail. Applying k-ω shear stress transport (SST) model, we calculate the gas-liquid flow in the stirred tank and estimate overall gas hold-up in comparison with experimental data.

Electron-beam heating on Pt/Ti wire for novel measurement technique of thermal diffusivity using SEM and IR-thermography – *(P. Baskaran, Y. Ota, R. Nanao, Y. Suzuki, M. Tomita, T. Matsukawa, T. Matsuki, T. Watanabe, Y. Hayakawa, H. Inokawa, K. D. Nisha, M. Shimomura, K. Murakami, H. Ikeda)*

Abstract. In order to evaluate the thermal diffusivity for nanometer-scale materials, we have constructed a novel measurement technique based on an ac calorimetry method using scanning electron microscopy and thermography. In this study, as a first stage, we confirmed local electron-beam (EB) heating on Pt/Ti bilayer wire patterns. From the time evolution of temperature on the patterns, it was found that the pattern irradiated with electrons is heated faster than other patterns distant from the irradiated one. This fact indicates that the local heating by the EB irradiation is realized.

Risk Evaluation Model for Information Technology Services in Integrated Risk Assessment – *(Noriaki Matsumura, Masakatsu Nishigaki, and Takahiro Hasegawa)*

Abstract. A risk evaluation model for information technology (IT) services in integrated risk assessment is proposed in this paper. The model covers management systems for information security and IT services. The component-impact coefficient parameter is introduced to define the strength of the relation between assets and IT services. The concept of composition of relations and the weighted sum principle are applied to analyze and evaluate the risk of IT services. When we applied the model to IT services in operation, the risk evaluation was output as quantities that reflect the component-impact coefficient, and risk treatment prioritization was attained in the descending order of numerical values. The proposed model therefore improves the precision of risk evaluation, and application of the model allows more accurate risk evaluation than the conventional method.

Development of plasma driven permeation measurement system for plasma facing materials – *(Mingzhong Zhao, Shota Yamazaki, Moeko Nakata, Fei Sun, Takuro Wada, Ayaka Koike, Yoji Someya, Kenji Tobita, Yasuhisa Oya)*

Abstract. To study the hydrogen isotopes plasma driven permeation (PDP) behavior in plasma facing materials, a linear Radio Frequency (RF) plasma device has been constructed in the radiation controlled area at Shizuoka University. The deuterium (D) plasma is generated by injecting RF power with the frequency of 13.56 MHz through a copper antenna and confined by DC magnetic field. The sample is sealed by gold (Au) coated O-ring and one side (upstream side) of sample is exposed to the D plasma. The other side of sample, named as downstream side, is pumped out by a turbo molecular pump and a rotary pump. The permeated D through the sample is monitored by a quadrupole mass spectrometer (QMS) which is connected to the downstream chamber. Infrared heater is adopted to control the sample temperature. The PDP experiments under different plasma parameters show that the permeation process agrees with RD regime. The D recombination coefficient on upstream surface of W is obtained.

State of the art survey of deep learning and machine learning models for smart cities and urban sustainability – *(Saeed Nosratabadi, Amir Mosavi, Ramin Keivani, Sina Ardabili, Farshid Aram)*

Abstract. Deep learning (DL) and machine learning (ML) methods have recently contributed in the advancement of models in the various aspects of prediction, planning, and uncertainty analysis of smart cities and urban development. This paper presents the state of the art of DL and ML methods used in this realm. Through a novel taxonomy the advances in model development and new application domains in urban sustainability and smart cities are presented.

A Model of Induced Motion of Inclusions in Inhomogeneously Stressed Crystals – *(Oleksandr P. Kulyk, Leonid A. Bulavin, Stella F. Skoromnaya, Victor I. Tkachenko)*

Abstract. A physical model of liquid inclusion motion in an inhomogeneously stressed crystal is stated. The model is based on the phenomenon of induced transitions of atoms of the matrix into the solution and back to the matrix. The dependence of the speed of inclusion motion on its size is obtained and it describes the experimental results with high accuracy. Numerical estimates of the inclusion's characteristic parameters correspond to tabulated data and results obtained by

other authors. The proposed model of induced inclusion motion in a crystal with an inhomogeneous dislocation distribution can be applied to the crystals with inhomogeneity of another nature.

Real time 3D motion processing for AR entertainment ~ Virtual Youtuber "magical girl tomato-chan" - *(H. Kase, J. Nlishizawa, T. Takagi, K. Takagi, A. Koike, T. Aoki)*

Abstract. We demonstrated real time 3D animation and AR image by using real time 3D motion capture and data processing for the AR entertainment, then, we applied this system for the virtual youtuber "magical girl tomato-chan". The 9-axis acceleration with geomagnetism motion sensors were put on the body, hands, fingers, legs and so on. The detection signals were sent to the high-performance PC using USB3.0 interface, and face form was taken by small camera with microphone for voice data input. The real-time 3D animation "tomato-chan" was generated by using these data; motion data for body motion, camera data for face, and voice data for mouth, then AR data also generated. We derived the real time animation data in YouTube live broadcasting.

Augmented Smart Refrigerator - An Intelligent Space Application – *(B. Tusor, Š. Gubo, T. Kmeť and J. T. Tóth)*

Abstract. Recently, with the advancement in computation technology, ubiquitous computing paradigms like Intelligent Spaces are not only gaining popularity but are also slowly getting into the price range of average households. However, while many everyday devices and services can be accessed and afforded by middle class families, smart refrigerators are still too expensive, even though they can be very useful to aid the economics and budgeting of the household. In this paper, an affordable smart refrigerator framework is proposed that can be implemented by using cheap, easily accessible devices to augment older, regular refrigerator models, integrating the core functionalities that many expensive models have, for a much lower cost.

16:10-18:00 – ROOM A

Poster session and coffee break

IA Young Researchers

Chairs: Yasunori Okano and Rychard Jablonskí

- **Internal temperature estimation in microwave flow reactors –** *(Akiko Kitagawa1, Kazuhiro Takeda)*
- **Ab initio study of the effect of electric field on a donor-acceptor pair in Si nanostructures** *– (K. Yamaguchi, G. Prabhudesai, M. Muruganathan, H. Mizuta, M. Tabe, D. Moraru)*
- **Numerical Investigation of Gas-Liquid Two-Phase Flow in a stirred tank –** *(Nao Ishida, Al Abri Mohammed, Atsushi Sekimoto, Yasunori Okano, Shinya Abe and Kosuke Tanaka)*
- **Electron-beam heating on Pt/Ti wire for novel measurement technique of thermal diffusivity using SEM and IR-thermography –** *(P. Baskaran, Y. Ota, R. Nanao, Y. Suzuki, M. Tomita, T. Matsukawa, T. Matsuki, T. Watanabe, Y. Hayakawa, H. Inokawa, K. D. Nisha, M. Shimomura, K. Murakami, H. Ikeda)*
- **Risk Evaluation Model for Information Technology Services in Integrated Risk Assessment –** *(Noriaki Matsumura, Masakatsu Nishigaki, and Takahiro Hasegawa)*
- **Development of plasma driven permeation measurement system for plasma facing materials –** *(Mingzhong Zhao, Shota Yamazaki, Moeko Nakata, Fei Sun, Takuro Wada, Ayaka Koike, Yoji Someya, Kenji Tobita, Yasuhisa Oya)*
- **Deep Learning and Machine Learning Models for Human Action Recognition –** *(Mozhgan Mokari, Khosro Haj Sadeghi)*
- **State of the art survey of deep learning and machine learning models for smart cities and urban sustainability –** *(Saeed Nosratabadi, Amir Mosavi, Ramin Keivani, Sina Ardabili, Farshid Aram)*
- **A Model of Induced Motion of Inclusions in Inhomogeneously Stressed Crystals –** *(Oleksandr P. Kulyk, Leonid A. Bulavin, Stella F. Skoromnaya, Victor I. Tkachenko)*
- **Real time 3D motion processing for AR entertainment ~ Virtual Youtuber "magical girl tomato-chan" -** *(H. Kase, J. Nishizawa, T. Takagi, K. Takagi, A. Koike, T. Aoki)*

- **Augmented Smart Refrigerator - An Intelligent Space Application –** *(B. Tusor, Š. Gubo, T. Kmeť and J. T. Tóth)*

IA Researchers

Chairs: Valerie Anne Wilkinson and Igor Semchenko

Corrosion Resistance and Hydrophobic Properties of Gradient Coatings Based on Carbon and Alloying Elements – *(Ekaterina A. Kulesh, Alexandr V. Rogachev, Dmitry G. Piliptsou, Alexandr S. Rudenkov, Jiang X. Hong, Victor A. Emel´yanov)*

Abstract. Gradient α-C coatings were precipitated from plasma fluxes of carbon and metal ions (Ti, Cr, Al). Polished silicon and steel (304) plates were used as the substrates. The structure, morphology, and phase composition were determined by X-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM). The parameters of electrochemical corrosion were determined by using a standard three-electrode circuit in the solution of artificial sea water (3.5% NaCl). The XPS method established the formation of carbide compounds in the coatings obtained. It is stated that the ratio of carbide/carbon phases in the coating is determined by the type of alloying metal. The hydrophobic properties of the surface were determined by the method of a resting drop by measuring the contact wetting angles, the values of which for all coatings do not exceed 90 °, therefore, the surface is well wetted by a corrosive medium and stays hydrophilic. The analysis of the polarization curves showed that the presence of gradient coatings on the surface leads to the increase in the corrosion resistance of the steel substrate. Cr/α-C(5…20 Hz):Cr coatings are characterized by the highest corrosion resistance. It is established that the protective properties are determined by the phase composition of the coating.

Azimuthal and Angular Ellipsometry of Continuous and Porous Semiconductor Surface Layers – *(T. Aoki, M.V. Isaiev, L.V. Poperenko, I.V. Pruskyi, S.G. Rozouvan, I.V. Yurgelevych)*

Abstract. An ellipsometric diagnostics of monocrystalline silicon, film of gallium arsenide epitaxially deposited on Si substrate and porous silicon with different degree of a porosity *P* was carried out. To characterize the optical anisotropy and homogeneity of semiconductors the angular dependences of such ellipsometric parameters as Δ ($\cos\Delta$) and Ψ ($\mathrm{tg}\Psi$) were measured. Due to their angular dependences the principal angle of an incidence and a value of Ψ_{min} ($\mathrm{tg}\Psi_{min}$) and its angular position for two mutually perpendicular azimuthal directions in own plane of the sample relatively to its *p*-direction were determined. It was obtained that optical properties of the surface of GaAs film deposited on Si substrate with a buffer nitrogen layer and both continuous and porous Si samples are characterized by high homogeneity and isotropy for two mutually perpendicular directions. The optical properties of the samples of porous silicon with different degree of porosity after keeping in isopropyl alcohol were studied too. It was found that the ellipsometric parameters are significantly different for these two samples of porous silicon with different degree of porosity *P*, namely the differences in the value of the principal angle of an incidence and the angular position of the $\mathrm{tg}\Psi$ minimum are about 10°. It was established that keeping of the samples of porous silicon in isopropyl alcohol during one day leads to a decrease the principal angle of an incidence and refractive index due to porous silicon oxidation.

Structural Properties of BiFeO3 and Bi0,9La0,1FeO3 Powders Synthesized by Sol-Gel Process – *(A.V. Semchenko, S.A. Khakhomov, V.E. Gaishun , D.L. Kovalenko, V.V. Sidsky, W. Strek, D. Hreniak)*

Abstract. The present work aims to design and study novel functional materials with multiferroic properties required in electric applications, such as magnetic and magnetoresistive sensors, actuators, microwave electronic devices, phase shifters, mechanical actuators etc. Complex oxides $BiFeO_3$ and $Bi_{0,9}La_{0,1}FeO_3$ for analysis of its structural properties were synthesized as powders by sol-gel method. The size, shape, and degree of crystallinity of the formed nanoparticles can be changed by varying the temperature and the concentrations of the initial reactants and the stabilizer. This work is devoted to interrelation between composition of sol-gel $BiFeO_3$ and $Bi_{0,9}La_{0,1}FeO_3$ nanopowders and their nanostructural properties.

Polarization properties of a rectangular balanced omega-element in the THz range – *(I. Semchenko, S. Khakhomov, M. Podalov, A. Samofalov)*

Abstract. The paper aims to create a new type of polarizers in the THz range of electromagnetic waves, comprising an array of micro-dimensional planar rectangular omega elements. The metal omega elements under consideration have a well-balanced shape, since the incident electromagnetic wave induces in them an electric dipole moment and a magnetic moment, which are equally significant. Such an optimal shape of the omega elements allows their use in the absorbers of microwave and THz waves. The paper illustrates that this shape of omega resonators is also universal for their use in THz polarizers.

Additive Manufacturing of Cermic Insulators – *(L.A. Nefedova, V.I. Ivkov, M.M. Sychov, S.V. Dyachenko, L.A. Lebedev)*

Abstract. Ceramic samples were fabricated from alumina using traditional and additive technologies. Samples were studied using GE vtomex c 450 Roentgen tomograph. It allowed to compare accuracy of geometry, surface roughness and porosity of samples. It is shown that additive technology due to high accuracy of fabrication is a perspective way of precision fabrication of ceramic parts with high quality.

Real-time analysis and characterization of dynamic performances for coloration-bleaching processes in electrochromic devices based on WO3 layers prepared by sol-gel synthesis – *(E.V.Sokhovich, V.I.Khalimon, O.V.Prostitenko, S.V.Mjakin, M.M.Sychov, V.F.Borodzyulya, V.S.Zemko, S.O.Lebedev)*

Abstract. A comparative characterization of multiple coloration-bleaching cycles under various modes of power (voltage and current supply) is performed for electrochromic devices (ECDs) based on WO_3 layers prepared from metal tungsten or tungsten carbide and annealed at different temperatures from 150 to 350°C. The results indicate that optimal voltage/current values and exposure time strongly depend on WO_3 synthesis and annealing conditions. Particularly, a sustainable functioning of ECD involving WO_3 prepared from metal tungsten and annealed at 150°C is achieved upon a stepwise change of coloration and bleaching voltage from 1.5 to 2.5 V at the current 1 mA within 600 s, while for the sample prepared from tungsten carbide and annealed at 350°C a similar mode within 300 s is effective, probably due to certain differences in the electrochromic material structure. Deviations from optimal power supply conditions result in the destabilization of ECD performances and significant efficiency decrease after several coloration-bleaching cycles, particularly due to an incomplete bleaching.

Systematic review of deep learning and machine learning models in biofuels research – *(Sina Ardabili, Amir Mosavi and Annamaria R. Varkonyi-Koczy)*

Abstract. The importance of energy systems and their role in economics and politics is not hidden for anyone. This issue is not only important for the advanced industrialized countries, which are major energy consumers but is also essential for oil-rich countries. In addition to the nature of these fuels, which contains polluting substances, the issue of their ending up has aggravated the growing concern. Biofuels can be used in different fields for energy production like electricity production, power production, or for transportation. Various scenarios have been written about the estimated biofuels from different sources in the future energy system. The availability of biofuels for the electricity market, heating, and liquid fuels is critical. Accordingly, the need for handling, modeling, decision making, and forecasting for biofuels can be of utmost importance. Recently, machine learning (ML) and deep learning (DL) techniques have been accessible in modeling, optimizing, and handling biodiesel production, consumption, and environmental impacts. The main aim of this study is to review and evaluate ML and DL techniques and their applications in handling biofuels production, consumption, and environmental impacts, both for modeling and optimization purposes. Hybrid and ensemble ML methods, as well as DL methods, have found to provide higher performance and accuracy.

Prediction of combine harvester performance using hybrid machine learning modeling and response surface methodology – *(Tarahom Mesri Gundoshmian, Sina Ardabili, Amir Mosavi, Annamaria R. Varkonyi-Koczy)*

Abstract. The first step in confronting and controlling the loss and waste problem at the harvesting stage is to recognize the various parameters such as: harvest time, harvest type (automatic or manual), the correct settings of harvesting machine, etc. Due to the importance and unique position of the machine in agricultural production systems as a source of power and the process of doing work in agriculture of the present age, the evaluation of the mechanism and performance of the devices is an inevitable priority of the management of agricultural units. Modeling the function of the system (Combine harvester) gives better judgment of the performance of its various parts. Therefore, these systems can be evaluated using predictive methods such as artificial neural networks, ANFIS, etc. In this study, the modeling of the conventional combine harvesting was performed using radial basis function (RBF) and ANFIS methods to predict the PL, MOG and BS based on A, B and C variables. The results show the high ability of the ANFIS method compared to RBF method. On the other hand the process was optimized using RSM method to minimize the PL, MOG and BS values.

Building energy information: demand and consumption prediction with machine learning models for sustainable and smart cities – *(Sina Ardabili, Amir Mosavi and Annamaria R. Varkonyi-Koczy)*

Abstract. Building energy consumption plays an essential role in urban sustainability. The prediction of the energy demand is also of particular importance for developing smart cities and urban planning. Machine learning has recently contributed to the advancement of methods and technologies to predict demand and consumption for building energy systems. This paper presents a state of the art of machine learning models and evaluates the performance of these models. Through a systematic review and a comprehensive taxonomy, the advances of machine learning are carefully investigated and promising models are introduced.

Urban Train Soil-Structure Interaction Modeling and Analysis – *(Danial Mohammadzadeh, Nader Karballaeezadeh, Morteza Mohemmi, Amir Mosavi, and Annamaria R. Varkonyi-Koczy)*

Abstract. Design and advancement of the durable urban train infrastructures are of utmost importance for reliable mobility in the smart cities of the future. Given the importance of urban train lines, tunnels, and subway stations, these structures should be meticulously analyzed. In this research, two-dimensional modeling and analysis of the soil-structure mass of the Alan Dasht station of Mashhad Urban Train are studied. The two-dimensional modeling was conducted using Hashash's method and displacement interaction. After calculating the free-field resonance and side distortion of the soil mass, this resonance was entered into PLAXIS finite element program, and finally, stress and displacement contours together with the bending moment, shear force and axial force curves of the structure were obtained.

Formation and research of properties of photocatalytic materials on the basis of TiO2 for water treatment – *(D.L. Kovalenko, V.E. Gaishun, V.V. Vaskevich, S.A. Khakhomov, S.K. Khudaverdyan, G.Y. Ayvazyan)*

Abstract. The paper describes the sol-gel method for producing photocatalytic materials based on titanium oxide. The temperature-time regimes of heat treatment of the obtained materials are determined. The surface properties of the resulting coatings were studied by scanning electron microscopy and asthmatic force microscopy. The photocatalytic properties of the synthesized coatings and bulk samples were studied on destruction of methylene blue molecules in the developed water purification systems.

D. I. Mendeleev and Technological Institute – *(Elena A. Aleksandrova, Maxim M. Sychov)*

Abstract. In 2019 the scientific humanity commemorates the 150-th anniversary of the Periodic Table. This event is celebrated with numerous presentations, conferences and workshops. Russian scientist D. I. Mendeleev, who has priority in creation the Periodic Law and Periodic Table of the Elements, thanks to this invention became famous all over the world. Dmitrii Ivanovich was extremely versatile person, his sphere of interests included organic and inorganic chemistry, physical chemistry of gases and solutions, mineralogy, aerodynamics, technology, art, agriculture, technology of gunpowder, petroleum production, mechanics, education, metrology, economy, mechanics and philosophy. In this article

we want to highlight the role of D.I. Mendeleev on the development of the Saint-Petersburg Institute of Technology, where the great scientist was working for some years since 1863. This period of his life is known as the most fruitful and full of famous inventions and genius predictions.

Colonoscopy Videos: Towards Automatic Assessing of the Bowels Cleansing Degree – *(M. Luca, A. Ciobanu, V. Drug)*

Abstract. In the attempt to decrease the number of colon cancers deaths, colonoscopy is one of the main analyses recommended by the American and European guidelines, as well as the updated Asia Pacific consensus statements, meant to early detect abnormal structures formed on colon surface. In order to obtain the best images, a very effective colon cleansing is necessary. Thus, polyps, diverticulitis, or any peculiar aspects of the intestinal membrane, might be observed. Subjective evaluation influenced by various cleansing degrees might conduct to different results, or even to omissions. Expert assessment variability is another factor influencing the diagnosis. We further describe special software, useful for an objective, semi-supervised, evaluation of bowel cleansing degree.

19:00 – 21:00 Walking tour – the Lights of Budapest

- **optional – meeting at 19:00 in the Lobby of Hotel Gellért**

September 5, Thursday

Parallel presentations

9:00-10:40 – ROOM A
Machine intelligence and computer science
Chairs: Daniel Moraru and Teréz A. Várkonyi

Domain Reduction Techniques for Sequential Fuzzy Indexing Tables – A Case Study – *(B. Tusor, J. Bukor, L. Végh and O. Takáč)*

Abstract. In recent years, single-board computers have been gaining popularity because they make it possible to use low cost, low energy consumption devices to solve complex tasks that would be much harder to solve with microcontrollers. However, these devices have much more limited capabilities both computation and memory-wise compared to traditional computers, which in turn limits the options available to use them for classification problems. One of the available options is using Lookup Table-based classifiers that require minimal computation, although in return they require more memory space. Sequential Fuzzy Indexing Tables are improved versions of Lookup Tables that require less memory, but for large problem spaces their storage cost is still very high. This is due to the size of its structure, which can be reduced with suitable domain conversion techniques. In this paper, multiple options are investigated, analyzed and compared in order to solve this problem.

List of deep learning models – *(Amir Mosavi, Sina Ardabili and Annamaria R. Várkonyi-Kóczy)*

Abstract. Deep learning (DL) algorithms have recently emerged from machine learning and soft computing techniques. Since then, several deep learning (DL) algorithms have been recently introduced to scientific communities and are applied in various application domains. Today the usage of DL has become essential due to their intelligence, efficient learning, accuracy and robustness in model building. However, in the scientific literature, a comprehensive list of DL algorithms has not been introduced yet. This paper provides a list of the most popular DL algorithms, along with their applications domains.

Advances in machine learning modeling reviewing hybrid and ensemble methods – *(Sina Ardabili, Amir Mosavi and Annamaria R. Varkonyi-Koczy)*

Abstract. The conventional machine learning (ML) algorithms are continuously advancing and evolving at a fast-paced by introducing the novel learning algorithms. ML models are continually improving using hybridization and ensemble techniques to empower computation, functionality, robustness, and accuracy aspects of modeling. Currently, numerous hybrid and ensemble ML models have been introduced. However, they have not been surveyed in a comprehensive manner. This paper presents the state of the art of novel ML models and their performance and application domains through a novel taxonomy.

Improvement of abstract reasoning in teaching computer science at higher education level – (Teréz A. Várkonyi, Tibor Gregorics, and András Nagy)

Abstract. Nowadays, abstract reasoning is a key competence in computer science. It strongly affects mathematical and programming ability and it needs to be improved. The improvement, at higher education level, is usually connected to some knowledge transfer where present tendencies and needs are introduced. In programming, worldwide trends are object orientation and component-based programming. In this paper, the authors introduce new features of a template class library which has already been applied successfully to teach object-oriented programming. The library requires abstract understanding of problems and helps teachers to show relevant programming techniques to the students.

Deep learning and machine learning in hydrological processes climate change and earth systems a systematic review – *(Sina Ardabili, Amir Mosavi, Majid Dehghani, Annamaria R. Varkonyi-Koczy)*

Abstract. Artificial intelligence methods and application have recently shown great contribution in modeling and prediction of the hydrological processes, climate change, and earth systems. Among them, deep learning and machine learning methods mainly have reported being essential for achieving higher accuracy, robustness, efficiency, computation cost, and overall model performance. This paper presents the state of the art of machine learning and deep learning methods and applications in this realm and the current state, and future trends are discussed. The survey of the advances in machine learning and deep learning are presented through a novel classification of methods. The paper concludes that deep learning is still in the first stages of development, and the research is still progressing. On the other hand, machine learning methods are already established in the fields, and novel methods with higher performance are emerging through ensemble techniques and hybridization.

9:00-10:20 – ROOM B

Bio- and environmental engineering

Chairs: Satoshi Matsuda and Jan Mistrik

Modelling temperature variation of mushroom growing hall using artificial neural networks - *(Sina Ardabili, Amir Mosavi, Asghar Mahmoudi, Tarahom Mesri Gundoshmian, Saeed Nosratabadi, Annamaria R. Varkonyi-Koczy)*

Abstract. The recent developments of computer and electronic systems have made the use of intelligent systems for the automation of agricultural industries. In this study, the temperature variation of the mushroom growing room was modeled by multi-layered perceptron and radial basis function networks based on independent parameters including ambient temperature, water temperature, fresh air and circulation air dampers, and water tap. According to the obtained results from the networks, the best network for MLP was in the second repetition with 12 neurons in the hidden layer and in 20 neurons in the hidden layer for radial basis function network. The obtained results from comparative parameters for two networks showed the highest correlation coefficient (0.966), the lowest root mean square error (RMSE) (0.787) and the lowest mean absolute error (MAE) (0.02746) for radial basis function. Therefore, the neural network with radial basis function was selected as a predictor of the behavior of the system for the temperature of mushroom growing halls controlling system.

Analysis of Microbial Community in Garbage Composting Process – *(S. Matsuda and A. Yanagihara)*

Abstract. The amount of municipal waste is about 40 million tons per year in recent Japan, of which one-third is occupied by garbage fraction, mainly kitchen waste. Thus, it is valuable that this kind of food waste can be treated in environmentally-friendly way. Among several possible options, the microbial treatment type, which is called composting process, is regarded as one of the hopeful options [1, 2, 3]. That is why the microbial garbage treatment has been studied in our lab. for a long period. One of the valuable results was the development of the “static type” of small-scale garbage treatment system for domestic use [4, 5]. The term "static" means mixing operation is once a day at feeding only, and temperature nor air flow is not controlled. This system has a simple structure but has excellent characteristics in treating garbage with little generation of bad smell, and in particular, no consumption of electricity.

Design of air-cell cushion for prevention of pressure ulcers – *(T. Mashiko, Y. Kakimoto, and J. Takano)*

Abstract. The air-cell cushion is a promising material for the prevention of pressure ulcers, but there are still many things to be revealed toward the design of an optimal cushion. We measured the body-cushion interface pressure distribution, in comparison with the case of traditional urethane cushion, where different bodies, air pressures, cell sizes, etc. were tried. The results show, in terms of the pressure dispersion effect and the pressure relief effect, the superiority to the urethane cushion, controllability of both effects, and some others, such as the influence of cell division, which implies the existence of some optimal cell size.

The Effects of Strip Cropping Systems on Physico-Chemical Properties of Soil in the Moldavian Plain – *(Maria-Mihaela CIOBĂNIȚĂ, Gerard JITĂREANU, Petronela ANDRIESCU, Paul-Marian GHERASIM, Manuela FILIP, Costică AILINCĂI)*

Abstract. The research was carried out on the sloping land at the Agricultural Research Station of Podu-Iloaiei (41°18'52" N latitude, 27°25'45" E longitude) and the Experimental Farm of the Agricultural University of Iasi (47°12'62" N latitude, 27°51'52" E longitude) on a cambic chernozem (The World Reference Base for Soil Resources (WRB, 2006) and The Romanian Soil Taxonomy System (SRTS-2012). The experiments carried out the Experimental Farm of the Agricultural University of Iasi and at the Podu-Iloaiei Agricultural Research Station, during 2001-2018, had the following objectives: study of water runoff and soil losses by erosion, in different crops; annual rate of erosion processes under the influence of anti-erosion protection of different crops; influence of water runoff and soil erosion on organic matter and mineral element losses from soil. Measurements made after 36 years after the placement of perennial grass strips show that the slope of the platforms has decreased by 21.0-35.0% compared to the initial slope of the terrain, by the agro-terracing process, and the slope of the taluses with perennial grasses, increased by 214-397%. On 16% slope lands, the mean annual soil losses by erosion were comprised between 4.762 and 9.326 t ha^{-1} year $^{-1}$ in row crops (soybean and sunflower) and between 1.564 and 2.453 t ha^{-1} year $^{-1}$ in wheat and rape crops. The crop structure, which determined the diminution in mean soil losses by erosion until 2.800 t ha^{-1} year-^{1} included 20 % winter wheat, 20% of peas, 20% maize and 40 % perennial grasses and legumes.

10:40-11:00 Coffee break

Parallel presentations

11:00- 12:20 –ROOM A

Electronics and nanoelectronics 2

Chairs: Tripathi Saroj Raman and Tamara Potlog

Schottky Diode Detectors with Low Leakage Current at High Operating Voltage – *(V.M. Sklyarchuk, V.A. Gnatyuk, V.G. Pylypko, and T. Aoki)*

Abstract. For the first time, $Hg_3In_2Te_6$ (MIT) based Schottky diode photodetectors with the lowest reverse dark currents at high bias voltages were created. Both the Schottky rectifying and near Ohmic contacts were obtained by thermal vacuum

deposition of Cr onto the MIT crystal surfaces pre-treated with Ar-ion bombardment at different regimes. The crystal surface morphology was monitored by AFM. Cr/MIT/Cr photodiodes were sensitive in the range of 0.6-1.8 μm and operated at increased bias voltage up to 300 V with low current density < 150 μA/cm^2 and < 20 μA/cm^2 at 1 V at room temperature. *I-V* characteristics of the Cr/MIT/Cr diodes were investigated and showed high rectification ratio up to 10^3 at 1 V. A noticeable increase of the monochromatic current photosensitivity of Cr/MIT/Cr photodetectors was observed with increasing bias voltage and this parameter was weakly temperature dependent at voltages > 10 V.

Radiation Patterns of Double DNA-like Helices as Elements of Metamaterials and Antenna Systems – *(Ivan Mikhalka, Igor Semchenko, Sergei Khakhomov)*

Abstract. In this paper a double DNA-like helix as a promising element of metamaterials, metasurfaces and antenna systems for various frequency ranges is considered. The article demonstrates the possibility of creating the required radiation pattern of such a helix, excited by a plane electromagnetic wave by changing its angle of incidence. It is shown, that an incident wave at some angle can activate two wave modes in a helix, each of them propagates with its own phase velocity, and responsible for a certain type of radiation. This effect can be used in passive antenna devices and metamaterials, where the control of the direction of propagation of the reflected wave without changing the frequency of the excitation is required. In addition, the paper provides an overview of the main properties of cylindrical helical radiators, which in the future can be used in fabrication metamaterials and metasurfaces

Spectroscopic ellipsometry – optical characterization of photosensitizers for photovoltaics and photodynamic therapy *– (J. Mistrík)*

Abstract. Optical constants of two selected photosensitizers were determined by spectroscopic ellipsometry. Firstly, characterization of CdS (used in photovoltaics) revealed absorption tail that made explanation of spectral broadening of photo-electron conversion of CdS/TiO2 heterostructure possible. Secondly, absorption of phtalocyanine (used for photodynamic therapy) was determined not only in therapeutic spectral window. Broader spectral range UV-VIS-NIR of obtained optical constants provide experimental reference for adjusting theoretical ab-initio calculation.

Thermally Annealed in Vacuum Undoped and Al-doped ZnO Thin Films for Multifunctional Applications – *(Ion Lungu, Tamara Potlog)*

Abstract. Undoped and Al-doped ZnO thin films have been prepared by spray pyrolysis in oxygen and argon atmospheres. The structural properties of ZnO thin films were investigated using atomic force microscopy (AFM) and X-ray diffraction (XRD). The optical properties were studied by UV-VIS spectroscopy and photoluminescence (PL) at room temperature. The electrical resistivity and Hall mobility were measured using the van der Pauw technique at room temperature. AFM studies show that the ambient atmosphere influences the roughness parameters of the ZnO surfaces. The XRD results revealed that undoped and Al-doped ZnO films are polycrystalline and developed [0002] preferred orientation. The best electrical parameters (conductivity, mobility carriers and carrier concentration) are obtained for 1.0 at.% of Al-doped ZnO synthetized in Ar atmosphere. In all cases, the electrical parameters under Ar are higher than under O_2 atmosphere, unless they are not doped. Different applications of undoped and Al-doped ZnO thin films are discussed.

11:00- 12:20 – ROOM B

Chemical processes and materials 2

Chairs: Takashi Mashiko and Balázs Rakos

Mechanical properties of 3d printed cellular structures with topology of triply periodic minimal surfaces – *(Balabanov S.V., Makogon A.I., Sychov M.M.)*

Abstract. Design of cellular structures determines its properties and application. We 3D printed structures with topology of triply periodic minimal surfaces (TPMS) consisting of repeating units with minimal possible surface. As a result of

mechanical tests of samples dependencies of strength of samples on geometry were received. It was established that the largest specific strength and an energy absorption properties have samples with the Diamond geometry.

Optical Diagnostics of Metal-Dielectric Heterostructures with Uppermost Graphene Layer – *(L.V. Poperenko, V.V. Prorok, A.O Shcherbakov, I.V. Yurgelevych)*

Abstract. The coefficients of reflection and the ellipsometric parameters, namely the phase shift Δ between the *p*- and *s*-components of the polarization vector and the azimuth Ψ of the restored linear polarization were measured by methods of reflectometry in *p*-polarized light and spectral ellipsometry for samples of heterostructures "chrome-one of the noble metals (copper, silver, gold)-hafnium oxide-graphene". The optical constants, namely the refractive *n* and the absorption *k* indices and the optical conductivity σ of the films were calculated for different light wavelengths in the approximation of semi-infinite medium. The characteristic spectral regions of the interband and the plasmon absorption of these multilayered films were determined too. It was also found that in the visible, where the plasmon excitation provides some contribution to the intraband absorption, a singularity in the form of a broad maximum at photon energies of 1.0 - 1.5 eV is observed for the sample Cr(1.5 nm)_Cu(43 nm)_HfO_2(7 nm)_Graphene. At several wavelengths the plasmon excitation effect was observed in noble metal-based heterostructures within the visible. The most favorable area for such heterostructures as optical sensors was determined in so-called arbitrary coordinates "a light wavelength of probing light beam – an angle of its incidence on the heterostructure".

12:20- 13:40 Lunch

14:00 Bus departure to Óbuda Campus of Óbuda University

14:30-16:00 Laboratory visits

16:00 - Transfer to Balatonfüred
Accomodation: Hotel Annabella Superior

18:30 - IA Committee meeting *(place to be decided on spot)*

19:00 Dinner at Hotel Annabella

September 6, Friday

Invited Keynote talks - ROOM A

9:30-10:00 – X-ray photon and charrier counting imager by CdTe/Si ROIC – *(T. Aoki, K. Takagi, T. Takagi, H. Kase, A. Koike)*

Chair: Dumitru Luca

Abstract. CdTe photon-counting X-ray image sensor with charge-counting readout IC was developed for high quality X-ray imaging. CdTe is one of the good materials for X-ray imaging. It is very difficult to make integrated circuit on CdTe wafer however, we should stack Si-readout IC(ROIC) and CdTe multi-pixel sensor chip by bumping process. In this paper, we use sliver paste based bumping for this stack connection. We developed new ROIC and obtained a desired gain and good linearity are equipped on the charge-to-digital convertors (QDC), spectra of 241Am and 57Co can be discriminated, and differences between with and without a material have been shown as image. We demonstrate X-ray penetrate image by using this device.

10:00-10:30 - Assessing the oxidation-corrosion balance during dynamic electrochemical oxidation of titanium surface - *(C.-T. Teodorescu-Soare, M. Dobromir, G. Stoian, and D.Luca)*

Chair: Toru Aoki

Abstract. The concurrent oxydation-corrosion balance (OCB) processes during the anodization of titanium surface via a self-organization process is the key factor in the formation of titania nanotubes using the templateless approach. The evolution of OCB was investigated here during dynamic anodization of Ti surface using periodic sawtooth-like voltages with diferent start values, rate of change and frequency. The results were interpreted in terms of the efects of the diffusion of active ion species at the electrolyte-anode interface. The results may serve to draw a more general picture of the phenomena involved in the synthesis of one-dimensional structures in valve metals.

10:30-10:50 Coffee break

10:50- 12:30 – ROOM A

Modeling and simulation

Chairs: Jun Kondoh and E. Aleksandrova

The Dialogic Advance of Scientific Educational Practices – *(Valerie A. Wilkinson)*

Abstract. The fourth year of our collaboration and third iteration of our experimental research is composed of a structured Control class of 62 students and an Experimental class of 51 students. The start-up preparation before the first class forced close examination of the practices and strategies in structuring the two groups. The one group is conceived of as a Project Based Learning (PBL) simulation; the other group is Task-Based language learning (TBLL). The Project Team simulation promotes development of layered relationships and valorizes leadership in teams. The TBLL group has professor, technical assistant, and researcher with orderly routines. The university asks us as educators to work to promote diversity, innovation and creativity. Consistent high quality group development is also desired. Are these goals in conflict?

Enhancing Academic English for Broad Spectrum Communication Competencies in Science, Technology, Engineering, and Mathematics (S.T.E.M.) Universities – *(V. A. Wilkinson, D.M. Chandler)*

Abstract. In the Faculty of Engineering at Shizuoka University, third year students take required Academic English (AE) from a professor in their major field. This AE class requires the professor to integrate English language skills with administrative, lab, and research practices. For the third iteration of the research project, the authors intend to develop best practice recommendations for AE instruction in a STEM setting. These recommendations are based on applicability tests for a wide variety of class structures in order to be meaningful for a wide variety of science professors. This research iteration consists of two classes: an Experimental class using Project Based Learning (PBL) and a Control class using Task-Based Language Learning (TBLL). Students are trained to develop and deliver poster presentations in their fields of research using Academic English in workshop style classes.

Micromechanical modeling of Damage Behavior at Crack Tip Vicinity of Orthotropic Using Image Processing *(Nabi Mehri Khansari, Mozhgan Mokari, Amir Mosavi)*

Abstract. Over the recent decades, orthotropic materials like composite structures have widely been applied in various industries especially under mixed mode I/II loading conditions. Therefore, estimation of residual strength and constitutive properties of these materials in such conditions need to be thoroughly examined. Several methods have been proposed for testing the constitutive behavior and strength of the materials but due to encountering with damage zone at crack tip vicinity, the evaluation of the parameters is so difficult. In the present paper, a new method termed “MMD’ based on Micromechanical Modeling of Damage mechanics for initiation of microcrack at crack tip vicinity of composite structures considering Image processing method has been employed. In this method, constitutive properties of damage zone for a

PMC composite structure has been estimated. It was shown that the results of (MMD) method have a remarkable precision in comparison with experimental data.

Nonlinear Aeroelasticity of damaged composite panel under supersonic flow *(Nabi Mehri Khansari, Seyed Saeed Mozafareiyan, Amir Mosavi, Timon Rabczuk)*

Abstract. In the present paper, new analytical approach is proposed for investigation of the nonlinear aero-elastic response of damage composite plate under supersonic flow. In this content, two-dimensional bending equation of simply-supported damaged composite plate is considered based on classical plate theory (CPT), the Von Kármán nonlinear relations, and linear Piston theory for aerodynamic pressure. Although, various models have been penalized for investigation of damaged solid properties under uniform loading, no specific model has been reported for predicting behavior of damaged composite panel under non-linear aero-elastic loading. At the present study, non-linear aero-elastic behavior of damaged PMC composite panel is proposed based on new approach called “aeroelastic damaged model (ADM)”. By applying Galerkin’s method the partial differential equations of motion reduce the governing equations to nonlinear ordinary differential equations and then solved by a numerical integration method. The results show that damaged and non-damaged mode indicate the effects of damage characterization on frequency spectrum and accuracy of the method.

12:30- 14:00 Lunch

14:30 Bus departure to the guided tour to Herend, Tihany and Balatonfüred

19:30 Gala Dinner – Enni Jó Restaurant, Balatonfüred

September 7, Saturday

9:00 – Transfer to Hotel Gellért, Budapest
11:30 – Awards, closing session – ROOM A
12:30 – 14:00 Lunch
14:00 – Visit to Gellért Thermal Bath – optional