

Seventh International Conference “Modern Trends in Science”
14 - 18.06.2017, Blagoevgrad, Bulgaria

Seventh International Conference
“Modern Trends in Science”
FMNS-2017



14 - 18.06.2017, Blagoevgrad, BULGARIA

BOOK OF ABSTRACTS

Patronized by
Prof. Borislav Jurukov
Rector of South-West University

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& the National Science Fund of Bulgaria

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Dear Colleagues and Friends,

On behalf of the Organizing Committee, I would like to welcome you at the **Seventh International Conference „Modern Trends in Science”** (FMNS-2017), organized by the Faculty of Mathematics and Natural Sciences at South-West University “Neofit Rilski”, Blagoevgrad, BULGARIA. I am happy that more than 200 authors from 10 countries have contributed to the scale and importance of the conference. I highly appreciate the fact that more than a half of the participants are young researchers.

The main objective of FMNS-2017 is to provide a platform for researchers, working in different fields of natural sciences, to report their current research achievements, to exchange new ideas and experiences, to create new contacts and to find global partners for future cooperation. I am convinced that the multifarious scientific program of the conference, along with the unique academic atmosphere as well as the cultural and historical heritage of our city, will provide an inspiring environment for both scientific and social communication.

We are grateful to the sponsors of the FMNS-2017 conference for helping to make this event successful.

I wish all participants in FMNS-2017 an excellent presentation, fruitful discussions and a pleasant stay in Blagoevgrad.

Mario Mitov

FMNS-2017 Conference Chair

CONGRATULATORY ADDRESS

**to the participants in the Seventh International Conference
"Modern Trends in Science",
organized by the Faculty of Mathematics and Natural Sciences of
the South-West University "Neofit Rilski" - Blagoevgrad
from Academician Evgeny Golovinsky**

Dear Colleagues,

Thanks for the invitation to participate in the work of the Seventh International Conference "Modern Trends in Science". Whenever I have the opportunity, I have taken part in the work of the previous conferences organized by our faculty. This time, my absence from the country will prevent me from keeping the good tradition.

Allow me to share with you that 30 years ago, in 1987, I was given the chance and the responsibility to found and lead the first Department of Chemistry at South-West University. The Department was conceived and implemented within the framework of the then Faculty of Engineering and Pedagogy, established in 1983 as part of the Higher Pedagogical Institute in Blagoevgrad. In 1989 this faculty held a discussion on how to call the future faculty to unite science departments such as mathematics, physics, informatics, chemistry and others. My colleagues from the Faculty Council offered different names to the planned academic structure, but in the end everyone was united around my proposal that the new faculty be called "Faculty of Mathematics and Natural Sciences ". This my proposal for the name of the new faculty was adopted. Since December 1989, the Faculty of Mathematics and Natural Sciences has been established by decision of the Council of Ministers. I want to believe that not only this is the contribution that I have given to the development of South-West University "Neofit Rilski".

The international conferences organized by the Faculty in the course of a year on the topic "Modern Trends in Science" became a part of its overall activity. Previous practice has shown the value of these memorable events. On some of them I have invited my colleagues from abroad who have always been with great impressions from the meetings with Bulgarian science and its representatives from the South-West University. Among these scientists there were also representatives of interdisciplinary sciences, especially in disciplines developing on the border between chemistry and biology. By the way, I also want to share my longing for our Faculty of Mathematics and Natural Sciences to have a department, in which knowledge and training in natural sciences is extended to the field of biological sciences. By the way, thirty years ago, when our faculty was forming, this emptiness had already been clear enough.

There is no man-made work that does not have its own beginning and its natural end. The story inexorably marks the classic "from" and "up". I hope I'm not wrong, but it seems to me that there is only one creation of civilized societies, which has only a start, but fortunately it is usually not over. This is the creation and activity of those oases of the human spirit, which we call the holy word "universities".

Created by the intellectual need and by the persistent will of the most awakened representatives of society, scientific and educational institutions continue their existence for dozens and hundreds of years for the pride of nation and state. I am convinced that this will be the fate of the South-West University "Neofit Rilski" in Blagoevgrad and the already gained national and international recognition of its Faculty of Mathematics and Natural Sciences. Certainly cooperative with their development, I wish South-West University and its Faculty of Mathematics and Natural Sciences success and intellectual will to promote their not only a very useful and important, but also a noble mission.

ORGANIZING COMMITTEE:

Chair: Prof. Mario Mitov - Vice-Dean of Faculty of Mathematics and Natural Sciences

Vice-Chair: Assoc. Prof. Elena Karashtranova - Vice-Dean of Faculty of Mathematics and Natural Sciences

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Hristina Kovacheva - South-West University “Neofit Rilski”, Bulgaria

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Chair: Academician Blagovest Sendov

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Plamen Atanasov - University of New Mexico, Albuquerque, USA

Lori Nalbandian - Centre for Research & Technology, Hellas, Greece

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Peter Petrov - Bulgarian Academy of Sciences, Bulgaria

Luchezar Avramov - Bulgarian Academy of Sciences, Bulgaria

Ljuben Mihov - South-West University “Neofit Rilski”, Bulgaria

Ivanka Georgieva - South-West University “Neofit Rilski”, Bulgaria

GEOGRAPHY, ECOLOGY AND ENVIRONMENTAL PROTECTION

Veselin Boyadzhiev - Sofia University “St. Kliment Ohridski”, Bulgaria

Marian Varbanov - Bulgarian Academy of Sciences, Bulgaria

Anna Ganeva - Bulgarian Academy of Sciences, Bulgaria

Krasimira Ilieva-Makulec - Kardynał Stefan Wyszyński University
in Warsaw, Poland

Janusz Uchmański - Kardynał Stefan Wyszyński University in Warsaw,
Poland

Conference Program

Registration

14.06.2017 13:00 – 18:30

15.06.2017 08:00 – 10:30

University Conference Center "Bachinovo"

Opening Ceremony

15.06.2017 10:00 – 10:30

Central Auditorium of Conference Center

Chairman: Prof. Mario Mitov, PhD

Plenary Lectures

Central Auditorium of Conference Center

15.06.2017

10:30 – 11:15

**Acad. Prof. Julian Revalski – President of Bulgarian Academy of
Sciences, Bulgaria**

***"Evolutionary Game Theory: "playing" between Mathematics,
Biology and Social Sciences"***

11:15 – 12:00

**Prof. Armen Sergeev - Vice-President of European Mathematical
Society, Russia**

"Mathematics and Physics: forged together with one chain"

16.06.2017

10:30 – 11:15

Prof. Erwin Rosenberg - TU-Vienna, Austria

***"Increasing the Safety and Performance of Lithium-Ion Batteries
by New Materials and New Approaches"***

11:15 – 12:00

**Prof. John Greenman - University of the West of England, Bristol,
UK**

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“Microbial Fuel Cells and their likely role in the future”

Sessions (oral presentations)

15 - 16.06.2017

13:30 - 15:00

15:30 - 17:15

Conference Halls of Center “Bachinovo”

Poster Session & Welcome Party

15.06.2017

17:15 - 19:00

Lobby of Center “Bachinovo”

Official dinner

16.06.2017

20:00 – 23:00

Restaurant of Center “Bachinovo”

Social Program (Excursion)

17.06.2017

Section: Chemistry
Hall 3

Thursday, June 15

Chairman: **Assoc. Prof. David Havlíček**

- 13:30- *Tanja Kamburi, Luljeta Pinguli, Ilirjan Malollari, Lorina Malollari*
13:45 Impact of malt quality parameters on beer filtration optimization process
- 13:45- *Tanja Kamburi, Luljeta Pinguli*
14:00 The role and the influence of enzymes in the optimization of wort production for beer
- 14:00- *Jane Bogdanov, Menče Najdoska-Bogdanov, Bogdan Bogdanov*
14:15 Comparative study of commercially available alcoholic beverages from southeast Balkans based on anethole-containing plants
- 14:15- *Yordanka Tasheva, Anton Palichev, Todor Palichev*
14:30 Decreasing sulfur in diesel fraction by different methods
- 14:30- *Kristina Georgieva, Fatme Tabanli, Simeon Simeonov, Mitko Stoev*
14:45 Chemistry of knife making
- 14:45- *Katerina Ranchova, Radoslava Keszova, Maria Farazova, Lili Asenova, Mitko Stoev*
15:00 Enzymatic preparation of bioethanol and bioethanol gel from cellular agricultural residues

Coffee break

Chairman: **Assoc. Prof. Petko Mandjukov**

- 15:30- *Elena Hristova*
15:45 Study of precipitation chemistry composition in urban area
- 15:45- *Blagorodka Veleva, Elena Hristova, Rallica Valcheva, Emilia Nikolova*
16:00 Chemical characterization of atmospheric particulate matter (PM10 and PM2.5)

- 16:00- *Petr Stepnicka*
16:15 Synthesis and coordination properties of isomeric functional phosphinoferrocene donors
16:15- *Jiří Plocek, David Havlíček, Lukáš Taraba, Matěj Mižňanský*
16:30 Proton conductivity measurement on powder samples
16:30- *Petranka Petrova, Maya Chochkova, Irina Karadjova, Ivanka Dakova, Metody Karadjov*
16:45 Selective preconcentration of Pt and Pd using amino acid functionalized silica gel

Friday, June 16

Chairman: **Assoc. Prof. ZHIVKO VELKOV**

- 13:30- *Ivan Nemeč, Irena Matulkova, Ivana Cisarova, Matous Kloda,*
13:45 *Robert Gyepes*
The salts of aminopyrimidines – prospective molecular crystals for nonlinear optics
13:45- *Boyka Stoykova, Maya Chochkova, Galya Ivanova, Iva Tsvetkova,*
14:00 *Hristo Najdenski, Martin Sticha, Tsenka Milkova*
Adamantane-1-carboxamides: synthesis and antimicrobial activity
14:00- *Rumen Georgiev, Atanas Chapkanov, Tatiana Dzimbova*
14:15 Short-chain peptide analogues as potential hormonal inhibitors - trends and perspectives
14:15- *Dominik Rejman, Eva Zborníková, Radek Pohl, Marcel Ehn, Milan Kolář,*
14:30 *Kateřina Bogdanová, Renata Večeřová, Gabriela Seydlová, Radovan Fišer, Libor Krásný*
Design, synthesis, and properties of lipophosphonoxins II: novel broad spectrum antimicrobial agents
14:30- *Matouš Kloda, Ivana Císařová, Ivan Němec*
14:45 Reactivity of selected nitrogen-containing heterocycles with respect to their potential application in nonlinear optics

Coffee break

Chairman: **Assoc. Prof. Atanas Chapkanov**

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- 15:30- *Valery Vachkov, Zhiivko Velkov*
15:45 Quantum-chemical modeling of selected transition metals tellurides and sulfides
- 15:45- *Yavor Mitrev, Radoslav Chayrov, Ivanka Stankova*
16:00 ^1H and ^{13}C NMR spectral assignments of the fifteen systematically modified adamantane derivatives
- 16:00- *Jane Bogdanov*
16:15 Electron capture chemical ionization of 2,7-Naphthalene derivatives
- 16:30- *Ivan Angelov, Venko Beschkov*
16:45 Optimization of biogas production from lignocelulosic materials by different methods of substrate treatment
- 16:45- *Bekbolat Nussupbekov, Ayanbergen Khassenov, Mitko Stoev,*
17:00 *Dana Karabekova, Anuar Beysenbek, Berik Kazankap*
Electrohydraulic ragging of metallurgical silicon (*addendum*)

Section: Ecology and Environmental Protection
Hall 4

Thursday, June 15

Chairman: **Assoc. Prof. Emilia Varadinova**

- 13:30- *Violeta Evtimova, Atanas Grozdanov, Ventzeslav Delov, Dimitar Parvanov*
13:45
Distribution of cetaceans in the South-western Black Sea waters
- 13:45- *Emilia Varadinova, Maria Kerakova*
14:00
Trophic structure of the riverine benthic macroinvertebrates in type-specific reference conditions
- 14:00- *Anita Kaliszewicz*
14:15
The optimal reproductive strategy of a clonal *Hydra* under different biotic and abiotic conditions
- 14:15- *Luchezar Pehlivanov, Apostolus Apostolou, Boris Velkov*
14:30
Effects of small HPPs on the river fish communities. Case studies
- 14:30- *Anna Augustyniuk-Kram*
14:45
Relationship between host insect, enzymatic activity and virulence of entomopathogenic fungi
- 14:45- *Piotr Ceryngier*
15:00
Potential of natural enemies to control the numbers of the invasive harlequin ladybird

Coffee break

Chairman: **Assoc. Prof. Lidia Sakelarieva**

- 15:30- *Janusz Uchmański, Krzysztof W. Opaliński, Karolina Rau*
15:45
Intraspecific competition in an island environment: variability and dispersal of terrestrial snail *Helix aspersa aspersa*
- 15:45- *Krassimira Ilieva-Makulec*
16:00
Nematodes in natural and agricultural ecosystems: community parameters reflecting changes undergoing in the soil

- 16:00- *Dimitar Parvanov, Emilian Stoynov, Hristo Peshev, Atanas Grozdanov*
16:15
Habitat viability and threats assessment for the reintroduction of the Bearded Vulture (*Gypaetus barbatus*) in Bulgaria
- 16:15- *Emilian Stoynov, Elena Kmetova-Biro, George Stoyanov, Hristo Peshev, Ivelin Ivanov, Ilian Stoev, Luchezar Bonchev, Nadya Vangelova, Zlatka Nikolova, Lyubomir Iankov, Dimitar Parvanov, Atanas Grozdanov*
16:30
Population boost of the Griffon Vulture *Gyps fulvus* in Bulgaria based on reintroductions
- 16:30- *Hristo Peshev, Emilian Stoynov, Dimitar Parvanov, Atanas Grozdanov*
16:45
Spatial dynamics of *Gyps fulvus* population in SW Bulgaria
- 16:45- *Atanas Grozdanov, Emilian Stoynov, Hristo Peshev, George Stoyanov, Luchezar Bonchev, Nadya Vangelova, Dimitar Parvanov*
17:00
Behavioral specifics may help conservation of Griffon Vulture *Gyps fulvus* in modern Europe through establishment of vulture safe areas – a model from Bulgaria
- 17:00- *Emilian Stoynov, Nadya Vangelova, Diana Zlatanova, Hristo Peshev, Dimitar Parvanov, Ventseslav Delov, Atanas Grozdanov*
17:15
Wolf and Vultures sympatric presence in Europe – ecological benefits and constrains

Friday, June 16

Chairman: **Assoc. Prof. Emilia Varadinova**

- 13:30- *Alexander Pulev, Borislav Naumov, Lidia Sakelarieva, George Manolev, Lyuben Domozetski*
13:45
Distribution of Eastern Montpellier Snake *Malpolon insignitus* (Geoffroy de St-Hilaire, 1809) (Reptilia: Psammophiidae) in Southwestern Bulgaria

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- 13:45- *Alexander Pulev, Lyuben Domozetski, Lidia Sakelarieva,*
14:00 *George Manolev*
Zoogeography of Eurasian Blind Snake *Xerotyphlops vermicularis* (Merrem, 1820) (Reptilia: Typhlopidae) in Southwestern Bulgaria
- 14:00- *Nevena Malakova, Lidia Sakelarieva, Alexander Pulev*
14:15 Distribution and conservation status of the Wall Lizards *Podarcis* Wagler, 1830 (Reptilia: Lacertidae) in protected area BG0001022 „Oranovski Prolom – Leshko”
- 14:15- *Jerzy Romanowski, Dawid Marczak*
14:30 Beaver *Castor fiber* - monitoring of successful reintroduction and current management issues in Kampinos National Park (central Poland)
- 14:30- *Stoyan Yordanov, Ventseslav Delov, Krastio Dimitrov, Atanas*
14:45 *Grozdanov, Dimitar Parvanov*
Notes on behavioral ecology of bats in Southern Black Sea region of Bulgaria
- 14:45- *Michail Michailov*
15:00 Environmentalistika - what is it?

Coffee break

Chairman: **Assoc. Prof. Konstantin Tyufekchiev**

- 15:30- *Donka Staneva, Ivanka Yordanova*
15:45 Content and behavior of cesium-137 and strontium-90 in soil and some indicative plants in Bulgaria 30 years after the Chernobyl accident
- 15:45- *Boyko Kolev, Veselina Dalgacheva, Veronika Goceva*
16:00 Analysis of some soil parameters before and after fire
- 16:00- *Boyko Kolev, Hrisula Gatzelaki*
16:15 Modelling of the potential production of agricultural crops
- 16:15- *Nikolinka Atanasova*
16:30 The cluster - a sustainable system for waste management
- 16:30- *Nikolai Mihailov, Lidia Sakelarieva*
16:45 Biological diversity, environmental justice, and moral values

Section: Geography
Conference Hall 5

Thursday, June 15

Chairman: **Assoc. Prof. Emilia Patarchanova**

- 13:30- *Vladimir Karadzhov*
13:45 Contemporary demographic development of Bulgaria - how to be among the world leaders in population mortality without war?
13:45- *Emilia Patarchanova, Gergana Nikolova*
14:00 Social and social capital - opportunities for sustainable development of municipalities in Kustendil
14:00- *Stefan Petrov, Vladimir Karadzhov*
14:15 Contemporary processes of depopulation in Vidin district, Bulgaria, Eastern Europe
14:15- *Valentin Iliev*
14:30 Regional consequences of refugee settlements territorial dispersion in Lebanon
14:30- *Mariya Grozeva*
14:45 Accomodation facilities and opportunities for tourism development in rural areas of South-West planning region in Bulgaria
14:45- *Plamen Stoyanov*
15:00 A study of the opportunities for reconstruction and development of crafts and activities of companies in the cultural and creative sector in the municipalities of Slivnitsa, Dragoman and Godech

Coffee break

Chairman: **Assoc. Prof. Krasimir Stoyanov**

- 15:30- *Stoyan Nedkov, Petar Nikolov, Ivo Ihtimanski*
15:45 Mapping of ecosystem condition in urban landscapes using integrated index of spatial structure

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- 15:45- *Stoyan Nedkov, Ivo Ihtimanski*
16:00 Mapping of cultivated crops services provided by urban ecosystems in Bulgaria
- 16:00- *Svetoslav Nikolov, Ivan Drenovski*
16:15 Economic valuation of some ecosystem services in the Bulgarian part of Vlahina Mountain
- 16:15- *Ivan Drenovski*
16:30 About continental rainfall index (coefficient) in Bulgaria
- 16:30- *Krasimir Stoyanov, Galina Bezinska, Miroslav Ivanov, Emil Gachev*
16:45 Physical-geographical and meteorological preconditions for floods in Aydarovska River (South-West Bulgaria)

Friday, June 16

Chairman: **Assoc. Prof. Emil Gachev**

- 13:30- *Emil Gachev, Brigitte Magori, Flavius-Sorin Sirbu, Alexander Gikov*
13:45 Rock glaciers in Bulgarian highest mountains as story-tellers of environmental past
- 13:45- *Tzanko Tzankov, Svetla Stankova, Krasimir Stoyanov, Rosen Iliev, Ilia Mitkov, Tatyana Aleksieva*
14:00 Comparative analysis between the Rhodopean Mountain massif and the Rila-Pirin Mountains range (South Bulgaria, North-East Greece)
- 14:00- *Stefani Nesheva, Ivan Drenovski*
14:15 Development of sample routes for school trips in the vicinity of Sofia
- 14:15- *Miroslav Ivanov*
14:30 Main stratigraphic units in Blagoevgrad Graben - relation, facies features, Late Miocene orthoplen destruction and relief evolution
- 14:30- *Emil Gachev*
14:45 Prominent surface karst and glaciokarst features in Durmitor mountains (Montenegro)
- 14:45- *Vladimir Vlaskov*
15:00 Geomorphological aspects of urban growth

Coffee break

Section: Mathematics
Hall 7

Thursday, June 15

Chairman: **Prof. Dončo Dimovski**

- 13:30- *Lorena Margo, Eljona Milo*
13:45 Bootstrapping time series that contain a seasonal component
13:45- *Eljona Milo, Lorenc Ekonomi, Lorena Margo*
14:00 Comparison of different methods for missing data imputation in time series
14:00- *Danjela Braho, Edlira Donefski*
14:15 Statistical convergence of asymptotic martingales
14:15- *Edlira Donefski, Lorenc Ekonomi, Danjela Braho*
14:30 Edgeworth approximation for Chi-squared distribution
14:30- *Zoran Misajleski*
14:45 Proximate and approximate sequences
14:45- *Limonka Lazarova*
15:00 Results on the composition of distributions

Coffee break

Chairman: **Prof. Peter Boyvalenkov**

- 15:30- *Biljana Zlatanovska, Dončo Dimovski*
15:45 Explicit solutions of modified Lorenz system
15:45- *Tatjana Atanasova – Pachemska, Limonka Koceva Lazarova,*
16:00 *Maja Srebrenova, Marija Miteva*
The category of partial proper homotopy
16:00- *Vassil Grozdanov, Vesna Ristovska*
16:15 On the $(W_{G_b, \varphi}; \alpha; \beta; \gamma)$ -
 \mathcal{S} diaphony of the net of Zaremba-Halton over finite groups
16:15- *Stoyan Vezenkov*
16:30 Double helix model of prime numbers and a new sieve technique
16:30- *Krasimir Yordzhev*
16:45 On a factor set of binary matrices

- 16:45- *Ilinka Dimitrova, Joerg Koppitz, Laddawan Lohapan*
17:00 Generating sets of semigroups of transformations preserving
a zig-zag order

Friday, June 16

Chairman: **Assoc. Prof. Vasil Grozdanov**

- 13:30- *Miroslava Ivanova, Lilko Dospatliev*
13:45 Evaluation of impact of consumption, investment and export
on import - data on German economy
13:45- *Anka Markovska*
14:00 Analysis of a mathematical model of adaptive immune re-
sponse to virus infection
14:00- *Mihail Kolev, Iveta Nikolova*
14:15 On mathematical modelling of the competition between the
immune system and viral infections
14:15- *Mihail Kolev, Anelia Urumova*
14:30 Mathematical modelling and numerical simulations in ecol-
ogy
14:30- *Miroslava Ivanova, Lilko Dospatliev*
14:45 Application of Markowitz portfolio optimization on Bulgarian
stock market from 2013 to 2016

Section: Informatics
Hall 8

Thursday, June 15

Chairman: **Assoc. Prof. Irena Atanasova**

- 13:30- *Blerina Çeliku, Ilija Ninka, Klajdi Qafzezi*
13:45 A survey on most common cryptographic algorithms: their design principles and current use
- 13:45- *Margarita Todorova, Mario Petrov, Spas Trenchev*
14:00 Research work of Backpropagation and Levenberg-Marquardt algorithms for recognition on biometrics data
- 14:00- *Mirjana Kocaleva, Aleksandra Stojanova, Natasha Stojkovikj,*
14:15 *Biljana Zlatanovska*
Modeling of the Rossler and Chua systems with AnyLogic program
- 14:15- *Slavcho Shtrakov*
14:30 Minors of finite operations
- 14:30- *Ivo Damyanov, Dimiter Kovachev*
14:45 Canalizing identifications
- 14:45- *Dhori Beta*
15:00 Improvement on some techniques used to detect and prevent SQL injections

Coffee break

Chairman: **Assoc. Prof. Slavcho Shtrakov**

- 15:30- *Velin Kralev, Radoslava Krалеva*
15:45 Approaches to designing relational databases
- 15:45- *Mariana Durcheva, Malinka Ivanova*
16:00 Key agreement protocol for distributed secure multicast for eAssessment
- 16:00- *Georgi Tuparov, Abdul Rahman Al Sabri, Daniela Tuparova*
16:15 Free hosting for mobile learning – comparative analysis

- 16:15- *Radoslava Krалеva, Aleksandar Stoimenovski, Velin Krалev*
16:30 Design and development of a mobile application for children with disorders
- 16:30- *Georgi Tuparov, Daniela Tuparova*
16:45 Tools for educational computer games development – feature analysis
- 16:45- *Ivan Todorin*
17:00 Protein folding using two angles for curving in space
- 17:00- *Ivan Todorin*
17: 15 Protein folding using three componential score function and one angle of curving

Friday, June 16

Chairman: **Prof. Peter Milanov**

- 13:30- *Ivo Damyanov, Nadezhda Borisova*
13:45 Programming languages in undergraduate courses and in software industry in Bulgaria
- 13:45- *Mariya Palahanova, Dimitar Kovachev, Ivelina Peneva*
14:00 On a class of programming tasks by using the random number generators
- 14:00- *Ivo Damyanov*
14:15 Syntax sugar in programming languages
- 14:15- *Vesna Ristovska*
14:30 Low-discrepancy sequences in quasi-Monte Carlo integration
- 14:30- *Gergana Kalpachka, Georgi Kotsev*
14:45 One approach for software development to management of assembly line
- 14:45-
15:00

Coffee break

Section: Methodology in Education
Hall 9

Thursday, June 15

Chairman: **Prof. Plamen Gramatikov**

- 13:30- *Lorena Kelo, Marie Dede, Sotiraq Marko, Esmeralda Guliqani*
13:45 Didactic methods of teaching Physics at "Fan S. Noli" University, in Korçë
- 13:45- *Sotiraq Marko, Lorena Kelo, Esmeralda Guliqani*
14:00 The problem solving method and the research, needed to transmit the new sets of knowledge in physics
- 14:00- *Svetlana Angelova*
14:15 Natural science knowledge "animal diversity" in the area of professional competencies of the future primary school teachers
- 14:15- *Georgi Malchev*
14:30 Non-formal education of physics including making devices for demonstration
- 14:30- *Adnan Sharaf Ali Yousef Al-Absi, Ivelina Peneva, Krasimir Yordzhev*
14:45 About the application of information technologies in the universities in Yemen
- 14:45- *Adnan Sharaf Ali Yousef Al-Absi, Ivelina Peneva, Krasimir Yordzhev*
15:00 Student's readiness for e-learning in the universities in Yemen

Coffee break

Chairman: **Assoc. Prof. Stefan Manev**

- 15:30- *Valentina Chileva*
15:45 TCP model for solving mathematical problem situations in primary school
- 15:45- *Krassimir Vitlarov, Zhelyazka Raykova*
16:00 A need for formation of scientific literacy in the study of the subject "Physics and Astronomy " 8th grade in the Bulgarian school

- 16:00- *Velichka Dimitrova, Magdalena Shekerliyska*
16:15 Role of using educational tasks in Chemistry
16:15- *Daniela Tuparova*
16:30 Cross curricular education in ICT classes
16:30- *Emilia Nikolova, Daniela Tuparova*
16:45 Cross-Curricular Teaching in STEM Education – possibilities
in Bulgarian schools

Friday, June 16

Chairman: **Assoc. Prof. Daniela Tuparova**

- 13:30- *Vasiliki Kasiora*
13:45 A project as a modern method in education
13:45- *Apostolia Charmani*
14:00 Art activities in correctional - pedagogical work with children
with SEN
14:00- *Elena Karashtranova*
14:15 Opportunities for usage of random number generator in teaching
of Mathematics and Informatics
14:15- *Tatjana Atanasova – Pachemska*
14:30 Formalism in knowledge of Mathematics
14:30- *Radost Vassileva*
14:45 Cognitive problems for developing students’ scientific literacy in
their Physics education

Coffee break

Section: Physics and Technical Sciences
Hall 11

Thursday, June 15

Chairman: **Assoc. Prof. Ralitsa Stanoeva**

- 13:30- *Petya Petkova, Petko Vasilev*
13:45 Study of magnetic behavior of Co_3O_4
- 13:45- *Lubomir Direkov*
14:00 Study of residual radioactivity in fish and fishery products imported into Bulgaria from China, Vietnam, Japan and Norway
- 14:00- *Peter Petrov, Darina Kaisheva, Gizo Bokuchava, Igor Papushkin*
14:15 Study of residual stresses during electron beam welding of alloyed steels using neutron diffraction
- 14:15- *Lyuben Ivanov*
14:30 Improved multisoliton compressor
- 14:30- *Peter Polyakov, Natalya Rusakova, Yuliya Samukhina, Iliya Gyudzhenov, Marek Tassev*
14:45 Waves in plasma medium with magnetized dust particles
- 14:45- *Ralitsa Stanoeva*
15:00 Analysis of dissociation of 10B and 10C nuclei in nuclear track emulsion

Coffee break

Chairman: **Assoc. Prof. Ivan Trenchev**

- 15:30- *Liliya Petrova*
15:45 Stresse's distribution in elastic isotropic semi-space with concentrated vertical force
- 15:45- *Liliya Petrova*
16:00 Force's lines influences in a single static undetermined beams
- 16:00- *Vasil Milovanski, Gergana Kalpachka*
16:15 Analysis of average power at simistor phase adjustment
- 16:15- *Yordan Deyanski, Boiana Garkova*
16:30 Design of passive optical network in urban areas
- 16:30- *Anna Majchrzycka*

Seventh International Conference "Modern Trends in Science"
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16:45 Thermal Properties of Helium – Oxygen Mixtures

16:45- *Militsa Milchova, Valentin Stoev, Miglena Trencheva, Elena Stav-*
17:00 *rova, Ivan Trenchev*

Financial indicators for analysis of the bank system

**Workshop “Recent Progress in Bio-electrochemical systems”
Conference Hall**

Friday, June 16

Chairman: **Assoc. Prof. Yolina Hubenova**

- 13:30- *Konstantin Petrov, Dzhamal Uzun*
14:00 The Black Sea problems – Electrochemical solutions
- 14:00- *Tsvetomila Parvanova-Mancheva, Elena Razkazova-Velkova,*
14:15 *Martin Martinov, Stefan Stefanov, Venko Beshkov*
Sulfide and nitrate driven fuel cell. Biochemical denitrification
- 14:15- *Elena Razkazova-Velkova, Martin Martinov, Stefan Stefanov,*
14:30 *Venko Beschkov*
Sulfide and nitrate driven fuel cell. Chemical denitrification.
- 14:30- *Ivo Bardarov, Yolina Hubenova, Mario Mitov*
14:45 On field operating Sediment Microbial Fuel Cells as low cost power sources
- 14:45- *Silviya Hristoskova, Ivo Bardarov, Dragomir Yankov,*
15:00 *Svetla Danova, Yolina Hubenova, Mario Mitov*
Identification of microbial community in a Sediment Microbial Fuel Cell

Coffee break

Chairman: **Prof. Konstantin Petrov**

- 15:30- *Nina Dimcheva, Elena Horozova*
15:45 Improved operational stability of a laccase-based electrode applicable in biofuel cells
- 15:45- *Elitsa Chorbadzhiyska, Yolina Hubenova, Mario Mitov*
16:00 Copper recovery combined with wastewater treatment in a Microbial Fuel Cell
- 16:00- *Dzhamal Uzun, George Pchelarov, Elena Razkazova-Velkova,*
16:15 *Ognian Dimitrov, Sasho Vassilev, Nadezhda Dermendzhieva, Konstantin Petrto*
Oxidation of sulphites with DWCNTs, MWCNTs, higher fullerenes and manganese by an electrochemical technique

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- 16:15- *Elena Razkazova-Velkova, Martin Martinov, Stefan Stefanov,*
16:30 *Venko Beschkov*
Wastewater treatment combined with energy harvesting
- 16:30- **Round table discussion**
- 17:15 **Summary of projects DFNI E02/14/2014 and DFNI E02/15/2014**

Saturday, June 17

- 09:30- **Visit of the Innovative Center for Eco Energy**
10:30 **Technologies, SWU - Rectorat**

Poster Session

Thursday, June 15

Chemistry

- P-C-1 *Gergana Koroleova*
Computer modeling of Cannabinoid receptors by molecular operating environment
- P-C-2 *Fatima Sapundzhi, Tatyana Dzimbova, Peter Milanov, Nevena Pencheva*
Molecular docking experiments of Cannabinoid receptors
- P-C-3 *Teodora Stefanova, Ramadan Ahmedov, Serhii Zaruba, Vasil Andruch, Kiril Gavazov, Vasil Delchev, Lilko Dospatljev*
A cloud-point extraction-chromogenic system for copper(II) based on 1-(2-thiazolylazo)-2-naphthol
- P-C-4 *Lilko Dospatljev, Miroslava Ivanova, Kiril Gavazov*
Correlation between cambisols soil characteristics and lead content in wild edible mushrooms (*Cantharellus Cibarius*, *Tricholoma Equestre*, and *Craterellus Cornucopioides*)
- P-C-5 *Kalina Kamenova, Yordanka Gluhcheva, Juliana Ivanova*
Effects of salinomycin, monensin, and DMSA on Pb-induced renal dysfunction
- P-C-6 *Yolina Hubenova, Nikolay Toshev, Romyana Bakalska, Mina Todorova, Mario Mitov*
Electrochemical behaviour of novel hemicyanine class dye
- P-C-7 *Yolina Hubenova, Georgy Ivanov, Mario Mitov*
Influence of polarized light on the current generation by Photosynthetic Plant Fuel Cell
- P-C-8 *Madlena Lazarova, Dragomir Yankov*
Influence of organic extractants on butyric acid separation
- P-C-9 *Boyka Stoykova, Tsvetelina Boycheva, Maya Chochkova, Petranka Petrova, Galya Ivanova, Martin Štícha, Tsenka Milkova*
Evaluation of antioxidant and anti-tyrosinase activities of 1,2,3-triazole-4-carboxamides of anti-influenza drugs

- P-C-10 *Gergana Nesheva, Petranka Petrova, Petko Mandjukov*
Spectrophotometric determination of copper in alcohol distillates

Ecology and Environmental Protection

- P-E-1 *Krassimira Ilieva-Makulec, Dawid Kozacki, Grzegorz Makulec*
Corvid roosts in the city: the impact on the taxonomic diversity and functional structure of the soil nematode community
- P-E-2 *Jerzy Romanowski, Michał Winczek*
Urban beavers *Castor fiber* in Warsaw (central Poland)
- P-E-3 *Piotr Ceryngier, Jerzy Romanowski*
High parasitization of a rare ladybird *Platynaspis luteorubra* – a reason of its rarity?
- P-E-4 *S.K. Sharma*
Framework for environmental and ecological protection in India

Technical Sciences

- P-T-1 *Fatima Sapundzhi, Metodi Popstoilov, Nadya Nikolova, Magdalena Bojinova*
Optimization algorithms for finding the shortest paths

Methodology in Education

- P-M-1 *Erma Pema, Vladi Kolic*
Facebook as an alternative tool in higher education. Survey with Albanian students
- P-M-2 *Elena Karashtranova, Nikolay Karashtrarov, Vladimir Vladimirov*
Analysis of the results from the state matriculation examination in mathematics

Informatics

- P-I-1 *Irena Atanasova*
Servlet and JSP technology for dynamic content

Plenary Lectures

Evolutionary Game Theory: "playing" between Mathematics, Biology and Social Sciences

Julian Revalski

Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

Abstract: In this tutorial talk we will outline the basic ingredients of non cooperative game theory, its main notions of solution and how this branch of applied mathematics has given the birth of the Evolutionary game theory. The major concepts of the latter, like evolutionary stable strategy, the replicator dynamics and the associated properties, constitute the modern approach to evolutionary biology. Further applications in social sciences will be outlined as well.

Mathematics and Physics: forged together with one chain

Armen Sergeev

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Abstract: Mathematics and physics have the same roots and were always closely related to each other. But at the beginning of XXth century the question of their interrelations acquired a new meaning. This was due to the breakthrough discoveries in theoretical physics | creation of quantum mechanics and general relativity. Both theories used heavily mathematical methods, existing at that time, namely, functional analysis and differential geometry. New directions in theoretical physics developed at the end of XXth century require new mathematical methods still lacking in mathematics. This a major challenge for mathematicians of XXIth century.

Increasing the safety and performance of lithium-ion batteries by new materials and new approaches

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Abstract: Lithium-ion batteries (LIBs) are today indispensable energy storage devices in the world of laptops, smartphones, for mobile communication and entertainment devices, for many applications in stationary energy storage and for electromobility [1]. LIBs have seen a continuous improvement in performance in recent years, both in terms of capacity, power and reliability, as well as in view of their safety. This latter aspect has become more important, as the increase in power and capacity of LIBs has led to the construction of aggregates of larger size which, by their dimensions and the amount of highly reactive components contained therein, represent a potentially very significant safety hazard [2,3].

Various safety features have therefore been designed and implemented in LIBs in order to prevent their catastrophic failure with the associated safety hazard. These include internal electronics to limit current and voltage, fuses, or separators that, upon exceedance of the allowable temperature range start melting and thereby inhibit further current flow between the electrodes. A central point of consideration remains, however, the electrolyte itself that is exposed to extreme potentials (both oxidizing and reducing), high temperature, and the presence of radicals and other reactive species and intermediates. Under these conditions a great variety of degradation and also condensation products can be formed which alter the electrolyte's properties and thus the characteristics of the entire electrochemical cell, or lead to the formation of volatile, highly flammable and thus hazardous emissions which either remain in the cell until discharged abruptly in an explosion, or are continuously vented.

Devices and strategies for the measurement of these emissions – both on-line and off-line – must be devised and tested. We report in this

presentation on the various approaches that have proven successful in characterizing the degradation of the LIB electrolyte and also the associated changes in the entire battery. Conclusions are drawn on possible routes of development in the future that will lead to increased safety in the operation of lithium ion batteries, as well as improved battery performance in terms of power, capacity and lifetime.

Acknowledgements: Financial support of this work by the Austrian Research Promotion Agency (FFG) under Grant No. 858298 (DianaBatt) is gratefully acknowledged.

References

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- [2] UL Consumer Technology: Safety Issues for Lithium-Ion Batteries, 11 pp., available online: <http://europe-ul.com/portfolio-items/safety-issues-for-lithium-ion-batteries/>
- [3] S. Abada, G. Marlair, A. Lecocq, M. Petit, V. Sauvart-Moynot, F. Huet, J. Power Sources 306 (2016) 178-192.

Microbial Fuel Cells and their likely role in the future

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Abstract: Microbial Fuel Cells (MFCs) consist of two compartments (anode and cathode), each containing an electrode with battery-like terminals. In the MFC, bacteria form a living community (called a biofilm) around the anode electrode. The biofilm-electrode is fed waste organic matter as biofuel and the microbes metabolise the fuel into electrons, H⁺ (protons), CO₂ and new cell progeny. The electrons are transferred to the anode and then round the external circuit until they arrive at the cathode. Meanwhile, the H⁺ ions travel across a proton permeable membrane separating the two compartments and diffuse into the cathode. The cathode contains electrolyte with dissolved oxygen present. The H⁺ ions, O₂ and incoming electrons combine to form water. The difference in voltage between the anode and cathode, drives electron flow in the circuit, resulting in electrical power. In theory, MFCs could represent an ideal power technology of the future producing electricity from the breakdown of low-grade organic carbon (generally regarded as waste) including urine, sewage and waste products from the food, fermentation and biotech-industries and can therefore “treat” the organic waste to provide environmental clean-up, whilst producing rather than consuming electrical power. The key energy challenges with MFCs are power output of individual units and scale-up, which can both be addressed through miniaturisation of individual units and multiplication into stacks. This depends upon economic costs of material fabrication and mass manufacture. It is envisaged that stacks will be distributed widely to enable humans to obtain sufficient power to run small applications (phones, computers, robots and gadgets). But this energy has the advantageous merit of being generated from the treatment of waste, and re-cycling of essential elements (e.g. phosphate), producing clean water, and working without adverse environmental effects.

Keywords: MFC; re-cycling; environmentally-friendly; scale-up; electrical power

Oral Presentations

Impact of malt quality parameters on beer filtration optimization process

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Abstract: Filtration optimization process needs developing a strategy based on observations, empirical determinations, and continuous monitoring in order to ensure efficient filter operation. This objective will be reached by identifying critical malt parameters which will influence filtration efficiency. Yeast and components that came from malt dominates the filtration process. The biggest case of concern, since they are more difficult to remove than yeast, is Non-Microbiological Particles. Malt is also responsible for the major part of enzymes that impact on beer and wort filterability. Experiments were carried out in pilot and industrial scale. Proteins and polyphenols dominates the filtration process, but if we use filter-aids and centrifugation, carbohydrates will dominates the filtration characteristics. More important carbohydrates includes: unmodified starch, dextrin's, pentosans and β -glucans. Carbohydrates that have a signicative impact on filtration were tested using enzymatic techniques for three different beers.

Keywords: beer filterability, enzymes, malt quality, stabilization, yeast.

The role and the influence of enzymes in the optimization of wort production for beer

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Abstract: Biochemical changes during the entire brewing process involve mostly the action of different enzymes, which are essential in catalyzing these changes. Enzymes are present in mature barley (amylase and carboxypeptidases), in malt (α -amylase, limit dextrinase, proteases, glucanases, pentosanases) and yeast. For beer production the most important spectrum of enzymes includes amylases, protease and β -glucans. The purpose of boiling process is to reduce the viscosity of wort, as well as to reduce the resistance of the mass filter in order to significantly meliorate the circulation time in boiling process. The most important enzymes responsible for filtering process is β -glucanase. β -glucanase acts on gum substances of malt to improve the reduction of viscosity and clarity of beer. In this paper are presented the results of measurements performed for characteristics like viscosity, turbidity and filtration time. In the first test measurements were performed after the addition of β -glucanase enzyme. In the second test measurements were performed after the addition of breakbright enzyme. These results are compare with the values obtained when these enzymes are not added.

Keywords: β -glucanase, boiling process, enzyme, filtration time, viscosity.

Comparative study of commercially available alcoholic beverages from southeast Balkans based on anethole-containing plants

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Abstract: A simple static headspace gas chromatographic method (SHS-GC-FID) was developed and used for analysis of trans-anethole containing alcoholic beverages. The work focused on the plant derived (either aniseed, fennel or star anise) volatile components. Additionally, from the GC analysis one can determine whether the ethanol used was fermentation/distillation or from industrial origin. Generally, the content of trans-anethole depends on the ethanol content of the beverage, which is correlated to the solubility. Using the developed method several samples of commercially available alcoholic drinks based on anethole containing plants from Bulgaria, R. Macedonia, Greece and Turkey were analyzed. The obtained chemical compositions of the volatile fraction along with experimentally obtained physical properties (density, refractive index and conductivity) were used for assessment of quality and comparative study.

Keywords: Headspace gas chromatography, trans-anethole, alcoholic beverages, physical properties

Decreasing of sulfur in diesel fraction by different methods

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Abstract: Sulfur content of diesel fuel has been cut down to ultra low levels by environmental regulation in many countries with the aim of reducing diesel engine's harmful emissions and improving air quality. As a result, research on the production of ultra low sulphur diesel has gained enormous interest in the scientific community worldwide.

The present paper considered some possibilities for decreasing of sulfur content in diesel fraction by different methods. It's established that extraction processes with selective solvents decrease sulfur content in different degree. It was calculated distribution coefficients of the systems. It was applying an adsorption process for purifying of middle distilled fractions from unlikely components. The obtained results show the possibility for looking for new techniques for optimization of the adsorption process.

Keywords: desulfurization, ULSD, heavy diesel fractions

Chemistry of knife making

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Abstract: The goal of the paper is discussing of chemical and ecological aspects of knife making of kitchen chef knife as a part from applied material sciences connecting knowledge, practical skills of chemistry and mechanical engineering. The chemical composition of steels, chemical reaction in gas ovens during the thermal treatments, hamon making, hardening of steel, quenching in water, water inorganic salts solutions, oils baths, tempering of the blade and chemistry of abrasives for grinding are discussing. The protection of the blade by chemical etching, chemistry of micarda making and stabilizing wood handle by polymers, gluing by epoxides, sharpening, polishing and protection of the blade are discussing. The ecological model of kitchen chef knife with wooden sheath is presented.

Keywords: steel, thermal treatment, etching, stabilized wood

Enzymatic preparation of bioethanol and bioethanol gel from cellular agricultural residues

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Abstract: The bioethanol and bioethanol gel are having safety indoor applications as a biofuel for biokamine, aromatherapy, alcoholic drinks and food heating. The goal of the paper is to study enzymatic preparation of bioethanol from cellular seeds as a wheat, corn etc. and to compare with traditional methods of preparation by yeast using sugar containing agricultural fruits as grapes, plumps, apples etc. The origins of toxic impurities in bioethanol for high alcoholic drinks are discussing.

Keywords: enzymes, fermentation, distillation, bioethanol, bioethanol gel

Study of precipitation chemistry composition in urban area

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Abstract: This study presents new data on the chemical composition of precipitation (rainwater) in Sofia. Wet only precipitation sample were collected with automatic sampling device WADOS in the Central Meteorological Observatory (CMO) of NIMH, Sofia during the period 1.07.2015 – 30.06.2016. All collected samples were analyzed for acidity (pH), electrical conductivity (EC), chloride (Cl⁻), nitrates (NO₃⁻), sulphates (SO₄²⁻), ammonium ions (NH₄⁺), calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), iron (Fe), zinc (Zn) and silicium (Si). The measured pH values in precipitation samples collected in the study period are between 4.3 and 7.88. 36 % of the pH values range between 4.3 and 5.0, 29 % in the range 5.0 – 6.0 and 33 % in the range 6.0 – 7.9. Mean concentration of analyzed ions in precipitation samples followed the order: SO₄²⁻ > NO₃⁻ > Cl⁻ > Ca > K > Na > NH₄⁺ > Mg > Zn > Fe.

Keywords: acidity, precipitation chemical composition

Chemical characterization of atmospheric particulate matter (PM₁₀ and PM_{2.5})

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Abstract: The objective of this work was to study a chemical characterization of particulate matter (PM₁₀ and PM_{2.5}) in Sofia. Several experimental campaigns for PM₁₀ sampling from 2012 to 2015 and for PM_{2.5} sampling from 2014 to 2016 were organized at Central Meteorological Observatory of NIMH in Sofia. The sampling of 24 hour average concentration was performed by low-volume sampler TECORA on quartz filters for PM₁₀ and Teflon filters for PM_{2.5} according to the European Standards. The ED-XRF technique is applied to determine more than 20 elements (P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Br, Rb, Sr, Y, Zr, Cd, Sn, Sb, I, Ba, Pb) in the filter samples. Data quality was assured in international intercomparison exercise and proficiency test organized by International Atomic Energy Agency (IAEA). In the present study results of PM₁₀ and PM_{2.5} mass concentration and its elemental composition are compared and discussed.

Keywords: urban air pollution, PM₁₀ and PM_{2.5} elemental composition, EDXRF analyses.

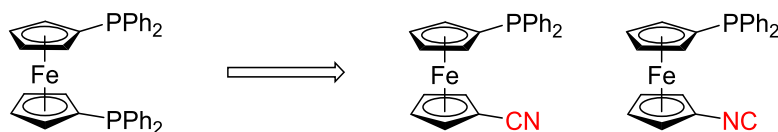
Synthesis and coordination properties of isomeric functional phosphinoferrocene donors

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Abstract: Ferrocene donors became indispensable ligands for coordination chemistry. Despite the progress in the design of ferrocene ligands, the most often studied and practically utilized compound still remains the archetypal diphosphine, 1,1'-bis(diphenyl-phosphino)ferrocene (dppf). In our work, we focused on formal dppf derivatives having one of the phosphine groups replaced with another functional, possibly donating moiety. This contribution will detail the preparation of two isomeric ligands, viz. 1'-(diphenyl-phosphino)-1-cyanoferrocene and 1'-(diphenylphosphino)-1-isocyano-ferrocene (see Scheme below), and the results of our investigations into their coordination and catalytic properties.



Keywords: Ferrocene ligands; Nitriles; Isonitriles; Phosphines; Group 11 metal complexes

Proton conductivity measurement on powder samples

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Abstract: Materials exhibiting proton conductivity can be potentially used for proton exchanging membranes (PEM) which represent essential part of hydrogen fuel cells. The explanation of proton transfer mechanism in proton conductors is not simple task and differs for different types of proton conductors. It is known, that hydrogen bonds play important role in proton transfer. But mechanism of proton transfer in crystalline compounds with hydrogen bonds is not still satisfactory explained. In this contribution, we are studying mechanism of proton transfer in several crystalline salts with short hydrogen bonds measuring proton conductivity both on oriented single crystals with known structure and on bulk powder samples. The measurement on powder samples is much more simple than on oriented single crystal and can give us the basic information, if the studied compound can act as proton conductor or not. In this contribution we will show our results on about 10 mostly newly prepared hydrogensalts of nitrogen containing organic cations.

Keywords: proton conductivity measurement, fast screening on powder sample, hydrogen-bond system

Selective preconcentration of Pt (II) and Pd (II) using amino acid functionalized silica gel

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Abstract: In this article we report the use of silica gel immobilized with the amino acid cystine, cysteine, and methionine (Sig-Cys-Cys, Sig-Cys and Sig-Meth, respectively) for extraction and preconcentration of Pt (II) and Pd (II) from hydrochloric acid solutions. Extraction efficiency and selectivity of the sorbents towards Pt (II) and Pd (II) were studied by batch procedure. Some analytical parameters such as acidity of the sample solution, eluent type and volume, effects of foreign ions were investigated for quantitative recovery of Pt (II) and Pd (II). The results obtained demonstrate that the Sig-Cys and Sig-Meth show high sorption activity toward trace metals while Sig-Cys-Cys is not able to extract quantitatively the studied elements. The experiments show that platinum is extracted only as Pt (II) chloro-complex after reduction with SnCl₂. Under optimum conditions, the detection limits for platinum and palladium ions were found to be 0.2 and 0.1 µg g⁻¹, respectively. Solid phase extraction procedure was developed for Pt (II) determination in cream samples. The accuracy of the proposed method was confirmed by recovery tests.

Keywords: Solid phase extraction, noble metals, atomic spectrometry

The salts of aminopyrimidines – prospective molecular crystals for nonlinear optics

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Abstract: The salts of mono-, di- and triaminopyrimidines represent very promising hydrogen-bonded molecular crystals with potential for the applications in nonlinear optics (NLO). The heteroaromatic nitrogen-containing molecules act as carriers of NLO properties and hydrogen bonds system positively affects molecular packing in these crystalline materials. In addition, the formed hydrogen-bonded structures frequently gain advantageous chemical and physical properties. These materials exhibit interesting NLO properties, which can be employed for several technical applications.

Several structural, spectroscopic and optical aspects will be presented in this contribution. The main emphasis will be focused on the combination of quantum chemical calculations, X-ray diffraction and vibrational spectroscopic results. Moreover details concerning phase characterisation and monitoring of observed phase transformations will be presented and discussed.

This work was supported by OP VVV "Excellent Research Teams" (Project No. CZ.02.1.01/0.0/0.0/15_003/0000417 - CUCAM).

Keywords: nonlinear optics, crystal structures, vibrational spectroscopy, phase transformations

Adamantane-1-carboxamides: synthesis and antimicrobial activity

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Abstract: The rapid emergence of resistant bacteria highlights the urgent demand for new effective drugs. In view of importance of adamantane skeleton in various antimicrobial drugs, herein the synthesis of N-adamantane-1-carboxamides of polyamine derivatives is described. The newly compounds were screened in vitro for their antibacterial activity against two Gram-positive- (*Staphylococcus aureus*, *Bacillus subtilis*) and two Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*) bacteria, as well as for antifungal activity against *Candida albicans*. The results revealed that amongst the synthetical bisamides, N,N'-bis-adamantane-1-carboxamides of 1,6-diaminohexane was the most effective one and inhibited both Gram-negative and Gram-positive strains with MIC of 125 $\mu\text{g}\cdot\text{ml}^{-1}$. Moreover, the same amide also showed the highest antifungal activity (MIC of 63 $\mu\text{g}\cdot\text{ml}^{-1}$) against *Candida albicans*.

Keywords: Adamantane-1-carboxamides, Antibacterial activity, Antifungal activity

Short-chain peptide analogues as potential hormonal inhibitors - trends and perspectives

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Abstract: Bioactive peptides are peptides with hormone- or drug like activity modulating physiological function through binding interactions to specific receptors leading to induction of physiological responses. Bioactive peptides are a specific protein fragments that have a positive impact on body functions and conditions and may ultimately influence health. These peptides play an important role human health. One important group from bioactive peptides is the antihypertensive peptide.

ACE inhibitors are one of the most active classes of molecules that lower blood pressure. ACE inhibitors are the drugs which lowers the increased blood pressure by inhibiting the angiotensin converting enzyme responsible for the conversion of angiotensin I to angiotensin II. ACE inhibitors prevent the progression of renal disease by causing a reduction in angiotensin II mediated intraglomerular pressure. Angiotensin-converting enzyme plays an important role in the control of arterial blood pressure, and the following discussion has been the background to the synthesis of inhibitors of the enzyme and lead substances for the design of other inhibitors.

Various structure activity relationship studies led to the synthesis of ACE inhibitors, some are under clinical development.

In this report are discussed the trends about design and development of new compounds, structure-activity relationships and approaches to planned syntheses of new ACE-inhibitors.

Keywords: bioactive peptides, ACE inhibitory peptide

**Design, synthesis, and properties of
Lipophosphonoxins II: Novel broad spectrum
antimicrobial agents**

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Abstract: The increase in the number of bacterial strains resistant to known antibiotics is alarming. In this study we report the design and synthesis of novel compounds, termed Lipophosphonoxins II (LPPO II). We show that LPPO II display excellent activities against Gram positive and -negative bacteria, including pathogens and multiresistant strains. We describe their mechanism of action – plasmatic membrane pore-forming activity selective for bacteria. Importantly, LPPO II neither damage nor cross the eukaryotic plasmatic membrane. Further, we demonstrate that resistance to LPPO II is difficult to arise, likely due to their rapid and selective membrane-targeting mode of action. Finally, we reveal that LPPO II are not toxic to either eukaryotic cells or model animals when administered orally or topically. Collectively, these results suggest that LPPO II are highly promising compounds for development into pharmaceuticals.

Keywords: antibacterial, lipophosphonoxins, cell membrane, phosphonate

Reactivity of selected nitrogen-containing heterocycles with respect to their potential application in nonlinear optics

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Abstract: Derivatives of aromatic heterocycles containing nitrogen atoms are known to be promising starting molecules for preparation of novel NLO-active materials. Moreover, some of those heterocycles, such as triazines, undergo a variety of addition reactions due to the lower electron density in the π -electron system. The products of those reactions are often chiral, which increases the probability of non-centrosymmetric crystal structure forming, needed for several NLO applications. The aim of this contribution is to present some of those reactions and their products with potential application in the field of nonlinear optics.

The prediction of nonlinear optical (NLO) properties of starting molecules and reaction products was based on quantum chemical calculations. Additionally, the results of the quantum chemical calculations were used for the interpretation of recorded vibrational spectra of the products. Vibrational spectroscopy was also used to study selected reactions in solution. Prepared crystalline materials were characterized mainly by the means of X-ray diffraction analysis and various patterns of hydrogen bonding were observed. Finally, measurements of second harmonic generation efficiency of selected powder samples were performed.

Keywords: Nonlinear optics, second harmonic generation, crystal structure, vibrational spectroscopy

Acknowledgment: This work was supported by OP VVV "Excellent Research Teams" (Project No. CZ.02.1.01/0.0/0.0/15_003/0000417 - CUCAM).

Quantum-chemical modeling of selected transition metals tellurides and sulfides

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Abstract: In this work, we will present our preliminary attempts to create models of sulfides and tellurides with selected transition metals using semi-empirical quantum-chemical method PM3, as it is incorporated in the program package Hyperchem 8.0 Professional edition. The results thus obtained will be compared with empirical data to these compounds. The resulting models will be used in the courses Materials Science and Molecular Modeling which motivates us further to perform this study. The optimal conditions for the modeling of crystals structure of in-organic salts will be used for the finding of appropriately doped systems that have necessary properties for industrial utilization.

Keywords: quantum-chemistry, semi-empirical methods, PM3, structure and properties

¹H and ¹³C NMR spectral assignments of the fifteen systematically modified adamantane derivatives

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Abstract: The NMR spectral assignment of a series of novel amino acid substituted rimantadins and amantadines is presented. In all cases, the chemical shifts of the core structure is not affected significantly by the type of the substituent, except in the cases, when aromatic moiety is present in the amino acid fragment. Further investigations in order to clarify the solution structure and dynamics of the latter are still in progress.

Keywords: NMR spectra, amino acid, rimantadine, amantadine

Electron capture chemical ionization of 2,7-Naphthalene derivatives

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Abstract: Series of 2,7-substituted naphthalene derivatives with potentially cleavable naphthyl groups (X = F, Cl, Br, SPh and OPh) were prepared using standard chemical transformations. Experimental conditions were optimized for mass spectrometric studies using electron capture chemical ionization (ECCI). The prepared compounds were subjected to ECCI and the relative efficiencies of fragmentation were evaluated. In all of the cases no radical ion ($M^{\cdot-}$) was detected. Using the unsymmetrical 2-X-methyl-7-Y-methylnaphthalenes the relative tendencies towards cleavage under the experimental conditions were established: $Br > Cl \approx SPh > OPh >> F$. The key factors that influence the cleavage appear to be reaction cross section and bond strength. No signal in the mass spectra for the F- of the fluoride derivatives was observed.

Keywords: 2,7-dimethylnaphthalenes, cleavage, mass spectrometry, electron capture chemical ionization

Optimization of biogas production from lignocelulosic materials by different methods of substrate treatment

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Abstract: Biogas is considered a possible alternative to the conventional fuels. It is produced by anaerobic digestion of different organic materials. Generally those materials include mostly manure and municipality waste. Our research focuses on the possibility to utilize new types of organic materials in combination with the traditional ones. We believe that adding new materials will enhance the process of producing biogas and will contribute to higher range of waste treatment. The final product is biogas with higher methane content which makes it usable for heat and power generation. Therefore we focused on utilizing of coniferous material mixed with other organic materials in anaerobic digestion reactor.

Keywords: biogas, coniferous materials, waste treatment, biotechnology

Distribution of Cetaceans in the South-western Black Sea waters

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Abstract: As a result of the lack of intensive survey effort, relatively little is known about the demography of cetaceans in the Black Sea region. Spatial and temporal distribution of cetaceans in South-western Black Sea waters were investigated using a dataset collected from a boat survey expedition. A total of 776 hrs and 44 mins of visual monitoring and 1736 hrs and 30 mins of passive acoustic monitoring were recorded. Shipboard transects covered the area of 5125 km². From October 2016 to January 2017, 1668 cetacean individuals were sighted during 119 sighting events. In addition, 105 acoustic detections were made. Three species were recorded: the harbor porpoise (*Phocoena phocoena relicta*), the short-beaked common Dolphin (*Delphinus delphis ponticus*) and the bottlenose dolphin (*Tursiops truncatus ponticus*). Overall, *Delphinus delphis* was the most frequently sighted species (82% of the total number of identified animals). *Phocoena phocoena* (10%) and *Tursiops truncatus* (8%) were rarely encountered during the period of investigation. These findings fill in a significant gap in the knowledge of cetaceans occurring in a poorly studied region of the Black Sea, providing essential information to future management initiatives.

Keywords: Cetaceans, Black Sea, *Tursiops truncatus*, *Phocoena phocoena*, *Delphinus delphis*

**Trophic structure of the riverine benthic
macroinvertebrates in type-specific reference
conditions**

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Abstract: The functional feeding groups of riverine macrozoobenthos were studied in two Ecoregions (East Balkan and Pontic Province) and two watersheds (Aegean or Black Sea) on the Bulgarian territory. Totally 83 benthic samples from 40 sites, situated at 35 rivers which are belong to 10 different types were studied for establishment site specific referent conditions. Specific trophic structure of benthic communities, characterized anthropogenically unaffected, reference conditions was formed. Functional feeding groups distribution was in compliance with the principles listed in River Continuum Concept and represented dominant presence of Shredders, followed by Predators and Scrapers. The analysis of the abundance shows relatively identical distribution of shares of the functional feeding groups constituting the benthic macroinvertebrates found in studies reference sites of both watershed. Ecological state was assessed by index based on trophic structure of macrozoobenthos which was applied for the purposes of the biological monitoring of the running water bodies.

Keywords: macrozoobenthos, functional feeding groups, reference conditions, river types

The optimal reproductive strategy of a clonal *Hydra* under different biotic and abiotic conditions

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Abstract: Clonal populations in which, after switching to sexual reproduction, simultaneous hermaphrodites may coexist with variable proportions of males and females provide a unique opportunity to test both aspects of allocation theory: sex ratio in the population and sex investment within a hermaphrodite. An individual-based model (IBM) was used to determine how sex investment and sex ratio manipulations affect the fitness of the clone on an example of *Hydra circumcincta*. Its clonemates represent a genet, and after switching to sexual reproduction, they can be selfing hermaphrodites, males or females. The results of the model indicated that low competition among polyps to fertilize eggs favors dioecy and a male-biased sex ratio over hermaphroditism independently of male-biased allocation to sex functions. When mate competition increases, the fundamental sex ratio 1:1 with females able to change their investment in eggs is favored. When there is strong mate competition, trioecy, observed in natural populations of *Hydra*, becomes optimal and seems to be a stable reproductive strategy.

Keywords: sex allocation, trioecy, reproductive investment, asexual reproduction

**Effects of small HPPs on the river fish communities.
Case studies**

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Abstract: Surveys of the state of fish fauna upstream and downstream 8 Small HPPs (SHPPs) situated on middle and upper courses of rivers within East and West Aegean Sea basins were carried out. Sampling of fish with electricity was performed complying with the Standard EN 14011. Assessment of the ecological state of the surveyed rivers was done using the Bulgarian Fish Based Index and the Trout River Index as described in the Ordinance H-4/2012. In the middle courses of the rivers Arda and Vacha (meta-/hyporithron covering the Maritsa barbel zone) no specific negative impacts of the surveyed SHPPs on the fish fauna were found. In the epi-/metarithron zones of some tributaries of the Struma river (Trout and Maritsa barbel habitats) more pronounced barrier effect were found downstream than upstream. In other cases the local factors and human activities probably have more pronounced effect on the state of fish communities up- and downstream the SHPPs than the presumptive barrier effect.

Keywords: Fish fauna, HPP, Impact, Barrier effect, Local factors

Relationship between host insect, enzymatic activity and virulence of entomopathogenic fungi

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Abstract: Entomopathogenic fungi are an important agent in natural and biological control for many insects and other arthropods. The major role in the infection process plays the secretion of hydrolytic enzymes such as proteases and chitinases.

In the study the effect of *in vivo* serial passage of *Beauveria bassiana* strains through two different insect hosts (*Galleria mellonella* larvae and *Acanthoscelides obtectus* beetles) on their enzymatic activity and virulence was evaluated. The change of the host species during the passage caused a decline in the virulence of the test strains of *B. bassiana*. This manipulation has also resulted in a decrease of protease activity but did not affect significantly chitinase activity. The results are discussed in relation to the chemical structure of insect cuticle and interactions in the host-pathogen system.

Keywords: entomopathogenic fungi, virulence, protease, chitinase, insect host

Potential of natural enemies to control the numbers of the invasive harlequin ladybird

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Abstract: The harlequin ladybird, *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae), is an Asiatic species that has become invasive in the late 1980s in North America and subsequently in other continents, including Europe, South America and Africa. Populations of *H. axyridis* often attain very high numbers in the invaded areas, posing a threat to native insects, especially other ladybird beetles. Explosions of the invasive populations of *H. axyridis* are frequently attributed to low levels of their control by natural enemies due to a phenomenon called the enemy release. It seems likely that the enemy release has indeed contributed to the rapid increase of *H. axyridis* in the initial phase of its invasion. Later, however, previous effects of the enemy release might be counterbalanced by acquisition of new enemies. Recent observations indicate that *H. axyridis* has acquired some parasitoids and parasites and/or has become more susceptible to them. This especially applies to sexually transmitted parasites.

Keywords: biological invasion, *Harmonia axyridis*, parasites, parasitoids

**Intraspecific competition in an island environment:
variability and dispersal of terrestrial snail *Helix
aspersa aspersa***

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Abstract: Positive skewness of weight distribution of individuals from an even-aged population is a measure of the intensity of competition between them. Skewness coefficient decreases during the course of an experiment because of the mortality of individuals. Such results are typical for experiments with plants. Terrestrial plants are sedentary organisms. Animals can disperse or migrate. This paper answers the question of how the dispersal of individuals influences intraspecific competition. The results of experiments with the snail *Helix aspersa aspersa* are presented. They show that: (a) the average weight of individuals in experiments with the possibility of dispersal is greater than the average weight of individuals from closed local populations without possibility of dispersal, (b) the skewness of weight distribution is smaller and decreases faster with the course of experiments when individuals can disperse, as compared with the results of the control experiment without dispersal., and (c) when the costs of dispersal are greater (when distances between local populations are greater) only individuals with greater weights (better (superior?) competitors) disperse to longer distances.

Keywords: intraspecific competition, individual variability, skewness of weight distribution, *Helix aspersa aspersa*

**Nematodes in natural and agricultural ecosystems:
community parameters reflecting changes undergoing
in the soil**

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Abstract: Due to their high abundance, high taxonomic and functional diversity, nematodes play an important role in the food web in almost any soil ecosystem. They can both influence and reflect shifts in the soil environment. Different nematode community parameters (e.g. richness, diversity, structure of domination, trophic structure) and indices (e.g. Maturity Index, Enrichment Index, Structure Index, Channel Index) have been found to indicate changes in soil characteristics and processes. In the study the indicative values of some parameters of nematode communities in natural soil as well as in soil under contrasting management practices (e.g. organic vs. conventional crop, long-term monoculture vs. rotation crop and long-term no-till vs. conventional tillage practices) are discussed.

Keywords: nematode abundance, trophic structure, community indices, managed and unmanaged ecosystems

Habitat viability and threats assessment for the reintroduction of the Bearded Vulture (*Gypaetus barbatus*) in Bulgaria

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Abstract: The availability of areas for reintroducing the Bearded Vulture in Bulgaria was assessed. There were eight historical and potential breeding sites in the country that were chosen for the assessment. Each of them was compared to the other seven, as well as to already occupied territories within other countries. The information was gathered at 15 km radius around high-probability nesting cliffs. Nineteen selected variables that have an essential impact on the choice of breeding sites were analysed (food availability, variability of the environment, presence of other vulture species, poisoning threats, etc.). Viability matrix on habitat quality and threats was produced and a scoring system was introduced, in order to rank each of the selected areas and their potential for a reintroduction of the Bearded Vulture. Density of power lines, poisoning of wildlife and specific types of habitat quality parameters were determined as the most restrictive variables. Two protected areas - Rila National Park and Central Balkan National Park, were proposed as the best sites for reintroduction of the Bearded Vulture. Vrachanski Balkan Nature Park and Eastern Rhodopes were also identified as suitable areas, although they had relatively lower scores. The obtained results showed that the process of reintroduction of the Bearded Vulture in Bulgaria could be started immediately. However, an implementation of additional specific management interventions is important as it would allow for further risks prevention and habitat enhancement.

Keywords: Gypaetus barbatus, Habitat assesment, Reintroduction, Rila National Park, Central Balkan National Park

SECTION: ECOLOGY & ENVIRONMENTAL PROTECTION

O-E-10

Population boost of the Griffon Vulture *Gyps fulvus* in Bulgaria based on reintroductions

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Abstract: The Griffon Vulture was considered to be extinct in Bulgaria by the end of the 1960s. In 1978 the species was rediscovered in the Eastern Rhodopes with one breeding pair and less than 30 immature individuals. Despite the success of the immediately initiated and later intensified conservation measures the species increased very slowly and in next three decades the breeding area remained relatively small, ranging 20 to 30 km along Arda River. To boost the recovery of the species along the country, in 2010, releases of captive bred and translocated wild birds from Spain and France, has started. For 7 years, more than 275 individuals were freed in 5 reintroduction sites – 4 along Balkan Mountain and in the Kresna Gorge. In 2016, the first successful fledging of 11 chicks and total number of 22-28 breeding pairs marked the successful reintroduction of the species in three new sites - Vrachanski Balkan (8-10 pairs and 4 fledglings), Eastern Balkan Mountain (8-10 pairs and 5 fledglings) and Kresna Gorge (6-8 pairs and 2 fledglings). This led to further increase of the national population of the species with some 20%. Together with the on-going increase of the autochthonous Griffon Vulture population in the Eastern Rhodopes (75-80 pairs) the total national population is now over 100 pairs and the range has doubled from 5 000 km² to more than 10 000 km².

Keywords: re-introduction, vulture restaurants, vulture safe areas, Balkan Mountain, Kresna Gorge

Spatial dynamics of *Gyps fulvus* population in Southwest Bulgaria

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Abstract: Movements and sojourn of Griffon Vulture in Bulgaria are poorly known. In the light of multiple reintroductions of the species in Bulgaria and by means of intensified classic and introduction of modern technologies a lot of new data was collected. Here we analyze data from more than 450 resightings of marked birds as well as 9 birds tracked by GPS/GPRS transmitters, and we provide an inside of seasonal movements – directions, timing and intensity as well as sojourn and home-ranges of Griffon Vultures in Southwest Bulgaria, of specimen either native to the country or such originating from Macedonia, Croatia, Serbia, Greece and also such marked in Israel. The season change and related weather provide for dynamics of flight conditions, food and water for drinking and bathing availability and accessibility, breeding and migration of certain age groups. The Griffon Vulture could be now considered breeding, wintering, migrating and summering species in Bulgaria. The overall median foraging range, calculated as MCP, for the ten pooled Griffon Vultures was 10 999 km². For the 95% and 50% kernel contours, medians were 493 km² and 54 km² respectively. Mainly juvenile and immature birds up to three years old are involved in an annual migration cycle with two peaks – in May-June – coming back from wintering ground and September-October – heading towards wintering grounds. Summering and wintering by joining existing colonies was also registered.

Keywords: *Gyps fulvus*, Migration, Sojourn, Home-range, Kresna Gorge

Behavioral specifics may help conservation of Griffon Vulture *Gyps fulvus* in modern Europe through establishment of vulture safe areas – a model from Bulgaria

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Abstract: Passed through a population bottleneck in the late 1960s and early 1970s, when the Griffon Vulture was considered to be extinct in Bulgaria, nowadays the species is an object of intensive conservation measures in the country. The long-term and wide spectrum of conservation efforts led to positive population trend. The species is now increasing in Bulgaria, while still declining in neighbor countries such as Turkey, FYR of Macedonia and continental Greece. Threats such as poisoning with different origin, electrocution, habitat alterations, food shortage and direct persecution are acting in different intensity alone or together over the Griffon Vulture population in its entire range. We analyzed successful and unsuccessful examples of intensive and extensive threat-based and site-based conservation practices. As a result, we found that certain behavioral specifics, such as gregariousness, conservativeness towards feeding and roosting sites, food type, quality preferences, and bias in seasonal mobility of the Griffon Vulture could be used for its adequate management and achievement of positive population trend in the socio-economical circumstances of modern Europe. Positive examples were provided and a model for establishment of a network of Vulture Safe Areas, based on concentration of protection efforts and birds was proposed as an urgent conservation tool.

Keywords: vulture restaurants, vulture safe areas, wildlife poisoning, electrocution, food base

Wolf and Vultures sympatric presence in Europe – ecological benefits and constrains

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Abstract: Relationship between wolf and vultures is rarely studied in Europe. Some authors report positive interaction between wolf as a predator and vultures as scavengers benefiting to feed on predator's prey leftovers. Some most recent studies, however, highlight the danger of Man-Wolf conflict and the related use of poison baits, as a great threat for vultures. Vultures and wolves followed a dramatic decline in last two centuries in Europe. Poison baits use is a major factor for that. Conservation measures are underway across the continent and there is large disproportion in distribution of vulture populations. Despite generally common features, the Iberian Peninsula harbours between 17 and 65 times more vultures from the four European species than Balkans, where in turn there are two times more wolves on three folds bigger area of occupancy. Behavioural, ecological and socio-economic factors are behind the minimized sympatric distribution of wolf and vultures in Europe. Conservation of vultures in areas, where wolf appears is complicated and up to now hardly proven working. The Man-Wolf conflict and poison use is hardly controlled even in developed countries. Thus, urgent indirect buffering measures were proposed. Among these is the establishment of a network of Vulture Safe Areas and feeding sites management.

Keywords: Man/wolf conflict, Neophron percnopteurs, Gyps fulvus, Aegypius monachus, Gypatus barbatus

Distribution of Eastern Montpellier Snake *Malpolon insignitus* (Geoffroy de St-Hilaire, 1809) (Reptilia: Psammophiidae) in Southwestern Bulgaria

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Abstract: The aim of the report is to supplement and summarize the data about the spread of Eastern Montpellier Snake (*Malpolon insignitus*) in southwestern Bulgaria. Many new localities have been recorded in this part of the country. The distribution of the species in the Struma River valley has been specified (to Oranovo gorge to the north). The largest specimen of *Malpolon insignitus* in Bulgaria, with a total length of 167 cm, has been registered. It has been recorded for the first time a winter activity of the species in the country (14.02.2016).

Keywords: *Malpolon insignitus*, distribution, large specimen, winter activity, SW Bulgaria.

Zoogeography of Eurasian Blind Snake *Xerotyphlops vermicularis* (Merrem, 1820) (Reptilia: Typhlopidae) in Southwestern Bulgaria

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Abstract: The aim of the report is to supplement and summarize the data about the spread of the Eurasian Blind Snake (*Xerotyphlops vermicularis*) in southwestern Bulgaria, and to determine the zoogeographical importance of the species. Many new localities have been registered in this part of the country. The distribution of the species in the Struma River valley has been specified (to Oranovo gorge to the north). For the first time the *Xerotyphlops vermicularis* has been recorded in the Bulgarian part of the Mesta River valley, in the region of the village of Beslen. The role of the species for a future zoogeographical regionalization of Bulgaria is defined as significant.

Keywords: *Xerotyphlops vermicularis*, new locality, distribution, zoogeography, SW Bulgaria.

Distribution and Conservation Status of the Wall Lizards *Podarcis* Wagler, 1830 (Reptilia: Lacertidae) in Protected Area BG0001022 „Oranovski Prolom – Leshko”

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Abstract: The aim of this report is to supplement and summarize the data about the spread of three species of Wall lizards: the Common Wall Lizard (*Podarcis muralis*), the Erhard's Wall Lizard (*P. erhardii*) and the Balkan Wall Lizard (*P. tauricus*) in the protected area BG0001022 "Oranovski Prolom - Leshko ", southwestern Bulgaria. Many new localities of the three Wall lizards have been recorded. The Common Wall Lizard has been found in the largest number of localities, while the Erhard's Wall Lizard has been the rarest. In many places, the three species occur in the same habitat. A juvenile melanistic specimen of *Podarcis muralis* has been registered. *Podarcis tauricus* has been recorded at the highest altitude in Bulgaria (1219 m). All three species of the genus *Podarcis*, distributed in the studied area, are protected under the national and international legislation.

Keywords: *Podarcis muralis*, *Podarcis erhardii*, *Podarcis tauricus*, altitudinal distribution, melanism.

**Beaver *Castor fiber* - monitoring of successful
reintroduction and current management issues in
Kampinos National Park (central Poland)**

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Abstract: The beaver *Castor fiber* became nearly extinct in Poland in 1940s. The national Program of Active Beaver Protection was introduced in 1975 and the species was reintroduced to Kampinos National Park in April 1988 and soon spread throughout the area. The population of app. 20 beaver families was estimated to inhabit the area in 2000 - 2014. The field survey for signs of beavers along aquatic habitats in the entire Kampinos National Park revealed the population of 29-31 family groups (app. 110 individuals) in 2015/2016. The local beaver population is part of the larger network of viable populations in middle Vistula river valley. The presence of beavers ignites conflicts with local land owners over damage to trees and flooding of meadows and pastures. The major management issue is to minimize the beaver damage perception in local communities while protecting the species in nature reserves in Kampinos National Park.

Keywords: *Castor fiber*, reintroduction, management, conflict species

Notes on behavioral ecology of bats in Southern Black Sea region of Bulgaria

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Abstract: The present study was conducted during 2013 – 2017. The research area includes the Southern part of the Black Sea biogeographic region in Bulgaria, mainly Strandza Mountain. Seasonal and diurnal activity patterns of bat community members were studied, as well as shelters usage strategies. Spatial relationships of local bat communities were established. The basic input data were gathered by using transect line and vintage point bat detector survey, infrared observation and recording, mist netting and direct shelter registrations. The habitats of the local bat communities were characterized by main abiotic and biotic factors – temperature, rainfall, moisture regimes, plant communities etc. The behavioral response of bats to environmental conditions was described using ad libitum method, behavioral sampling methods – video sampling, acoustic analyses, and automatic recording devices. The results cover cave-dwelling, forest-dwelling, and house-dwelling bats.

Keywords: bats, behavior, ecology, Black Sea region.

Environmentalistika - what is it?

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Abstract: The proposed material is placed on discussing the issue of the correct interpretation and use of the terms in the science and activities in the field of environment. Usually it argues that in this area there is nothing to change. But is it really? According to the established regulations (EPA) has adopted several definitions on which it is necessary to do some work for their improvement.

By analyzing more precise information about the Earth's population will encounter interesting facts. During the second half of the nineteenth century the world's population has increased enough to highlight the need for more serious attitude towards life and influencing (on it) processes. Expressed in other words, from the standpoint of physics, whether there is sufficient "critical mass" to occur such an undertaking ie be separated science ecology.

A similar situation is observed today. Earth's population is growing rapidly, its needs and desires are increased many times. Changes and impacts our surroundings are almost daily. Therefore, the actions associated with it can not be associated with ecology or regarded as synonymous with ecology.

So naturally arises the need for a new direction as a science or activities for ambient (surrounding) our environment. This is not ecology. Adequate term in Bulgarian language absent so we use the English equivalent in Bulgarian form - environmentalistika.

Content and behavior of cesium-137 and strontium-90 in soil and some indicative plants in Bulgaria 30 years after the Chernobyl accident

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Abstract: During the period April - May 1986 following the accident at the Chernobyl NPP significant amounts of technogenic radionuclides including cesium-137 and strontium-90 were deposited in the country. The work presents results for concentration activities of these radionuclides in soils from North and South Bulgaria, their distribution down the soil profile and their availability in some indicative plants like mosses and lichens for 2016. Residual quantities of both radionuclides studied were established in all samples analyzed. The peculiarities of their migration down the soil profile are discussed. The detected activity levels are not dangerous to humans and ecosystems in the studied areas.

Keywords: radioactivity, soil, plant, caesium - 137, strontium - 90

Analysis of some soil parameters before and after fire

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Abstract: It is typical of our country that each year as a result of forest fires occurring large areas are being devastated. The consequences of fires are expressed in deforestation, soil erosion, changes in biodiversity, degradation of forests and ecosystems.

The aim of the present study is to evaluate the changes of some characteristic parameters of soil as a result of fire. For achieving the objective, changes in pH, humus content and chemical composition of the soil before and after the fire were assessed. Studies have been conducted in the village of Frolosh, Kyustendil district, in 2016.

Keywords: soils, soil parameters, forest fire, ecosystems

Modelling of the potential production of agricultural crops

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Abstract: Potential production is included in the management concepts in fifties years of the past century, when the response of crops to unexpected changes in environmental parameters, assumed great importance. The idea of linking technical efficiency with the ability to produce a specific output with minimum inputs (factors) in a particular technology. Technical efficiency is defined as the possibility of any manufacturing unit to get the maximum possible (potential) production in an appropriate range of factors and technology. The condition to obtain the maximum possible (potential) production is performed in the production process when unable to produce the same amount of output with fewer factors or unable to produce more output with the same inputs. According adopted in imitation modeling terminology potential output form the so-called first hierarchical level. This means that the growth and development of plants run at optimum moisture and nutrients territory. Potential output is the maximal possible production (MPP) with fixed technology at optimum load/ utilization of natural and anthropogenic inputs. The aim of this paper is to present the growth and development of various types of crops in the first hierarchical level.

Keywords: maximal possible production (MPP), potential production, simulation modelling, technical efficiency

The cluster - a sustainable system for waste management

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Abstract: Following the adoption of the Republic of Bulgaria in the EU, our country joined the efforts to build effective and innovative clusters that have a strong commitment to European institutions and initiatives in this area (i.e. the European Cluster Alliance). Clusters are not only politically necessary, they are a good way to build a competitive economy. The report examined and analyzed existing clusters in Bulgaria, as well as the latest survey by the Organization for Economic Cooperation and Development (OECD) business cluster in Central and Eastern Europe focused on creating opportunities for enhanced scientific and research policy in the field of management waste and promote the development of innovative praktiki. Creating exemplary model cluster "waste" -for regional waste management region Blagoevgrad and exchange etc. and the experience and knowledge between regional systems for the recovery and disposal of waste in Bulgaria would multiplier good effect.

Keywords: clusters, waste, ecology

Biological diversity, environmental justice, and moral values

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Abstract: The report focuses on the important relationship between the human moral values and decisions and the loss of biological diversity. The sixth mass extinction of species is going on at the time we are living and the extinction rates are extremely high because of humans. According to many specialists, it is a global environmental problem even more serious than the global warming and have negative effects on the ecological systems. Therefore the whole education system should aim society to learn and understand those ethical principles and decisions that can limit and even stop the human destructive impacts on the natural environment. And also to contribute to environmental justice and equality. Preserving biodiversity is becoming a new moral value through which people realize their responsibility to the varied forms of life on Earth and to the future generations. This requires a significant change in our moral consciousness and moral motivation for behaviour towards the environment which we share with many other species.

Keywords: biodiversity, ecology, moral values, environmental justice, environmental ethics

**Contemporary demographic development of Bulgaria -
how to be among the world leaders in population
mortality without war?**

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Abstract: This research aims to study the levels of mortality in modern demographic development of Bulgaria. For a relatively short period of time the country ranked among the leaders in mortality and negative population growth in the world according to UN and World Bank. The study examines some of the main social and political reasons that led to these negative results. The present situation can serve as a categorical example of poor management practices that should be avoided. At the present moment the trends are towards continuing deterioration of the demographic situation. The problems in some individual areas are extremely sharp, including depopulation of villages, population aging, the rapid pace of reduction in the total population number, the negative natural and mechanical population growth and more.

Keywords: demographic crisis, population, mortality, Bulgaria, Eastern Europe

Social and social capital - opportunities for sustainable development of municipalities in Kustendil

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Abstract: People are the most important and valuable resource of Bulgaria. They are entitled to decent living and full participation in society, good health and productive life. Policy Demographic Development is an integral part of the overall policy of economic, cultural and social development of the country. Sustainable development is a means of ensuring the welfare of Bulgarian citizens - both those living today and future generations. Sustainable development can create a reasonable and balanced management of population, resources and environment. In modern conditions especially become important not so much the number of people as the human resources, namely the abilities, skills and health of people, i.e. human capital in order to create the best quality of life for all citizens. Providing quality health care and education opportunities for the full development of personality is seen as an end in itself, not just as a means of achieving demographic targets. The study area is no exception to these trends. On the contrary there are many evidence of deterioration of socio-economic development in general and in particular the social sphere in the municipalities of the area. This has a direct impact on the living standard of the population living and working conditions, opportunities for professional development, quality and diversity of services, etc. Globalization, integration and economic growth are based on competition and new technologies, and should have their social dimension: to increase employment and incomes to use more fully the capabilities of social potential, provide greater access to economic and social resources reduce, not increase the gap between rich and poor.

Keywords: Social sphere, sustainable development, social capital, social and economic development

Contemporary processes of depopulation in Vidin district, Bulgaria, Eastern Europe

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Abstract: The contemporary demographic development of Bulgaria is characterized by deteriorated characteristics in a number of basic demographic indices. The country is ranked one of the last places in the world by population growth and one of the first places in the world in mortality rate and rate of decrease of the population (according to the UN, World Bank, etc.). The negative population growth additionally aggravates the situation. One of the most affected areas in this regard is the Vidin region, located in the northwestern part of the country. Depopulation of the rural areas is an integral part of the overall demographic crisis there. The present study aims to trace the pace of depopulation in the district during the period 2000 - 2015.

Keywords: depopulation, settlements, crisis, population, Europe

Regional consequences of refugee settlements territorial dispersion in Lebanon

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Abstract: This case study presents the spatial impact of migration in general and refugees settling locations in particular in shaping internal (intra-communal) and external (international) affairs of Lebanon in last 45 years. The impact of the external events has tremendous effect over the internal political subdivision of relatively small country like Lebanon which can be considered as catalyst of already existing political processes. Forced migration in terms of refugee inflows had its territorial impact of ethno – confessional communities balance and territorial securities aspects as external forces are involvement in flaring conflict taking place in this period. The issue is very sensitive in light of ongoing conflict in Syria – next string of the century evolving conflict in the Middle East. The paper aims to develop a spatial theoretical framework which could be used for settlement locations and population distribution over a territory in events of ongoing refugee crisis. The proposed framework is a diffusion of various branches of geography and other social sciences. The paper could be useful tool in understanding the ongoing processes, helps the decision making of the host country and international community and could be viewed as practical approach to counter the risk factors in some extent.

Keywords: refugees, territorial integrity, regional security

**Accommodation facilities and opportunities for
tourism development in rural areas of South-West
planning region in Bulgaria**

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Abstract: The development of tourism in rural areas of Bulgaria requires a series of conditions and factors, among which the most important are included in three groups:

- Preserved natural environment, providing opportunities for rest and recreation;

- Distinctive appearance of villages and guest houses that provide opportunities to learn about typical local customs, crafts, lifestyle, cuisine, architecture and so on.

- The third group of factors - not less important than the first two, is the quality of accommodation facilities, which must meet the demands of the modern traveler.

Under the Law on Regional Development of the Republic of Bulgaria South-West planning region comprises five districts: Sofia City, Sofia District, Pernik, Kyustendil and Blagoevgrad districts (SG. 50, May 30, 2008). This study mainly analyzes the available accommodation facilities set up in the villages of the South-West region. Also attention is drawn to the existing attractive natural and anthropogenic sites located relatively close to these villages.

Keywords: rural tourism, accommodation facilities, South-West planning region.

A study of the opportunities for reconstruction and development of crafts and activities of companies in the cultural and creative sector in the municipalities of Slivnitsa, Dragoman and Godech

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Abstract: The development and promotion of the cultural and creative sector within the studied area provides ample opportunities for economic revitalization of the region. In the present study I shall track and analyze the attitude of amateur artists, artists and craftsmen regarding the problems of the creative sector, as well as the activity of the companies in the sector. For that purpose I have conducted a survey which analyzes the issues in detail. The natural and anthropogenic resources are also important for the further development of creative small and medium enterprises.

Keywords: crafts, creativity, economic growth, innovation, regional policy.

Mapping of ecosystem condition in urban landscapes using integrated index of spatial structure

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Abstract: The EU Biodiversity strategy to 2020 aims to halt the loss of biodiversity and ecosystem services in the EU and helps to stop global biodiversity loss. The action 5 of the strategy calls member states to map and assess the condition of ecosystems and their services in their national territory. An ecosystem assessment needs to provide both an analysis of the natural environment by looking at the state of biodiversity and ecosystems and by evaluating the level of ecosystem services provided to people. The analysis of natural environment requires use of indicators to quantify the condition of an ecosystem. For the assessment of Urban ecosystems in Bulgaria a set of indicators was developed including five indicator groups such as biotic diversity, abiotic heterogeneity, energy budget, matter budget, water budget. Two of them, vegetation cover and spatial structure of urban areas, are recognized as very important for the spatial arrangement of the ecosystems that determine the provision of most ecosystem services. The indicator of spatial structure of urban areas is based on the classification of local climate zones for urban temperature studies developed by Steward and Oke (2012). It includes two main parts built type and land cover type. There are 10 built types indicated by number from 1 to 10 and seven land cover types indicated by capital letters from A to G. Using this scheme we developed an integrated index for spatial structure in urban areas which combines built types and land cover types merged within each polygon of urban ecosystem subtype. The identification of the index was performed using urban ecosystem database and visual interpretation of ortophoto maps. The vegetation cover of urban ecosystem reveals the role of the green infrastructure which is the main source of ecosystem services in urban areas. It is measured as the percentage of the total area for particular ecosystem subtype. For this study

we combined results from green infrastructure mapping based on satellite image and manual delineation in order to define average percentage of vegetation cover for each spatial structure index. The results were used to define the condition of urban ecosystems at national level in Bulgaria and produce maps.

Keywords: MAES, urban ecosystems, green infrastructure, vegetation cover, spatial structure index.

Acknowledgments: This study is supported by the project "Enhancing ecoSystem sERvices mApping for poLicy and Decision mAking" (ES-MERALDA) funded by the EU HORIZON 2020 program (<http://www.esmeralda-project.eu>).

Mapping of cultivated crops services provided by urban ecosystems in Bulgaria

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Abstract: Ecosystems provide a variety of benefits to people, including provisioning, regulating and cultural services. Provisioning services are the products people obtain from ecosystems, such as food, fuel, fiber, fresh water, and genetic resources. Urban ecosystems are the environment where most of the population live and perform their usual everyday activities, but they also could provide some provisioning services which are more common to other ecosystem types. Urban agriculture is increasingly proposed as an environmentally friendly answer to global challenges including urbanization, public health, food security and climate change. Cultivated crops are among the most important agriculture products that could be provided by urban ecosystems. Mapping of cultivated crops supply capacity in Bulgarian urban areas is an important challenge due to the lack of reliable sources of information compared to the agriculture ecosystems. The paper presents an approach using spatial proxy method that relates ecosystem services indicators to urban ecosystem subtypes based on causal relationship between environmental variables. For the purposes of the study were used three indicators - soil productivity, hydro-climatic conditions and ecosystem conditions. Soil productivity was evaluated by using complex indicator based on Bulgarian Regulation for categorization of agricultural lands. Hydro-climatic conditions indicator was formed by three sub indicators - actual evapotranspiration, organic matter in soil and risk to soil and atmospheric drought. Ecosystem conditions indicator was formed by four sub indicators - air quality, annual dust emissions 10 (MAN), Nitrogen dioxide (NO₂) and Sulfur dioxide (SO₂). The mapping procedure includes generation of GIS layers for each indicator following particular algorithm in ArcGIS that consists of various functions such as – select, join, interpolate, reclassify, intersect and etc.

These layers were used to develop four maps - one for each indicator and one for all indicators. The maps represent the capacity of urban ecosystems to provide crop in a case study area of Pleven district.

Keywords: Ecosystem services, cultivated crops, GIS, urban areas, agriculture.

Acknowledgments: This study is supported by the project "Enhancing ecoSystem sERvices mApping for poLicy and Decision mAking" (ES-MERALDA) funded by the EU HORIZON 2020 program (<http://www.esmeralda-project.eu>).

Economic valuation of some ecosystem services in the Bulgarian part of Vlahina Mountain

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Abstract: The main objective of this report is the economic valuation of the provisioning ecosystem services fibers and fuels. The total stock of wood in the Bulgarian part of Vlahina is put on the basis of the monetary estimation. The primary data about parameters of forest vegetation are obtained from Blagoevgrad and Kyustendil Regional Forestry. The market price method is used for this evaluation. The results shows high economic potential of the forests in the Vlahina Mountain as a source of fibers and fuels.

Keywords: Ecosystem services, Vlahina Mountain, economic valuation, fibers and fuels, wood.

About continental rainfall index (coefficient) in Bulgaria

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Abstract: Bulgaria is situated on the border between subtropical and temperate climate zone in Europe. Concerning this, many climatologists divide in Bulgarian territory at least two or three climatic regions. One of the main criteria for such differentiation is related to the distribution of rainfall during the year. For this purpose in Bulgarian climatology is used so-called "continental rainfall Index". In order to take full account of the differences in temperate and Mediterranean-type precipitation patterns is proposed a new formula for calculating the index, named "continental rainfall coefficient". The values of two indicators for a number of stations in the country for different periods are compared. On this basis are drawn some conclusions about its appropriateness and credibility.

Keywords: climate regions, rainfall pattern, summer and winter precipitation

**Physical-geographical and meteorological
preconditions for floods in Aydarovska River (South-
West Bulgaria)**

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Abstract: Physiographic conditions for the occurrence of floods and river flooding in small catchments of Southwestern Bulgaria on the example of Aydarovska River, a left affluent of the Struma River, discussed. Some measurements of water quantity were carried out and the weather conditions in river floods during the winter of 2015 were analyzed. The presented own data show that this type of processes are widely spread and often accompanied by debris flows.

Keywords: catchment area, morphometric parameters, Digital elevation model, GIS, Struma River valley

Rock glaciers in Bulgarian highest mountains as storytellers of environmental past

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Abstract: Rock glaciers are among the most interesting cryogenic landforms in the highest mountain areas of Bulgaria. These chaotic accumulations of large boulders that form series of ridges and hollows occupy areas up to 20 hectares and more. It is considered they were produced during the termination phase of the last ice age (16-10 ka BP) either by degradation of cirque glaciers, or by creep transformation of former screes. The cores of buried ice (permafrost), which these block masses contained, made them possible to move like a compact mass in a jelly-like state down slopes with minor surface tilts (even not greater than 6-8°) and travel distances reaching sometimes several hundreds of metres. More than 70 rock glaciers are found in Rila and Pirin at altitudes between 2200 and 2600 m a. s. l., which, at present climatic conditions, have been considered relict. But are they all relict in the present conditions? And were they formed at once, or on several stages when climate was appropriate? Searching the field evidence, the present study raises hypotheses that try to answer these questions.

Keywords: rock glaciers, Rila, Pirin, cold phases, Schmidt hammer.

**Comparative analysis between the Rhodopean
Mountain massif and the Rila-Pirin mountains range
(South Bulgaria, North-East Greece)**

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Abstract: The realized regional investigation in a scale 1:250000 show some important morphostructural differences between the Rhodope Mountain Massif and the Rila-Pirin Mountains Range (South Bulgaria and North-East Greece). The Rhodope Mountain Massif represents a morphostructural zone with almost oval and gently WNW-ESE elongated form. The first one is composed by six mosaic articulated morphostructural regions with irregular-oval form. The Rila-Pirin Mountains Range is a NNW-ESE elongated morphostructural range from link motion oriented morphostructural regions with different size and orientation. The both mentioned regional morphounits are distinguished through the big (more than 700 m) maximal topography altitude differences. The Rila-Pirin Mountains Range distinguished by compact high or middle high mountainous relief. The varied mountainous till hill-mountainous relief of the Rhodope morphostructural zone is flecked with negative morphostructures. This and some others important morphostructural differences between the topography of the Rhodope Mountain Massif and the Rila-Pirin Mountains Range be due to the deep Earth's crust Quaternary geodynamic processes in connection with the intra continental collision between Gondwana and Neo Europe in the eastern part of the Balkan Peninsula.

Keywords: mountain range, morphostructural zone, morphounits, differences

Development of sample routes for school trips in the vicinity of Sofia

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Abstract: The aim of such trips is to kindle the children's love towards nature, in a way to pull them apart from the overwhelming world of technology, which can tend to steal their childhood away. It's important to learn a way to a healthy lifestyle early on, to become more social, to learn how to start new, real-life, non-virtual friendships which has become a proneness in the past few years. School road trips are a method of teaching through experiencing and adventure amidst natural and historical heritage sites. Travelling can bring an exciting benefit to geography lessons, biology lessons, history lessons etc. Kids can practically encounter the things they have learned about only in theory. During travel the disciplines which kids study suddenly become different, much more pleasant and exciting than the way they appear to be from inside a class room. It's a way for the meadows and forests to become the class rooms.

Keywords: Travelling, Cultural-historical and natural heritage, education

**Main stratigraphic units in Blagoevgrad Graben-
relations, facies features, late Miocene orthoplen
destruction and relief evolution**

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Abstract: The purpose of the current study is to use one of the basic principles of geology (the principle of uniformitarianism), combined with facies analysis as a tool to investigate the depositional environments and stratigraphic relations between the main late Neogene-Quaternary sediment units of the Blagoevgrad Graben. The aim is to achieve a better understanding of the paleoenvironment and the evolution of the topography along the Middle Struma Valley. The study also aims to present new evidence that the alluvium facies zone actually coincides with braided channel of the paleo river Struma and that these sediments are evidence for the initial stages of the Late Miocene orthoplen destruction. Based on the first data about the Late Neogene deciduous macroflora in Blagoevgrad Graben and the already known fossil data regarding large mammalian fauna belonging to mammalian biozones- MN11, MN12 the stratigraphic position of Pokrovnik and Dzherman Formations has been changed. Based on this new data, a new hypothesis for the evolution of the relief along the Middle Struma Valley is built.

Keywords: Blagoevgrad Graben, facies analysis, river sediments, braided rivers, fossil macroflora, stratigraphy

**Prominent surface karst and glaciokarst features in
Durmitor Mountains (Montenegro)**

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Abstract: Durmitor is the second highest mountain of the Dinaric range, and the most popular in Montenegro. Although quite small (comparable to Vitosha) Durmitor has an expressive outlook that is among the most representative for the dinaric karst. The relief of this spectacular mountain, which is mostly built of limestone, is dominated by four large cirques, left by Pleistocene glaciers (one small glacier exists to present days). The bottoms of these vast depressions are heavily karstified, and turned to stone labyrinths, abundant with various surface features. Tall rock escarpments, which represent cirque side and back walls, are in contrast with the smooth plateau surface that lies above. Although surface waters are generally lacking, the karst environment of Durmitor hosts several lakes. Another characteristic of the mountain environment of Durmitor is the inversion of vegetation belts, a result of the specific local climate conditions. The mountain is framed by deep canyons from almost all sides, main among them is the canyon of Tara river, the deepest in Europe (and second in the world).

Keywords: Durmitor, karst, canyons, Pleistocene glaciers, sinkholes

A survey on most common cryptographic algorithms: their design principles and current use

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Abstract: The security for the data has become highly important since the communication by transmitting of digital products over the open network occur very frequently. Cryptographic algorithms and their performance metrics vary according to their use scenario, input data, and implementation platform. Each cryptographic scheme has its own features and design that renders secure theoretically or practically. In this paper, we study the most common cryptographic algorithms in current use; simulate their basic operations and understand design principles and security metrics of available encryption techniques. It is of a high importance to estimate how to improve nearly or in the future the efficiency of a certain algorithm to increase the overall security when applying encryption or decryption to secure our data in transit or storage and communications. The simulation results show how specific algorithms perform according to different size input blocks of data and where they are best suited.

Keywords: Security, attacks, performance metrics, efficiency, encryption.

Research work of Backpropagation and Levenberg-Marquardt algorithms for recognition on biometrics data

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Abstract: The work is presented a study of two algorithms for recognition and classification of images formed on the basis of data related to solving a specific application task. That of the trial was conducted on the basis of comparing parameters: time, number of errors in classification and influence the selection and structuring of data.

Keywords: pattern recognition, classification, clustering, feature extraction, feature selection, error estimation, neural networks.

Modeling of the Rossler and Chua systems with AnyLogic program

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Abstract: The Rossler and Chua systems are systems of ordinary differential equations defined as continuous dynamical systems. These systems are examples of a chaotic systems which are already known in the theory of chaos. Their graphical representation in mathematical software as Mathematica and MatLab will be compared to their graphical representation in AnyLogic program. The comparisons will be made in order to notice advantages and disadvantages of AnyLogic in regards to graphs obtained with mathematical software Mathematica.

Keywords: ordinary differential equations, mathematical model, AnyLogic software, Mathematica

Minors of finite operations

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Abstract: We present a new data structure for representing k -valued functions (operations), called minor decision diagram. The results are presented in terms of Multi-Valued Logic circuits (MVL-circuits), formulas and minor decomposition trees. When assigning values to some variables in a function f the resulting function is a subfunction of f , and when identifying some variables the resulting function is a minor of f . A set M of essential variables in f is separable if there is a subfunction of f , whose set of essential variables is M . The essential arity gap $\text{gap}(f)$ of the function f is the minimum number of essential variables in f which become fictive when identifying distinct essential variables in f . We prove that, if a function f has non-trivial arity gap ($\text{gap}(f) > 1$), then all sets of essential variables in f are separable. We define equivalence relations which classify the functions of k -valued logic into classes with the same minor complexities. These relations induce transformation groups which are compared with the subgroups of the restricted affine group and separable sets in functions. These methods provide a detailed classification of n -ary k -valued functions for small values of n and k .

Keywords: separable set, identification minor, minor decision diagram, minor complexity

Canalizing identifications

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Abstract: The variable that have the power to determine the value of the function by replacing it with a constant is just one of the available options for canalizing function. Identification of variables can also collapse the resulting function into constant or function depending on one variable. Such identifications we will call canalizing. This paper presents some results about canalizing identifications.

Keywords: Boolean functions, identification minor, canalizing functions, subfunctions

Improvement on some techniques used to detect and prevent SQL injections

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Abstract: The The SQL thread to the web applications, continues to be one of the most crucial problem nowadays. Although programmers have different tools to enhance applications security, and defense from SQL injection attacks, none of them is perfect. These attacks are still numerous and are getting more sophisticated. Between programmers and attackers developed a constant "battle". The aim of this article is to describe some of the techniques used in order to provide the privacy of the users' application data, making it possible to avoid the possibility of injecting the SQL code in these applications. The article gives some techniques that can be used to give access to important data from database, DoS attacks and to get maximum privileges on the database, and also some improvements on known methods, to detect and prevent these attacks on most used database management systems

Keywords: SQL Injection, Database, Web Application, Security

Approaches to Designing Relational Databases

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Abstract: This paper discusses the concept of designing schemes of relational databases which are resistant to the changes occurring in the primary documents. Also, some specific features of this concept and two different approaches for its usage are pointed out. These two approaches are: database designing with normalization; and designing a database schemes in canonical form. The design of two relational database schemes, which are commonly used in the commercial information systems, is described as well. The designed schemes are converted in a canonical form and their efficiency is proven. The guidelines for further research are formulated.

Keywords: relational databases; designing database; normalization;

Key agreement protocol for distributed secure multicast for eAssessment

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Abstract: eAssessment is defined as a method or a set of methods for assessment of students learning performance and/or learning outcomes as well as for evaluation of achieved competences and/or skills through usage of a wide variety of technologies. eAssessment is typical for online and distance education, but it is applicable also in blended-learning educational form, where combination of online and offline modes of examination are possible. Practices show that eAssessment process occurs in distributed eLearning environments in many of cases of training and educational institutions where students and educators perform a wide range of assessment activities accessible via Internet. Because all assessment activities are in the web, an emerged problem is related to secure transfer and storage of private and operable data during the eAssessment process.

The aim of the paper is to discuss the main assessment activities typical for an eAssessment process and to point out several important security issues, then after summarization and analysis of existing solutions and best practices for realization of secure eAssessment process to propose a model of a crypto system based on multicast security protocol.

The paper presents the current situation in the area of security during online examination, showing the existing practice that includes realization of secure communication channels through utilization of different cryptographic algorithms like: AES, DES, Diffie & Hellman, RSA, etc. And then we propose a new solution for security based on the protocol for distributed key agreement over idempotent semirings.

As is well known, multicasting is the ability to transmit a single stream to multiple subscribers at the same time. The multicast security protocols

are focused on the problem of key management. The goal of the key management is to distribute the group key securely to the group members who can then use it to encrypt or decrypt the multicast data. They deal with the number of key messages exchanged with increasing group size. The proposed protocol for distributed key agreement over idempotent semirings uses polynomials with coefficients in the dual idempotent semirings. The possibility for recalculating the shared secret key in the case when a new user joins the system, or when a user leaves the system is also discussed.

Keywords: eAssessment, security, multicast, protocol for distributed key agreement, idempotent semirings

Free hosting for mobile learning – comparative analysis

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Abstract: Smart phones and mobile internet access are important part of contemporary social environment. Young people prefer to use mobile devices for internet access and communication. As a part of this trend mobile learning becomes attractive and useful. Moreover in some developing countries mobile access to internet overruns other internet access methods due to poor or destroyed by war communication infrastructure and mobile devices like smartphones are basic internet access tool. In this situation e-learning environment hosted on the cloud and mobile devices are the only solution to provide learning content. In our paper we present a comparative analysis of some popular free hosting, suitable to provide e-learning content for mobile devices.

Keywords: e-learning, mobile learning

Design and development of a mobile application for children with disorders

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Abstract: The design of applications appropriate for the capabilities of each user is an important part of modern software engineering. Children with disorders are a special group of users, for whom the standard application design is not a good approach. They often have speech disorders and disorders in their physical and cognitive development. Only few researchers deal with the development of various computer technology, including computer programs, suitable for children with disorders. The mobile applications for children with disorders do not lack in the various stores for apps. The drawback of all of them is that there are not apps with interface in the Bulgarian language and this disadvantage makes them more difficult to be applied to children in Bulgaria.

This paper presents an approach for a design and development of a mobile application for Windows Phone. The proposed conceptual model is based on a study of the functionality of some applications as well as of other research on the opinions of children without disorders conducted by the authors of this work.

An approach to develop a mobile application tailored to the capabilities and individual needs of children with disorders is presented. The proposed application is going to be tested in real conditions and then its effectiveness will be analyzed.

Keywords: Assistive mobile technologies, mobile application, child-computer interaction, software engineering, children with cognitive disorders

Tools for educational computer games development – feature analysis

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Abstract: The games are a powerful tool for motivating and engaging the learners in the learning process. Nowadays technologies develop rapidly. New technological solutions are constantly making an appearance and trying to find their application in the educational process. One of the trends in educational technologies is serious games (educational computer games). In the present paper we discuss some features of software tools for development of educational computer games. We outline basic characteristics for tools taxonomy.

Keywords: serious games, development tools, framework for evaluation

**Protein folding using three componential score
function and one angle of curving**

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Abstract: The 3D structure of proteins is the major factor that determines their biological activity. The synthesis of new proteins and the crystallographic analysis of their 3D structure is very slow and very expensive process. If we can predict the 3D structure of many proteins, than only proteins with expected properties have to be synthesized. The main idea, implemented in the current research, is to modify HP Model such as not to use lattice cube with constant size and score function not to be count of contact, but to use flexible constrain for spreading away, which can vary in the process of folding according the percentage of failing to make possible conformation, caused by lack of space, the angle of curving is varing and the score function contains subfunctions for more energy minimizing components.

Keywords: HP Folding, Protein Folding Prediction, Bioinformatics

Protein folding using two angles for curving in space

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Abstract: The major factor that determines biological activity of a protein is its 3D structure. If we can predict the 3D structure of many proteins, than only proteins with expected properties have to be synthesized and that will be useful for drug design. The main idea, implemented in the current research, is to modify HP Model such as not to use lattice cube with constant size and score function not to be count of contact, but to use two variable angles of curving to gain more possible forms more similar to the real one and the score function is multiplication of subfunctions for three energy minimizing components - secondary structure, hydrophobic contacts and S-S bridges.

Keywords: HP Folding, Protein Folding Prediction, Bioinformatics

Programming languages in undergraduate courses and in software industry in Bulgaria

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Abstract: Programming languages is one of the main knowledge areas in the Computer Science curriculum. Software development professionals often need to learn new languages, constructs and concepts to effectively combine them in solutions they develop. Universities must adequately prepare their students for the challenges they will face. Studying programming languages is a part of more general knowledge covering programming paradigms, concepts, technologies, patterns and algorithms. The first programming language plays an important role since the freshmen have different backgrounds and different expectations. This paper presents a recent survey on programming languages used in Bulgarian academic courses and discusses results in the light of recent index of programming languages popularity and industry trends. The summary of languages studied at universities is juxtaposed with industry demands for professionals with specific knowledge in particular programming languages. The study covers all Bulgarian universities with undergraduate courses in the professional field of informatics and computer science and the programming skills demanded in job offers during the last six months in Bulgaria.

Keywords: Programming language, university, programming language trends, recognition of new programming languages, university curricula

**On a class of programming tasks by using the random
number generators**

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Abstract: The work discusses a class of programming tasks related to the researches on human short-term memory. For this purpose, some randomized algorithms using random number generators are reviewing.

Keywords: random number generator, short-term human memory, randomized algorithm

Syntax sugar in programming languages

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Abstract: While we are focused on making it easy to write programs we often forget that making them easy to read is also important. Lambda expressions, monads, idioms, etc. make it possible to syntactically extend the general purpose programming languages by adding more syntax sugar and bringing domain concepts into them. In this paper we demonstrate and discuss expressiveness and applicability of some programming constructs in C#.

Keywords: syntax sugar, lambda expressions, monads, idioms

Low-discrepancy sequences in quasi-Monte Carlo integration

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Abstract: The main idea in the quasi Monte Carlo method is to approximate the integral of a function f as the average of the function evaluated at a set of points x_1, \dots, x_n .

In this paper we consider the computers time for evaluating approximate value of the given definite integral on the unit interval using the so-called low-discrepancy sequences as a set of points x_1, \dots, x_n .

In the experimental computations for numerical integration we choose some different functions on the interval $[0,1]$ in one dimensional case, with different number of points in the sequences.

Obtained numerical results verify theoretical results: quasi-Monte Carlo has a bigger rate of convergence than the rate for regular Monte Carlo method.

Keywords: quasi-Monte Carlo integration, low-discrepancy sequences, numerical computations

An approach for software develop for management of assembly line

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Abstract: In the article is presented an approach for software develop for management of assembly line. Described are the basic software tools and hardware solutions required for the development of the software. Presented is the design of specific software for management of assembly line for bottling of liquid food products. Described is the algorithm developed for management of the assembly line. Presented is the realization of the management of the assembly line in the programming environment Simatic Manager Step 7 and the developed user interface in the graphical environment Simatic WinCC Flexible.

Keywords: Management Software, Assembly Line, User Interface.

Bootstrapping time series that contain a seasonal component

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Abstract: Periodic time series are used to model data with periodic structure in many different fields that include economy, meteorology etc. In the case of periodic time series, it is not advisable to use the classic bootstrap procedures because of the periodicity present in the data. Periodically correlated time series are a special class of periodic time series where the mean and the covariance remain unchanged if we shift T units in time. We are interested in the study of bootstrap procedures that are suitable for the time series that contain a seasonal component. For this reason we realize a simulation comparison of the bootstrap procedures proposed in the point estimation of the seasonal means and the overall mean and interval estimation of the overall mean in the case of some periodically correlated time series models proposed and also in a real data example. We use the R programming language to construct the programs based on the algorithms proposed. The actual coverage probabilities of the bootstrap equal-tailed confidence intervals for the overall mean are calculated considering different models, block sizes and sample sizes. The procedures proposed takes in consideration the periodicity present in the data and gives good results compared with the classic estimates.

Keywords: Seasonality, bootstrap, time series, actual coverage probability.

Comparison of different Methods for missing data imputation in Time Series

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Abstract: Time series analysis is an important area of statistics. The data are records that are taken through time and in many cases, we deal with missing data. When one or more observations are missing, it is necessary to estimate the model and also to obtain estimates of the missing values. Different strategies are used to estimate the missing values according to the series studied. It is necessary to use these strategies effectively in order to obtain the best possible estimates.

The process of estimating missing values in time series data involves analysis and modelling. Missing values in datasets are a well-known problem and there are quite a lot of R packages offering imputation functions. The objective of this paper is to examine and compare the effectiveness of various techniques for the estimation of missing values in time series data models. We will use the R language for the simulations and compare the results from different methods form missing data in time series. We will use “Amelia” and “MICE” packages for impute missing data and the aim is to compare the performance of each method.

Keywords: Time series, missing data, imputation, Amelia

Statistical convergence of asymptotic martingales

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Abstract Statistical convergence has become an active area of research under the name of statistical convergence since 1990s of the last century. It has appeared in a wide variety of topics such as number theory, measure theory, trigonometric series, summability theory, in the study of strong integral summability and Banach spaces.

In this paper statistical convergence is used to obtain some new results on amarts. Amarts generalize martingales considerably since every convergent sequence of random variables with integrable supremum is an amart. Our goal is the study of statistical convergence of asymptotic martingales of statistical Bochner integrable functions. We obtain some results for the statistical convergence of vector valued uniform amarts without assuming the Radon-Nikodym Property.

Keywords: statistical convergence, amart, statistical Bochner integrable

Edgeworth approximation for Chi-squared distribution

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Abstract: Edgeworth expansion is an approximation technique that helps us to estimate the distribution function of either the standardized mean, the mean or the sum of independent identical distributed random variables. This expansion is used to prove the asymptotic accuracy not only for the sample distributions but also for their bootstrap distributions. The bootstrap method is a very general resampling procedure for estimating the distribution of statistics based on independent observation. This technique allows the evaluation of a sample distribution.

In this paper we will see Edgeworth approximation for a distribution that has special importance in statistics, the Chi-squared distribution.

We have used the statistical software R and we have done simulations of this approximation in two cases: when we use bootstrap and when we don't use it. At the end, we will give some results based on our simulations study.

Keywords: Edgeworth approximation, bootstrap, Chi-squared distribution, simulations

Results on the composition of distributions

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Abstract: Let F be a distribution and let f be a locally summable function. The distribution $F(f)$ is defined as the neutrix limit of the sequence $\left\{F_n(f)\right\}$, where $F_n(x)=F(x)*\delta_n(x)$ and $\left\{\delta_n(x)\right\}$ is a certain sequence of infinitely differentiable functions converging to the Dirac delta-function $\delta(x)$. The composition of the distributions $x_+^{-1/r}$ and x_-^{-r} is proved to exist for $r=1,2,\dots$.

Keywords: Distribution, delta-function, composition of distributions, neutrix, neutrix limit

Explicit solutions of modified Lorenz system

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Abstract: By using the Lorenz system of differential equations and the systems of difference equations from [1], [2] and [3] which approximated the Lorenz system, we obtained homogeneous linear differential equation from fifth order with constant coefficients. Replacing the third differential equation in the Lorenz system by this homogeneous linear differential equation from fifth order with constant coefficients, we obtained new system of differential equations. The explicit solutions of the Lorenz system are not know, but the explicit solutions of the new system of differential equations can be found by solving the homogeneous linear differential equation from fifth order with constant coefficients and solving of homogeneous differential equation of second order with variables coefficients via solving of canonical differential equation of second order.

Keywords: Lorenz system, system of differential equations, explicit solutions.

The category of partial proper homotopy

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Abstract: In this paper, the category of partial proper homotopy is determined. Also, the correlations between categories of partial proper maps, partial proper homotopy and weak proper homotopy are considered.

Keywords: category, partial proper map, proper homotopy

Double helix model of prime numbers and a new sieve technique

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Abstract: There are many described techniques in Sieve theory, part of number theory, from sieve of Eratosthenes to modern ones of Brun's, Selberg's etc. to find out the prime numbers. Here we state a new model of observing the twin primes. All primes and their derivatives are members of two distinct arithmetic progressions $(5+6n)$ and $(7+6n)$, where n is integer. We ordered the primes in two sequences – 5-relatives ($5'$ -primes) and 7-relatives ($7'$ -primes). In our sieve technique we attack direct only the derivatives of primes themselves in so generated two progressions by using three formulas. Providing our sieve technique all primes remain and no error occurs. We named this observation of prime numbers double helix model and believe that it will help to reveal undiscovered secrets of primes.

Keywords: twin primes, double helix model of primes, sieve technique

On a set of binary matrices

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Abstract: Let Λ_n^k be the set of all $n \times n$ binary matrices with exactly k ones in each row and each column, $1 \leq k \leq n$. A matrix A will be called primitive, if there is no $l \times l$ submatrix of A that belongs to the set, Λ_l^k where $k \leq l \leq n$. The work describes a polynomial algorithm for verifying whether a binary matrix is primitive. For this purpose, the binary matrices are uniquely represented by ordered n -tuples of integers.

Keywords: binary matrix, primitive binary matrix, semi-canonical binary matrix, n -tuples of integers, bitwise operations

Generating sets of semigroups of partial transformations preserving a zig-zag order on \mathbb{IN}

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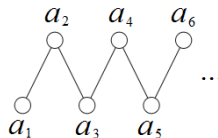
Abstract: Let $\mathbf{F} = (\mathbb{IN}; <_f)$ be a zig-zag poset, also called a fence, i.e. a partially ordered set in which the order relation forms a path with alternating orientations:

$$a_1 <_f a_2 >_f a_3 <_f a_4 >_f a_5 <_f a_6 >_f a_7 <_f \dots$$

or

$$a_1 >_f a_2 <_f a_3 >_f a_4 <_f a_5 >_f a_6 <_f a_7 >_f \dots$$

Every element of \mathbf{F} is either maximal or minimal.



We say that a transformation α preserving a zig-zag order if $x <_f y$ implies that $x\alpha <_f y\alpha$, for all x, y in the domain of α .

We consider the monoid $\text{PF}_{\mathbb{IN}}$ of all partial transformations on \mathbb{IN} preserving the zig-zag order on \mathbb{IN} . We determine the relative rank of $\text{PF}_{\mathbb{IN}}$ modulo a set containing the idempotents and the surjections. Moreover, we show that all transformations in $\text{PF}_{\mathbb{IN}}$ with finite rank can be generated by the idempotents with finite rank and the full transformation γ_0 with finite rank, where γ_0 mapping each natural number n to $n+2$.

Keywords: transformation semigroup, partial transformations, zig-zag order, idempotents, generators, relative rank.

Evaluation of impact of consumption, investment and export on import - data on German economy

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Abstract: The German import represents 5.6% of total global imports and this establishes Germany as the third largest importer in the world. This study examines the dependence of imports on consumption, investment and exports in Germany, using time series data for the period 1997-2013. We received an error correction model that involved short-term and long-term effects and seasonal components. Based on the estimated model, 1% increase in investment or exports the short-term effect would result in an increase in imports by, respectively, 0.39% and 0.58%. We determined the period for which there would be a balance of imports in case of shock on independent variables. There is also a slight constant change in imports during different seasons and a general reduction of import growth by 5.59%.on the average.

Keywords: import, consumption, investment, export, error correction model

Analysis of a mathematical model of adaptive immune response to virus infection

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Abstract: A mathematical model of adaptive immune response to viral infection is formulated by five nonlinear ordinary differential equations. The model describes the interactions between virus, uninfected cells, infected cells, and the adaptive immune response represented by the antibodies and cytotoxic T lymphocytes. Theorems of existence, uniqueness and non-negativity of solution are proven. Numerical simulations of the model are presented.

Keywords: Mathematical model, ordinary differential equations, numerical simulations.

**On mathematical modelling of the competition
between the immune system and viral infections**

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Abstract: A mathematical model of adaptive immune response to viral infection is formulated as a system of six ordinary differential equations (ODE). The model describes the interactions between virus, uninfected cells, infected cells, and the adaptive immune response represented by antibodies and two subpopulations of cytotoxic T lymphocytes (CTL): CTL-precursors and CTL-effectors. Theorems of existence, uniqueness and non-negativity of solutions are proven. Primary and secondary immune responses against viral infection are investigated by numerical simulations using Matlab.

Keywords: numerical simulations, ordinary differential equations, nonlinear dynamics, virus, immune system

Mathematical modelling and numerical simulations in ecology

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Abstract: The paper is devoted to some applications of mathematical modelling and numerical simulations to ecology. Mathematical models can be used for clarifying the factors that are sufficient to explain experimental and field data, defining these factors in precise terms, suggesting experiments for calculation of these factors. Analyses and simulations of mathematical models have been used for reduction of the amounts of experiments needed for land recovery and conservation. In our paper we consider some problems related to soil physics. We analyse numerically a transport model describing a soil-plant system. The role of some parameters of the model is investigated.

Keywords: land-use change, numerical simulations, mathematical model

Application of Markowitz portfolio optimization on Bulgarian stock market from 2013 to 2016

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Abstract: Investors of any time and of any investment areas are faced with the conflicting objective of minimizing risks and simultaneously maximizing returns. Considering the trade-offs between risk and return, Harry Markowitz, an American financial economist, proposed the so-called optimal portfolio theory in 1952. The aim of this paper is to provide a practical study of Markowitz model in the Bulgarian stock market from 2013 to 2016. The significance of this study arises from the fact that although Markowitz model has been widely used by investors worldwide, its application in Bulgarian stock market is still relatively limited. From the data inputs which are weekly closing prices of 50 stocks traded on Bulgarian Stock Exchange between January 2013 and December 2016, efficient frontiers in addition to optimal portfolios are determined on the basis of Markowitz theory. As a result, Bulgarian investors can select their own optimal portfolio that maximizes portfolio rate of return with respect to their risk preference.

Keywords: Markowitz portfolio, optimal portfolio, variance, standard deviation, mean return

Stability with two measures for non-instantaneous impulsive differential equations

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Abstract: Impulsive equations are used for modeling in many different areas of science and technology. In the case when the impulsive action starts at an arbitrary fixed point and remains active on a finite time interval the accurate model is made by non-instantaneous impulsive differential equation. Such kind of simplified situation concerns the hemodynamical equilibrium of a person when intravenous drugs (insulin) are introducing in the bloodstream and the consequent absorption for the body is a gradual and continuous process. In this talk one of the basic qualitative properties of the solutions, stability, is studied with the help of modifications of the Lyapunov's method. Additionally, two different measures for the closeness of the initial values and for the solutions are applied.

Keywords: non-instantaneous impulses, stability, two measures, Lyapunov functions

Didactic methods of teaching Physics at "Fan S. Noli" University, in Korçë

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Abstract: Didactics, once valued as the art of a teacher, today is an established science with properly defined laws, regulations and methods. Considering the actual needs of our schools, the studies concerning the scientific approach of the didactic methods of physics take central priority. The pedagogue at the "Fan S. Noli" University, in Korçë, has put himself up to the selection of the most efficient forms and methods of conveying the concepts of physics to students with different backgrounds, who study the subject of physics for one semester. This article examines the factual aspects of applying just in time teaching method and the group studying method regarding the subject of physics (this includes lectures, seminars and lab work). The results derived, demonstrate an increased efficiency of the new teaching practices, compared to the traditional ones from two years ago. This is clearly manifested in the increased collaboration between students and teachers when discussing about the subject of physics. Finally, an increased conceptual scale is being evidenced, along with higher results/evaluations than two years ago.

Keywords: teaching, teaching methods, just in time teaching, group studying.

**The problem solving method and the research,
needed to transmit the new sets of knowledge
in Physics**

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Abstract: If the basic principle defining that "Science gets valued from organized knowledge" is properly respected, then the levels of a whole set of student work outcomes like motivation, interest, differentiated work and effectiveness regarding physics classwork, will increase significantly. From this point the results achieved from each student, cultivated during the learning process, will arise to a whole new degree. Cultivating the will to study natural sciences, especially physics, means organizing class work throughout independent student work, stimulating a sense of discovery for each student, not an inventorial one. The traditional type of lecture transmits only basic knowledge, without evaluating the real life situations. Also, it doesn't take into consideration a full scale analysis of the elements presented by a specific model as well as extracting the needed equations for calculating the quantitative aspect of physical phenomena and their place into the laws of physics. Averaging doesn't count when evidencing knowledge. The use of interactive methods is supported by presenting a problematic or experimental case and its solution. The teacher, as a moderator, and the student, as an explorer, interact to discover the analysis of a specific problem, along with its ways of solving. This also includes hypothesis formulation, raising arguments and verifying them. Finally, a balanced report is created between the work of the student and that of a teacher. This report helps the student transform, from a simple listener, to an analyzer and determinant of the correct knowledge.

Keywords: differentiated work, independent work, problematic situation, verification, knowledge.

**Natural science knowledge “animal diversity” in
the area of professional competencies of the future
primary school teachers**

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Abstract: In the circumstances of environmental crisis and problems that result from the unregulated human activity, we have the objective expectations towards the teachers that are supposed to create brand new way of thinking of children and youth that projects in the value area. The report presents the results from researching the competencies of the students that are primary teachers to be concerning the knowledge “animal diversity” integration in two overlapping slices: of the special scientific, in particular natural science training and the professional pedagogical – basic pedagogical, methodological, philosophic-logical and psychological training. The research results show that despite the implementation of effective pedagogical instruments, the students feel higher degree of insecurity when pedagogically transforming the knowledge “animal diversity” for the purposes of the natural science education in primary school. The reasons that stand out among the rest are the effective regulatory changes in school education, which bring about difficulties in the transfer “scientific knowledge – school knowledge” and in the particular objectification of animal diversity in the specific learning contents.

Keywords: professional competencies, natural science training, professional-pedagogical training, school knowledge.

Non-formal Education of Physics Including Making Devices for Demonstration

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Abstract: The article views non-formal education of physics as an opportunity for upgrading knowledge, acquiring new skills and improving the personal and social qualities of students during their high school education. The article offers an alternative form of education in the course of which students make their own devices for demonstrating harmonic oscillation in the 9th grade. It summarizes the importance of non-formal education namely as a way of enlarging the scope of students' intellectual properties and increasing their interest in science and engineering, which, in its turn, makes the learning process a desirable challenge.

Keywords: non-formal education, physics education, harmonic oscillation, devices, demonstration

About the application of information technologies in the Universities in Yemen

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Abstract: The paper consider some applications of information technologies in the field of education to Yemeni Universities. In three interrelated axis of questions, the investigation identifies students' attitudes towards the implementation of e-learning and analyses their skills related to the process. It explores students' evaluation of the website as an educative tool through their academic achievement and it inquires into their perceptions towards web-supported education. The significance of the application of information technologies in higher education in Yemen is discussing in the article. The work makes some strategic suggestions on enhancing the quality of education and the solution to certain problems concerning the integration of information technologies in education, which all developing countries face.

Keywords: information technologies, enhancing the quality of education, e- learning

Student's readiness for e-learning in the Universities in Yemen

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Abstract: The e-learning is an advanced version of the traditional education. It's defined as a way of learning by using the communication mechanisms of modern computer networks and multimedia, including voice, image, and graphics and mechanisms to search electronic libraries, as well as web portals, whether in the context of distance learning or in the classroom. The people engage in the transition to web-supported education are the administrative staff, the faculty, and the students. They all have their needs and they all should meet specific requirements in order to facilitate the transition. The article presents the results of questionnaire research of the student's readiness for e-learning in Yemeni universities.

Keywords: information technology, higher education, e-learning, questionnaire research

Technology model for solving mathematical problem situations TEV

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Abstract: A modern and creative training purposes along with construction of a harmoniously developed personality and mastery of a set of multiband knowledge. The mere mathematical training, however, is not aimed at acquiring only certain situations mathematical type, it aims to teach students to apply mathematical knowledge mastery in all situations. The implementation of this objective is achieved by solving problem situations. The process of problem solving is positioned between the initial state of the problem and the target position in space of the problem. This requires the problem to dis-divided into a series of sub-steps and each step is organized hierarchically. Such organizing and structuring the individual steps provides the model for solving mathematical problem situations TEV.

Keywords: mathematical problem situation, solving problem situation, model for solving mathematical problem situation

Role of using educational tasks in Chemistry teaching

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Abstract: One of the main purposes of modern education is building scientific literacy in students. Teaching Chemistry provides a variety of opportunities for achieving this. Appropriate tool for acquiring the literacy is the use of educational tasks. Research has been conducted on implementation of such tasks in learning of chemical processes in the 10th grade. The results showed that systematic and purposeful application can lead to increased interest, development of skills for selfstudying and building scientific competence.

Keywords: Chemistry, education, using educational tasks, scientific competence.

Cross curricular education in ICT classes

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Abstract: Information and communication technologies (ICT) have a strong integrative power in education. Development of digital competences is related with development of other key competences in the school education. The possible examples for integration of content, knowledge and skills from different school subjects in ICT secondary school course are in the focus of the paper.

Keywords: computer science education, STEM education, cross-curricular teaching

Cross-curricular teaching in STEM education – possibilities in Bulgarian schools

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Abstract: Science, Technology, Engineering and Mathematics (STEM) Education have an important role in contemporary technological society. Preparing and motivating of youths for the technological challenges is one of the aims of education. Computer science education as a part of STEM education can be ground of cross-curricular teaching. The possibilities of integration and development of knowledge from science and mathematics in the informatics classes are in the focus of this paper. We discuss school curricula as a prerequisite or cross-curricular teaching and propose a set of problem solving tasks, synergy of appropriate teaching methods.

Keywords: computer science education, STEM education, cross-curricular teaching

A Project as a modern method in education

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Abstract: This present study aims to refer and analyze the approach of the research-project in the classroom as a perspective of today's modern teaching and practice in the school context. It focuses on the scientific and educational importance and utility of the team-working (project) in large classes of primary school. In Appendix, at the end of paper, there are examples and empirical data at the time of the project in the learning and teaching process through photos in a classroom. The method of research is an educational tool for the teacher, which can evolve and develop the learning process in a way accessible to every student.

Keywords: Project, classroom, student, teacher

**Art activities in correctional - pedagogical work with
children with SEN**

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Abstract: This paper aims to present the innovative teaching methods of our century. The art activities are widely used as a tool to strengthen the learning performance of students. According to the international literature, the use of application of art activities, applied to young pupils with special educational needs in order to cultivate skills in such a way that evolutionarily to harmonise smoothly in the classroom. The aim of the work is the adequate understanding and familiarization of the method, the importance and significance of and the need to use in the classroom. Thus, this paper present the meaning of art pedagogy and how is innovative with children with SEN.

Keywords: Art pedagogy, art activities, children, special educational needs

**An opportunity of putting into practice co-related
education in statistics and informatics at the
Bulgarian high school**

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Abstract: The aim of the suggested approach is acquisition of the elements of Statistics that are included in the curricula of Mathematics, Informatics and Information Technologies. The educational tools offered show the opportunities for co-related education in Informatics and Statistics. The approach used for the development of educational materials allows a quick and flexible reaction to the changes in education.

Keywords: teaching, educational tools

Cognitive problems for developing students’ scientific literacy in their Physics education

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Abstract: The paper deals with one of the most topical issues related to school education – how to form and develop key competences in natural sciences? A variety of strategies for the realization of this goal are explored and a focus is placed on the opportunities to solve context-based real-life problems. The author suggests custom designed problems which can be used in physics education. They are in agreement with the requirements of the Program for international student assessment (PISA).

Keywords: science education, scientific literacy, key competences, context-based real-life problems, PISA

Study of residual radioactivity in fish and fishery products imported into Bulgaria from China, Vietnam, Japan and Norway

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Abstract: In the last few years - 2012 - 2014, in Bulgaria, mass imported fish and fish products from the regions of China, Vietnam, Japan and Norway. As we know in these areas, especially in the zone 61, which is adjacent to the nuclear power plant Fukushima, where there was a global emergency in 2011(7 degrees on the scale of INES), there was mass infection with radioactive substances of the Pacific water, plankton, algae and fish. Contamination of the Pacific water with radioactive substances It was extremely dangerous In the initial period after the accident, but also and after this, especially in 2015 years.

In case of severe accidents in the energy or experimental nuclear reactors in the environment received large quantities and extremely dangerous to humans radioactive isotopes as iodine-131, cesium-137, strontium-90 and other. Although iodine-131 has a relatively large amount of erosion not/about 8 days/he accumulate significantly in the algae, plankton, marine and ocean waters and their inhabitants. Strontium-90 has a half-life period of 28 years and as an analogue of calcium mainly accumulate in the bones of animals where he resides for a long time. Caesium-137 has a half-life period of 30 years and mainly accumulate in the blood and soft tissues of marine and ocean dwellers. The current study aims to find content of radioactive substances in Bulgaria in the imported fish and fishery products in excess of the limit values of the fishing and breeding areas of China, Japan, Norway and Vietnam. For about six months examined various samples of fish, mackerel, salmon and Pang fish canned mackerel.

Keywords: fish, radioactive, Fukushima, Pacific water, Strontium-90, plankton, nuclear reactors.

Study of residual stresses during electron beam welding of alloyed steels using neutron diffraction

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Abstract: In this work are presented the results from studies of residual stresses of plates of alloyed steel welded using electron beam welding technology (EBW). The chemical composition of the first and the second welded plate is respectively (wt %): 0.11% C; 0.27% Si; 1.35% Cr; 0,6% Mn; 3,25% Ni and 0.08% C; 1% Si; 2% Mn; 0.045% P; 0.03% S; 8-10.5%Ni; 18-20% Cr. EBW was carried out on the ESW300 / 15-60 welding units manufactured by Leybold-Heraeus in the Institute of Electronics – BAS. The technological parameters of the EBW process were the following: accelerating voltage $U = 60$ kV; beam current $I = 50$ mA, welding speed $V = 0,5$ cm/s; 1cm/s; 2cm/s, focusing lens-specimen distance $D_0 = 38$ cm. The measurement of residual stresses was carried out in Laboratory of Neutron Physics at the Joint Institute for Nuclear Research - Dubna, Russia. What was used is the flow of neutrons obtained by pulsed fast reactor IBR-2. The diffraction spectra were obtained on Fourier stress diffractometer FSD, located on the channel №11a of the reactor. The temperature fields in EBW of both of the alloyed steels have been calculated.

Keywords: residual stresses, neutron diffraction, alloyed steels, temperature fields

Improved multisoliton compressor

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Abstract: One of the most used methods for compression of laser pulses are fiber optical methods. Within the range of negative dispersion of the group velocity so-called “multisoliton compressor” is usually used. The most important disadvantage of this method is the appearance of a broad pedestal of the pulse, where most of the energy is concentrated. The energy within the pedestal grows with the enhancement of the input pulse energy. In this paper we propose the technique based on management of the fiber dispersion to improve the quality of the compressed pulse. It allows to increase a couple of times the compression factor and significant decrease the energy in the pedestal.

Keywords: optical fibers, laser pulse compression

Waves in plasma medium with magnetized dust particles

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Abstract: It is well known that gyromagnetic ratio for magnetic media can differ greatly from that for free electrons. This fact can significantly influence vibrational properties of plasma medium containing magnetized dust particles of such magnetic materials. The same medium is under investigation in our work. In the framework of hydrodynamic approach, it is derived that an account of intrinsic magnetic moment of the magnetized dust particles results in a rise of a new plasma branch. Frequency of the branch is affected by value of the gyromagnetic ratio.

Keywords: magnetoactive plasma, spin, dispersion equation

**Analysis of dissociation of ^{10}C and ^{10}B nuclei in
nuclear track emulsion**

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Abstract: Progress in the study of nuclear clustering in the relativistic ^{10}B and ^{10}C nuclei dissociation in nuclear track emulsion is presented. Recent findings related with the unstable ^8Be and ^9B nuclei in the coherent dissociation (“white” stars) are highlighted. The contribution of them to the structure of the nucleus in question is determined on the basis of measurements of the emission angles of relativistic He and H fragments.

Keywords: radioactive nuclei, dissociation, nuclear track emulsion

**Stresse's Distribution in Elastic Isotropic Semi-space
with Concentrated Vertical Force**

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Abstract: It is investigated the distribution of stresses in elastic isotropic semi-space in aside and depth at an acting of concentrated vertical force. It is made a transition to lines influences for stresses and theirs determination to arbitrary load. It is made an analysis and comparison of the results obtained.

Keywords: elastic isotropic semi-space, lines influences for stresses

Force’s lines influences in a single static undetermined beams

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Abstract: It is investigated in a general kind an expressions for forces in single static undetermined beams – bilateral fixed and beam fixed–joint. With the expressions investigated the ordinates of the influence lines are receive in the arbitrary sections of the beams. The beam’s elements are used for compound an influence lines in static undetermined systems with application of displacement’s method.

Keywords: single static undetermined beams, lines influences, displacement’s method

Analysis of average power at simistor phase adjustment

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Abstract: The systems for phase adjustment of average power depend on the particular load. This leads to complicated settings in operating mode. The made analysis, presented in the article, allows linearized of the process of regulating the average power, whereupon decreasing the influence of the load and the procedure is facilitated.

Keywords: Average Power, Simistors, Phase Adjustment

Design of passive optical network in urban areas

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Abstract: The steady increase in the demand for broadband services and the consequent increase in the volume of generated traffic in our communication networks have motivated the need to implement next generation networks in our territories. This paper aims to explain the design of a passive optical network (PON). We will look into the main element of these networks, optical fiber, in order to get to know its operating principles and most important features in detail. The theoretical part will be followed by the definition of FTTx networks and point-to-point and point-to-multipoint configurations, moving to elaborating at length on PON and conclude which of its technologies will be the most optimal ones nowadays. Finally, in the second part of this paper we will show practical implementation of theory in designing the network in urban areas.

Keywords: Optical fiber, Passive Optical Network, FTTx, Point to Point, Point to Multipoint

Thermal properties of helium – oxygen mixtures

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Abstract: The paper reports regression functions describing thermal properties of helium-oxygen mixtures used in saturation diving. Thermal properties were determined in the following range of pressure $p=0,1-1,8$ MPa, temperature $T=273,15-333$ K and helium molar fraction $x_{\text{He}}=0,65-0,98$. Regression equations that have been derived enable to determine heat capacity, density, coefficient of dynamic viscosity, thermal conductivity and coefficient of compressibility as the function of pressure, temperature and helium molar fraction in HELIOX mixture.

Keywords: thermal properties of helium-oxygen mixtures

Financial indicators for analysis of the bank system

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Abstract: In this article we will present several financial indicators for analysis and assessment of the banking system. The data which will be presented are gathered from official statistics of the National Bank of the Republic of Bulgaria. This paper introduces a new database of indicators of financial structure and financial development across 2005 - 2016. The database is unique in that it combines a wide variety of indicators.

Keywords: Financial indicators, bank system

Poster Presentations

Computer modeling of Cannabinoid receptors by Molecular Operating Environment

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Abstract: The cannabinoids receptors are of class of cell membrane receptors under the G protein-coupled receptors and their structures are not fully defined. These receptors have been intensively studied for drug development and for their role in the signaling pathway.

The homology modeling approaches and molecular docking methods can be used in the design and discovery of cannabinoid analogues, because the computational structure prediction methods provide a cost-effective alternative in the absence of experimental structures.

The present study presents an attempt to construct a homology model of the cannabinoid receptor by program Molecular Operating Environment. This research provides a consistent framework for further investigation of the cannabinoid receptor-ligand interaction.

Keywords: Cannabinoids receptors, CB1, CB2, Molecular Operating Environment, G protein-coupled receptors, docking, binding

Acknowledgments: This work is partially supported by the project "Bioinformatics research: protein folding, docking and prediction of biological activity", Contract NSF I02/16/12.12.14 with the Bulgarian National Science Fund.

Molecular docking experiments of Cannabinoid receptors

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Abstract: The cannabinoid receptor (CB1) is part of the endocannabinoid signaling system. CB1 is a therapeutic drug target, and its structure and conformational changes after ligand binding are of great interest. The present study aimed to investigate the interaction between the crystal structure of the human CB1 and several known cannabinoid ligands in order to determine the structure-activity relationship by using molecular docking.

The obtained results could be used further for in silico experiments of the cannabinoid receptor-ligand interactions.

Keywords: cannabinoids receptors, CB1, molecular docking experiments, ligand-receptor interactions, structure-activity relationship

Acknowledgments: This work is partially supported by the project "Bioinformatics research: protein folding, docking and prediction of biological activity", Contract NSF I02/16/12.12.14 with the Bulgarian National Science Fund.

A cloud-point extraction-chromogenic system for copper(II) based on 1-(2-thiazolylazo)-2-naphthol

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Abstract: Cloud point extraction-chromogenic systems, containing copper(II), azo dye (AD) and auxiliary ion-association reagent (IAR) were investigated. The following ADs were used: 1-(2-thiazolylazo)-2-naphthol (TAN), 4-(2-pyridylazo)resorcinol, 4-(2-thiazolylazo)resorcinol, and 5-methyl-4-(2-thiazolylazo)resorcinol. The IARs were 2,3,5-triphenyl-2H-tetrazolium chloride and 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide. The best extraction-chromogenic characteristics were obtained with TAN alone. The optimum conditions for Cu(II) extraction in Triton X-100 micelles with this reagent were found. The absorption maximum, molar absorptivity, limit of detection, and linear working range were 565 nm, $2.9 \times 10^5 \text{ dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$, 2.4 ng cm^{-3} , and $7.2\text{-}380 \text{ ng cm}^{-3}$, respectively. The extracted complex has a composition of 1:2 (Cu:TAN). Its structure was optimized at the BLYP/aug-cc-pVDZ level of theory.

Keywords: Cloud Point Extraction, Copper(II), Azo Dye, Spectrophotometry, TDDFT calculations

Acknowledgments: This work was supported in part through the development projects (grants No APVV SK-BG-2013-0003 and DNTS/Slovakia 01/7).

Correlation between cambisols soil characteristics and lead content in wild edible mushrooms (*Cantharellus Cibarius*, *Tricholoma Equestre*, and *Craterellus Cornucopioides*)

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Abstract: The study was conducted on Cambisols soils and wild edible mushrooms from the Batak Mountain, Bulgaria. The total lead content in the soils was measured after their decomposition with HF, HClO₄, and HNO₃ acids. The mushroom samples were prepared by dry ashing and subsequent dissolution in 3 M HCl. An inductively coupled plasma atomic emission (ICP-OES) system HORIBA Jobin Yvon ULTIMA 2 (France) was used for the lead determination at the following operating wavelength: 220.353 nm. Certified reference materials (three soils and tobacco leaves) were also analyzed for verification of the accuracy of Pb determination. A correlation/regression analysis was carried out to reveal possible associations between pH, humus content, and total lead content of the soils and the concentration of this element in the mushroom samples.

Keywords: Pb, Correlation, Cambisols soil, Mushroom samples

Effects of salinomycin, monensin, and DMSA on Pb-induced renal dysfunction

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Abstract: Lead (Pb) is a toxic metal with broad industrial application. It can accumulate in the bones and soft tissues, causing adverse health effects. 2,3-dimercaptosuccinic acid (DMSA) is a chelating agent, approved by the FDA (Federal Drug Administration) as antidote to Pb-poisoning. Study on rats, exposed to Pb treatment demonstrated that the natural polyether ionophorous antibiotic monensin increased the efficiency of DMSA as antidote to Pb poisoning. Salinomycin is the least toxic representative from the group of polyether ionophorous antibiotics. Herein we present novel information about the potential application of salinomycin as a chelating agent for the treatment of Pb-induced kidney injury. The results demonstrated that salinomycin decreased significantly the Pb concentration in the kidneys of Pb-treated mice compared to the toxic control group and restored serum creatinine and urea concentrations to normal control values. Salinomycin was more effective compared to DMSA and monensin as a chelating agent for treatment of Pb-induced renal dysfunction.

Keywords: lead poisoning, chelating agents, salinomycin.

Electrochemical behaviour of novel hemicyanine class dye

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Abstract: The hemicyanine class dyes possessing nonlinear optical properties have found wide application in NLO devices, optical switches, sensors and modulators. In the present study, the properties of newly synthesized styrylquinolinium dye 4-(E)-1-ethyl-4-(2-(4-hydroxynaphthalen-1-yl)vinyl)quinolinium bromide were investigated by means of electrochemical and spectrophotometric methods. A quasi-reversible electrochemical performance and a formal potential $E^0 = 0.165\text{V}$ (vs. SHE) of the dye have been documented by cyclic voltammetry. It has been established that after addition of NADH in aqueous solutions, the dye turns from benzoid to quinoid form. Based on the obtained results, it is supposed that NADH is converted in its oxidized form by dissociation of the hydride anion and the deprotonated dye is turned in its quinoid form by intramolecular charge transfer (ICT).

Keywords: hemicyanine, styrylquinolinium dye, electrochemical properties, intramolecular charge transfer, cyclic voltammetry, spectrophotometry.

Acknowledgments: This study was supported by the National Science Fund of Bulgaria through the contract DFNI E02/14/2014.

CHEMISTRY

P-C-7

Influence of polarized light on the current generation by Photosynthetic Plant Fuel Cell

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Abstract: The plant based fuel cells are devices, in which higher aquatic plants are grown as biocatalysts in fuel cells. The plants use the solar energy to produce carbohydrates from atmospheric CO₂ via the photosynthetic processes. A part of the intracellular electrons can be transferred to the anode. Recently, the impact of the abiotic factors temperature and light intensity as well as the altering of day with night on the electrical outputs obtained by direct photosynthetic plant fuel cell (DPPFC) using duckweeds was established. In this study the influence of polarized light with precise wavelength on the current generation processes is explored. The plants were irradiated with different light spectra - 650 nm light (red), 570 nm (yellow), 510 nm (green), and 475 nm (blue). The recorded current densities are compared to those obtained by DPPFC under non polarized light.

Keywords: Duckweeds, Direct Photosynthetic Plant Fuel Cell, Electricity generation, Polarized light.

Acknowledgments: This study was supported by the National Science Fund of Bulgaria through the contract DFNI E02/14/2014.

Influence of organic extractants on butyric acid separation

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Abstract: Organic acids have a variety of applications in the industry today. Some of them are obtained by bioprocessing of natural products instead of the general way from synthetic sources. Butyric acid can be produced via fermentation. For acid separation from the fermentation broth liquid-liquid extraction could be applied. Thus, effective extractants are needed. In this study pure dodecane, 2 % v/v trioctylamine 2 % v/v decanol in dodecane and 5 % v/v tributyl phosphate in dodecane were investigated as potential organic solvents. The results obtained are compared and discussed.

Keywords: butyric acid separation, liquid-liquid extraction, organic extractants

Evaluation of antioxidant and anti-tyrosinase activities of 1,2,3-triazole-4-carboxamides of anti-influenza drugs

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Abstract: Since tyrosinase has become popular as a key, copper-containing enzyme in melanin biosynthesis, a various depigmenting agents have been design. The newly 1, 2, 3- triazole- 4- carboxamides of amantadine, rimantadine and oseltamivir were prepared by using EDC/HOBt method and their structures were confirmed by spectroscopic methods. The target triazole derivatives were further evaluated for o-diphenolase inhibitory activity in vitro using mushroom tyrosinase and L-DOPA (3,4-dihydroxyphenylalanine) as a substrate. Preliminary studies have shown that the inhibitory activities of compounds decreased nearly threefold in comparisons with the standard tyrosinase inhibitor (kojic acid). Further, the assessment of potential antiradical activities of newly amides is in progress.

Keywords: triazole, tyrosinase inhibitor, antiradical activity

Spectrophotometric determination of copper in alcohol distillates

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Abstract: Distillation in copper vessels is a commonly used procedure in making of traditional alcoholic drinks by small and average producers. Due to the metal corrosion and/or oxidation processes the alcohol distillates obtained in this way are frequently contaminated by Cu.

A simple spectrophotometric method for determination of Cu (II) at microgram levels is proposed in the preset study. The method is based on use of Sodium (I) diethyldithiocarbamate (Na-DDTK, cupral) as ligand. The obtained in aqueous media yellow – brown neutral chelate complex $\text{Cu}(\text{DDTK})_2$ was subsequently extracted in CCl_4 at pH range 4-11. The absorbance of the organic solution was measured at wavelength 436 nm with molar absorptivity value of $10\,000\text{ L mol}^{-1}\text{ cm}^{-1}$.

The described procedure was applied for the estimation Cu (II) in microgram quantities in samples of alcohol distillates (grape brandy). The sensitivity of the method was improved by preconcentration using vacuum evaporation of the sample. Standard addition calibration was applied to obtain the Cu (II) concentration in the samples, as well as, to check the matrix effects and recovery. The contribution of various sources to the combined uncertainty of the results were evaluated and discussed. The analytical procedure was validated.

Keywords: Trace elements, copper determination, combined uncertainty

Corvid roosts in the city: the impact on the taxonomic diversity and functional structure of the soil nematode community

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Abstract: The aim of the study was to assess the influence of corvid roosting behaviour on soil nematodes. Two neighbouring areas located in the city of Warsaw were taken into consideration, one subjected to winter roosting activity of corvids and the other not influenced by birds. The samples were taken three times during the year, in May, July and September of 2013.

The results showed that the nematode communities in the soil of the roosting and control areas differed in terms of density, diversity and trophic structure. Bacterial-feeding nematodes responded extremely positively to increased guano deposition and probably high availability of food (mainly bacteria) in the soil of roosts. Thus our results indicated a significant, mainly indirect impact of the bird roosting activity on soil nematodes.

Keywords: urban ecology, corvid roosts, soil enrichment, nematode abundance, trophic structure

Urban beavers *Castor fiber* in Warsaw (central Poland)

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Abstract: The beaver *Castor fiber* was widespread in Poland until the 13th century. Due to anthropogenic pressure its numbers decreased, leading to extinction in the entire Vistula river catchment in Poland after 1850. A successful reintroduction programme in Vistula basin, conducted in 1975-1985 and supported by natural dispersion of beavers, resulted in the current presence of the species along the whole length of Vistula river. Spread of the beaver population on Poland was accompanied by the increasing number of records of the species in the habitats transformed by man, e.g. urban sections of rivers. To perform the first inventory of beavers in Warsaw the field surveys were performed in accordance with the recommendations of the beaver monitoring methods (Misiukiewicz 2015, Zając et al. 2015) in 2015 – 2017. It was assessed that the Warsaw section of Vistula river is populated by 11 beaver families, present on both banks. The presence of beavers were also recorded in additional sites in Warsaw, including channels and city parks. The inventory results indicate that the area of Warsaw is populated by a total of about 15 beaver families (approximately 55 individuals). This research confirms the high ecological plasticity of this species that adapted to living in close proximity to humans.

Keywords: *Castor fiber*, synurbization, urban fauna

High parasitization of a rare ladybird *Platynaspis luteorubra* – a reason of its rarity?

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Abstract: *Platynaspis luteorubra* (Goeze) (Coleoptera: Coccinellidae) is a ladybird beetle associated with warm grasslands and ruderal vegetation. It is adapted to exploit food resources inaccessible to the majority of arthropod predators, i.e. aphids attended by ants. Although widely distributed in Europe, North Africa and western Asia, *P. luteorubra* is usually rare throughout its range. Larvae of *P. luteorubra* are parasitized by their specific (monophagous) parasitoid, *Homalotylus platynaspidis* Hoffer (Hymenoptera: Encyrtidae). Most records of *H. platynaspidis* come from the southern part of its host's range (southern Europe, Middle Asia). Recently, parasitization of *P. luteorubra* by *H. platynaspidis* was recorded in three regions in central and northern Poland. These records represent the northernmost localities of *H. platynaspidis* in Europe. The recorded parasitism rates were in each of the three regions surprisingly high, ranging between 56% and 69%. We suppose that constantly high parasitoid pressure is the main force maintaining numbers of *P. luteorubra* at low levels.

Keywords: *Platynaspis luteorubra*, *Homalotylus platynaspidis*, parasitoid, rare species

Framework for environmental and ecological protection in India

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Abstract: Forest plays a key role in improving the ecological environment of the terrestrial ecosystem. India's growing population for economic development has put more pressure on forest resources causing the environmental degradation, forest and agricultural land degradation, loss of resilience in ecosystems, resource depletion and pollution of the natural environment. Pollution control and ecosystem resilience have become a major challenge for ensuring sustainable yield of materials for the present and future generation. In 1985, the Ministry of Environment and Forests was created in India and held responsible for the planning, promotion and coordination of environmental and forestry program. Legal Framework for Environmental Protection in India include the Water (Prevention and Control of Pollution) Act of 1974 ; Forest (Conservation) Act of 1980 ; The Air (Prevention and Control of Pollution) Act of 1981 and the Environment (Protection) Act, 1986 with an objective of reducing environmental pollution through proper recycling of garbage, industrial and agricultural wastes.

Keywords: ecosystem, environmental degradation, legal framework, pollution, recycling

Optimization algorithms for finding the shortest paths

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Abstract: The algorithms for finding the shortest path are among the most popular algorithms in computer science and are also widely used in engineering calculations. The main purpose of this study is to examine the shortest path algorithms: Dijkstra's algorithm, Floyd-Warshall algorithm, Bellman-Ford algorithm, and Dantzig's algorithm for finding the shortest path. A brief overview of the different types of the algorithms for finding the shortest path was performed. A sample implementation of C# of the considered algorithms in order to demonstrate how worked each of them were presented.

Keywords: shortest path problem, Dijkstra's algorithm, Floyd-Warshall algorithm, Bellman-Ford algorithm, Dantzig's algorithm

Facebook as an alternative tool in higher education. Survey with Albanian students.

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Abstract: Progressive developments in Information and Communication Technology are providing teachers with great opportunities for enhancing the effectiveness of classes in higher education and educational communities. Technological platforms are diverse, among them e-learning– described as the application of broadband internet and computers to assist teaching and learning - constitutes an essential innovation. Many tools which support and enrich this platform - blogs, wikis, podcasts, forums, threaded discussions, etc- are becoming popular in teaching. Helping students to find learning materials at anytime and anywhere may contribute to enhance and develop their learning level. In this context, this study focuses on the impact of facebook as an alternative environment for educational process in Albanian higher education. It can become a positive source to spread education. Facebook as an e-learning tool can be used as a supplement to increase the interaction between students and faculty members in order to improve student's academic performance. We composed a questionnaire consisting of closed-ended questions as an instrument of data collection. The paper analyzes and interprets the results of this study using SPSS program, which confirm this social network's capacity to enhance students' learning efficiency.

Keywords: higher education, tools, facebook, learning and effectiveness.

Analysis of the results from the state matriculation examination in Mathematics

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Abstraks: This paper presents an analysis of the results from the State Matriculation Examination in Mathematics achieved by the students from the Science and Mathematics High School "Acad. S. Korolyov" within the period of 2014 – 2016.

Keywords: State Matriculation Examination, Mathematics

Servlet and JSP technology for dynamic content

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Abstract: Servlet and JSP technology has become the technology of choice for developing many dynamic Web sites. This article gives an overview of the technology and some of the reasons for its popularity, and it provides some specific details on programming techniques. Servlets are Java technology’s answer to Common Gateway Interface (CGI) programming. They are programs that run on a Web server, acting as a middle layer between a request coming from a Web browser or other HTTP client and databases or applications on the HTTP server. JavaServer Pages (JSP) technology enables to mix regular, static HTML with dynamically generated content. Separating the static HTML from the dynamic content provides a number of benefits over servlets alone, and the approach used in JavaServer Pages offers several advantages over competing technologies such as ASP, PHP, or ColdFusion.

Keywords: Web Java, J2EE, JSP, Servlet

Workshop

**“Recent Progress in
Bio-electrochemical Systems”**

The Workshop “Recent Progress in Bio-electrochemical Systems” is partially supported by Contracts DFNI E02/14/2014 and DFNI E02/15/2014.

PREFACE

The bioelectrochemical systems, called biofuel cells (more famous as microbial fuel cells (MFC)), mimicking the natural interactions between microorganisms and environment, based on energy-transducing processes, are one of the newest technologies of the mankind inspired by nature. The technology of the biofuel cell has been originally developed for simultaneous wastewater purification and electricity generation. Nevertheless, nowadays it is proposed to be applied for bioremediation, biosynthesis and monitoring of the ecological state of the environment. The improvement of the biofuel cell performance is intensively in a progress during the last decade. The generated current and achieved power by the biofuel cell are determined by a number of parameters such as construction of the fuel cell, electrode materials and their resistance, the catholyte composition, the type of separator, the cultivation medium and its conductivity, the applied polarization mode, the presence of oxygen in the system, and last but not least the biocatalyst used. The technological challenges therefore are related to optimization of MFC-components and design for enhancement of electrical outputs, finding new exoelectrogenic species, understanding the origin and the mechanisms of extracellular transferred electrons, which will contribute to faster and wider application of this technology.

We are proud to hold the first international scientific workshop in Bulgaria, where world-renowned scientists will present their latest achievements and we will have the opportunity to discuss the ways to bring the technology to a higher level of technological development.

Assoc. Prof. Yolina Hubenova, PhD, DSc

Chair of the Workshop

“Recent Progress in Bio-electrochemical Systems”

The Black Sea problems – Electrochemical solutions

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Abstract: This is an overview of our studies on the Black Sea environmental problems. The Black Sea is a unique system containing H₂S (C_{H₂S}=5-10 mg.l⁻¹) in about 90 % of its waters where life does not exist. The aim of our research during the years is the development of an economically feasible electrochemical methods for using/cleaning the H₂S contained in Black Sea waters. Several electrochemical methods have been proposed and studied: (i) Electrolysis of H₂S contained in the waters of Black Sea for hydrogen and sulfur production is investigated conceptually. They are based on the low thermodynamic potential of hydrogen sulphide splitting ($\text{H}_2\text{S} = \text{H}_2 + \frac{1}{2}\text{S} - E_0 = 0.17 \text{ V}$). (ii) Simultaneous electrochemical purification of hydrogen sulphide and sulfur dioxide, which is based on affinity of the pair H₂S and SO₂. (iii) Development of H₂S/O₂ (air) H₂S/NO₂ and bio S²⁻/NO₂ fuel cells. Different anode catalysts for HS-oxidation have been tested: graphite, cobalt phthalocyanine and perovskite (La_{1,3}Sr_{0,7}NiO₄). No catalytic poisoning has been observed by the oxidation products (sulfite and/or sulfate). A multistage process is considered which involves extraction of seawater, adsorption of H₂S, electrochemical production of hydrogen and polysulfide's.

Keywords: Hydrogen production, hydrogen, sulfide.

Acknowledgments: This work was supported by the project "New fuel cells based on chemical and microbial processes", through the Ministry of Education and Science and the Bulgarian National Science Research Fund, contract DFNI E02/15.

Sulfide and nitrate driven fuel cell. Biochemical denitrification.

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Abstract: A fuel cell for simultaneous sulfide oxidation and nitrate reduction is constructed. Biological reduction of the nitrates using *Pseudomonas denitrificans* is conducted in the cathode compartment. Different concentration of the sulfides and nitrates are examined. The investigations are carried with graphite rods and pyrolyzed activated felt into the anode compartment. The depletion of the sulfides and nitrates is also presented.

The biochemical process in a fuel cell increases the depletion of the nitrates.

Keywords: fuel cell, sulfide oxidation, denitrification, *Pseudomonas denitrificans*,

Acknowledgement: This work was accomplished within the project E02-15/12.12.2014 of National Science Fund, Ministry of Education, and Science, Republic of Bulgaria.

Workshop "Recent Progress in Bio-electrochemical systems" O-BE-3

Sulfide and nitrate driven fuel cell. Chemical denitrification.

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Abstract: A fuel cell for simultaneous sulfide oxidation and nitrate reduction is constructed. Chemical reduction of the nitrates is used in the cathode compartment. Different concentration of the sulfides and nitrates are examined. The investigations are carried with graphite rods and pyrolyzed activated felt into the anode compartment. The depletion of the sulfides and nitrates is also presented. The addition of sodium chloride into the anode compartment increases the electrical power of the fuel cell due to increased conductivity.

Keywords: fuel cell, sulfide oxidation, denitrification,

Acknowledgement: This work was accomplished within the project E02-15/12.12.2014 of National Science Fund, Ministry of Education, and Science, Republic of Bulgaria.

Workshop "Recent Progress in Bio-electrochemical systems" O-BE-4

**On field operating Sediment Microbial Fuel Cells as
low cost power sources**

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Abstract: Sediment Microbial Fuel Cells (SMFCs) are considered as reliable power sources for electronic devices working in remote areas. The outside operation of a SMFC often introduces difficulties and leads to inconsistent power generation. The present work reports the results of 9 months on field experiments of freshwater SMFCs using different electrode materials. Plain graphite, metallurgical coke and granulated activated carbon were tested as anodes, while stainless steel and carbon felt were applied as cathodes. The highest current and power densities are achieved with SMFC using graphite anode and carbon felt cathode. Despite the lower values obtained with coke anode, due to the low cost it should be considered as a promising electrode material. The ability of constructed SMFCs to power in situ an environmental monitoring device is demonstrated.

Keywords: Sediment Microbial Fuel Cell, electrode materials, on field operation, power source

Acknowledgments: This study was supported by the National Science Fund of Bulgaria through the contracts E02/14/2014 and M09/06/2016.

Workshop "Recent Progress in Bio-electrochemical systems" O-BE-5

**Identification of microbial community in a Sediment
Microbial Fuel Cell**

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Abstract: Microbial fuel cell is a bio-electrochemical device with exoelectrogenic microbes as biocatalyst for direct electrical power production. Samples were taken from different places from cathode and anode compartments. Harvested soil, water and electrode samples were diluted with sterile saline solution and incubated. Aliquots from different dilutions were plated on solid microbiological media. Plates were incubated at different temperatures for different times. Isolated colonies were streaked on fresh plates to obtain pure cultures. The total DNA was isolated with ISOLATE II Genomic DNA Kit (BIOLINE) following the manufacturer's protocol. The 16S rRNA genes from mixed microbial DNA were PCR-amplified with Ilustra Rady-to-Go kit (GE Healthcare). The PCR products were visualized on 1% agarose gel and were sequenced with a universal primer 27F. The resulting sequences were analyzed and compared to the nucleotide sequence in the gene bank database (<http://www.ncbi.nlm.nih.gov>). A total of about 40 samples from different parts of MFC were analyzed and on the basis of the 16S rRNA gene library analysis were identified.

Keywords: Sediment microbial fuel cell, Microbial community, DNA, PCR

Acknowledgments: This study was supported by the National Science Fund of Bulgaria through the contract E02/14/2014.

Workshop “Recent Progress in Bio-electrochemical systems” O-BE-6

Improved operational stability of a laccase-based electrode applicable in biofuel cells

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Abstract: There are two biocatalysts – the enzymes laccase and bilirubin oxidase, that are capable of performing the oxygen reduction even more efficiently than platinum and, hence, they are often used for the development of cathodes for biofuel cells applications. The main drawback of the laccase-based bioelectrodes is the extremely short lifetime of the immobilized enzyme – below 24 hours. In this connection, the objective of the present work is to find a suitable immobilization approach, which ensures an extended lifetime of the immobilized laccase. Five different immobilization protocols of the laccase enzyme (isolated from the basidiomycetes *Trametes pubescens*) have been tested with three different electrode materials (graphite, gold and glassy carbon) for that purpose. An extended operational stability of ca. 3 weeks has been achieved for the immobilized on gold-nanoparticles modified glassy carbon electrode. The value of the open circuit voltage (over 450 mV vs. Ag/AgCl, 3M KCl at pH = 4.5) for the so produced electrode suggests that it is a good candidate for constructing a cathode for biofuel cell applications..

Keywords: laccase, immobilization, gold nanoparticles, biocathode,

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Workshop "Recent Progress in Bio-electrochemical systems" O-BE-7

Copper recovery combined with wastewater treatment in a Microbial Fuel Cell

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Abstract: A novel type of microbial fuel cell (MFC), called metallurgical MFC, is an attractive alternative for metal recovery with simultaneous waste water purification. Valuable metals can be recovered at the cathode by using electricity generated from microbial-assisted oxidation of organic matter at the anode. In this study, the possibility for copper recovery combined with wastewater treatment in double-chamber MFC was examined. CuSO_4 solutions with different concentrations were used as a catholyte and synthetic wastewater inoculated with activated sludge from municipality WWTP-Blagoevgrad was applied as an anolyte. Current generation resulting in a decrease of copper ions concentration in the catholyte and deposition of copper on the cathode was documented. It has been established that the use of more diluted Cu^{2+} solutions enhances the coulombic efficiency. The decreased COD in the anolyte at the end of experiments proves the concept for simultaneous copper recovery and wastewater treatment by means of MFC technology.

Keywords: microbial fuel cell, copper recovery, wastewater treatment

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Workshop "Recent Progress in Bio-electrochemical systems" O-BE-8

Oxidation of sulphites with DWCNTs, MWCNTs, higher fullerenes and manganese by an electrochemical technique

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Abstract: The current research work is focused on the use of new catalysts for the oxidation of sulfites to sulfates, electrocatalysts for oxidation and reduction of nitrates, based on fullerenes and nanotubes. For this purpose manganese was deposited on fullerenes and carbon nanotubes. The results show that electrodes containing higher fullerenes (HF), DWCNTs (Double Wall Carbon Nanotubes) and manganese are effective catalysts in S/O₂ fuel cells. HFs and DWCNTs have a high catalytic activity and can be employed as standalone catalysts. Mn has been deposited on DWCNTs, HFs and fullerenes by thermal treatment and/or freeze drying (lyophilization). The electrocatalysts were characterized by scanning electron microscopy (SEM), and X-ray diffraction (XRD). Electrochemical testing was done, including cyclic voltammetry and E/V polarization curve plotting. The polarization curves of the electrodes comprised of DWCNTs and lyophilized higher fullerenes with manganese particles show the lowest overpotentials.

Keywords: electrocatalysts, fullerenes, manganese, environment.

Acknowledgments: This work was funded through the project "New fuel cells based on chemical and microbial processes", through the Ministry of Education and Science and the Bulgarian Research Fund, contract DFNI E02/15.

Workshop "Recent Progress in Bio-electrochemical systems" O-BE-9

**Wastewater treatment combined with energy
harvesting**

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Abstract: The increase of environmental pollution control and regulations along with the demand of energy worldwide led to the development of a brand new direction of scientific interests - the evolution of fuel cells for environmental purposes. This paper presents the achievements of our team in the field of sulfide, sulfite and nitrate driven fuel cells. Choices of appropriate membranes, initial concentrations and conditions as well as catalysts for conducting the processes are represented. Some results from a pilot scale battery of fuel cells in real conditions for utilization the hydrogen sulfide from deep Black Sea waters are also given. A comparison of a chemical and microbial fuel cell driven by sulfides in the anodic compartment and nitrates into the cathode one is made.

Keywords: fuel cells, sulfides, sulfites, nitrates, wastewater treatment

Acknowledgements: This work was accomplished within the project E02/15-12.12.2014 and DN07/7 of National Science Fund, Ministry of Education, and Science, Republic of Bulgaria.

ADDENDUM

Electrohydraulic ragging of metallurgical silicon

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Abstract: The article presents a crushing technology of metallurgical silicon. The proposed ore crushing method is based on the use of the energy of an impulse shock wave resulting from an electrical spark discharge in liquid. Electro-hydraulic technology is one of the most acceptable in production environment because it provides intensive ragging and crushing of the test material. During testing, the initial diameter of the metallurgical silicon particles averaged $3 \cdot 10^{-3}$ - $15 \cdot 10^{-3}$ m. Tests at the electrohydraulic plant were carried out at various values of discharge energy ($W=65$ - 245 J), the capacitor bank capacity ($C=0.25 \cdot 10^{-6}$ - $1 \cdot 10^{-6}$ F), the interelectrode gap at a commutation switch $l_p=6$ - 10 mm, and a pulse repetition rate of 5 to 15 Hz. The value of the applied voltage to the switching device was adjusted from $15 \cdot 10^3$ to $40 \cdot 10^3$ W. By the impact of a series of pulses of 10^{-5} ÷ 10^{-4} s width on solid fractions, they initially cumulate plastic strain, which on the one hand increases its strength to some extent, but in the defect structure areas voltage arises which destroy materials. It was the first experimental study of the effect of underwater electrical explosion on a selectivity of ragging and crushing of metallurgical silicon. In accordance with fineness number of the material under examination, the best optimal parameter for the discharge energy is 200 J. The electro-hydraulic technology makes for crushing metallurgical silicon to fractions of preset parameters.

Keywords: metallurgical silicon, electric hydropulse method, discharge energy, an interelectrode gap at a commutation switch

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