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BOOK OF ABSTRACTS

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BOOK OF ABSTRACTS

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KEYNOTE LECTURE
CPMMI 2018

MATHEMATICAL ANALYSIS OF SWARM INTELLIGENCE

Xin-She Yang
Middlesex University London, United Kingdom

Algorithms based on swarm intelligence have become popular in recent years for solving challenging problems in optimization, data mining and machine learning. Algorithms such as particle swarm optimization and firefly algorithm are a multi-agent evolving system that can work well in practice, but it lacks some rigorous mathematical foundations. This talk presents some mathematical analysis of these swarm intelligence based algorithms with an emphasis on algorithmic characteristics in term of dynamical system theory, self-organization, fixed point theorem and Markov chain theory.

Some open problems will be outlined, concerning the convergence, stability, and robustness of algorithms.

***

PLENARY SESSION
CPMMI 2018

APPLICATION OF CAPUTO-FABRIZIO FRACTIONAL DERIVATIVE IN MECHANICS

Teodor Atanacković[1] and Stevan Pilipović[2]
[1]*Faculty of Technical Sciences, University of Novi Sad, Serbia*
[2]*Faculty of Sciences, University of Novi Sad, Serbia*

We study Caputo-Fabrizio fractional derivative and its application in Mechanics. Some properties are examined and application to variational calculus and viscoelasticity is presented. By using the entropy inequality in a weak form we derive a su¢ cient conditions on coefficients in the models of viscoelastic body that guarantee that the Second law of thermodynamics is satisfied. For new constitutive equations, we present a concrete example. We compare the obtained results with the corresponding ones for standard Caputo fractional derivatives.

***

SOME PROPERTIES OF HQC MAPPINGS AND ELLIPTIC PDE'S

Miodrag Mateljević and Miljan Knežević
Faculty of Mathematics, University of Belgrade, Serbia

We will present a few new facts about harmonic quasiconformal mappings. Also, we will give some estimations of the gradient of solutions of some class of elliptic PDE's.

***

A NOVEL HOLONIC ARCHITECTURE FOR A MEDICAL DIAGNOSIS SYSTEM BASED ON MAS TECHNOLOGY AND SWARM INTELLIGENCE

Rainer Unland and Zohreh Akbari
University of Duisburg-Essen, Essen, Germany

In today's global world a fast and reliable medical diagnostic generation is of eminent importance as can be seen, for example, from the recent problems with SARS/Middle East respiratory syndrome coronavirus (MERS-CoV) (Middle-East/Africa), Yellow fever (Nigeria, Brazil), or Hepatitis E (Namibia) – all from the beginning of this year. Such highly contagious and lethal diseases can threaten the world if they are not fought immediately with high efficiency and reliability. This requires, first of all, a fast and reliable medical diagnostic regardless of where the affected person may currently stay in the world. However, medical Diagnosis can be quite sophisticated and complex and so can its computer-based support. This paper presents a multi-agent systems based medical diagnosis system that is organized according to the principles of holonic systems (cf. [1]), multi-agent systems (cf. [2]), and swarm intelligence (cf. [3]). In principle, it functions similar to an ant colony; i.e., it consists of a

large number of simple agents that interact with each other by simple indirect communication. The idea is to keep the agents as simple as possible and to, especially, avoid to equip them with a sophisticated (partial) real-world model. Whenever a diagnosis request is sent to the system the originally flat colony of unsophisticated agents spontaneously and temporarily self-organizes itself in a proper case-based hierarchy, similar to a holonic hierarchy. While the components as well as the collaboration and communication process of the system are very simple, its real power and capabilities stem from the fact that this large number of simple agents collaborates intelligently in order to come to a reliable diagnosis. Altogether, the system is highly adaptable, scalable, flexible, reliable, and robust as it combines the strengths of multi-agent system technologies, stigmergy, swarm intelligence, and the holonic paradigm (cf., e.g., [4], [5]).

References

[1] Koestler, A: The Ghost in the Machine, Arkana Press; 1967

[2] Wooldridge, Michael: An Introduction to Multiagent Systems. John Wiley & Sons, 2002.

[3] Bonabeau, E.; Dorigo, M.; Theraulaz, G.: Swarm Intelligence: From Natural to Artificial Systems; Santa Fe Institute Studies in the Sciences of Complexity. Oxford University Press, New York, 1999

[4] Zohreh Akbari and Rainer Unland: A Holonic Multi-Agent System Approach to Differential Diagnosis. In: Berndt J., Petta P., Unland R. (eds) Multiagent System Technologies. MATES 2017. Lecture Notes in Computer Science, Vol. 10413. Springer, Cham, 2017

[5] Rainer Unland: A Holonic Multi-agent System for Robust, Flexible and Reliable Medical Diagnosis; Proceedings: On The Move Federated Conferences (OTM '03): Tenth International Conference on Cooperative Information Systems (CoopIS), International Symposium on Distributed Objects and Applications (DOA), International Conference on Ontologies, Databases and Applications of SEmantics (ODBASE); Workshop on Reliable and Secure Middleware; Catania, Sicily (Italy), 3-7 November 2003

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PSEUDO-DIFFERENTIAL OPERATORS OF INFINITE ORDER

Stevan Pilipović[1], Bojan Prangoski[2] and Jasson Vindas[3]
[1]*Faculty of Sciences, University of Novi Sad, Serbia*
[2]*University of Skopje, Macedonia*
[3]*University of Ghent, Belgium*

We introduce a new class of pseudo-differential operators of infinite order and apply this class in spectral theory of hypoelliptic operators of this class. Hypoellipticity and the Weyl type formula are presented.

***

STATISTICAL LEARNING OF REUSABLE TOPICS WITH MINIMALLY SMOOTHED DOCUMENT TOPIC MODELS

Marcus Spies
LMU University of Munich, Germany

Shortcomings of some current approaches to statistical topic modelling are presented based on empirical findings and analyzed theoretically. A new approach under development is presented that allows for optimally fitting document topic models even to small documents and minimizing the effect of document-term distribution smoothing. Candidate approaches to topic-term distribution estimation with a focus on reusability across corpora are discussed. Initial expermental results are reported.

***

DISCONTINUITY AT FIXED POINT

Vladimir Rakočević
University of Niš, Serbia

We (Pant, Ravindra and Rakočević) show that quasi-contraction considered by Fisher (Quasi-contractions on metric spaces, Proc. Amer. Math. Soc., 75 (1979), 321-325), and contractive denition considered by Proinov [Fixed point theorems in metric spaces, Nonlinear Analysis 64 (2006) 546- 557] are strong enough to assure the existence of a fixed point but does not force the mappings to be continuous at the fixed point. Our results not only improves the result of Fisher but also provides more affirmative answers (independent to the previous known answers) to the open question posed by Rhoades (Contractive definitions and continuity, Contemporary Mathematics 72(1988), 233-245).

***

ON THE GEOMETRY OF HIGHER ORDER TANGENT BUNDLES

Ali Suri
Faculty of sciences, Bu-Ali Sina University,
Hamedan, Iran

The tangent bundle T^kM of order k, of a smooth Banach manifold M consists of all equivalent classes of curves that agree up to their accelerations of order k. For a Banach manifold M and $k \in N \cup \{0\}$ we prove that T^kM admits a vector bundle structure over M if and only if M is endowed with a linear connection. This bundle structure heavily depends on the choice of the connection. Then we ask about the extent to which this vector bundle structure remains isomorphic. To this end we define the notion of the k'th order diferential $T^kg: T^kM \to T^kN$ for a given diferentiable map g between manifolds M and N. As we shall see, T^kg becomes a vector bundle morphism if the base manifolds are endowed with g-related connections. Moreover, we show that every Riemannian metric on M can be lifted to a Riemannian metric on T^kM. Then, we construct the principal bundle of orthogonal frames O^kM of the Riemannian vector bundle

T^kM over M and we prove that it is the associated bundle to T^kM with respect to the identity representation of $O(E^k)$. Finally, we develop a generalized principal bundle structure for $O^\infty M$ associated with $O^\infty M = \lim_{\leftarrow} T^kM$ by a radical change of the notion of the classical bundle of orthogonal frames and replacing O(F) by a generalized Frechet Lie group.

***

FRECHET DERIVATIVE AND ANALYTIC FUNCTIONAL CALCULUS

Dragan S. Đorđević
University of Niš, Serbia

We consider the Frechet derivative of the mapping $a \to f(a)$, as suming the following: a is an element of a complex unital Banach algebra, and f is a complex function which is defined and analytic in a neighborhood of the spectrum $\sigma(a)$. Some general results are proved and applications to spectral operators are given.

***

PHYSICAL INTERPRETATION OF DOPPLER RADAR SPECTRAL MOMENTS AND BEYOND

Bratislav Mirić
State University of Novi Pazar, Serbia

The goal of this study is improvement of the target recognition process, in terms of better recognition of the target type. Presented will be mathematical definitions and physical interpretations of Doppler radar's spectral moments, including characteristic examples of spectral moments' shapes as well as bispectrum produced by introducing different orthogonal transformations. These estimations will be applied on small velocity targets in order to recognize exact type of small velocity target. Also, the aim of this work is to explain the role of the cepstrum analysis in the process of identification of small velocity targets.

***

SESSION 1
CPMMI 2018

A STOCHASTIC MODEL OF THE PROBLEM OF ABLATION

Igor A. Soloviev[1], Diana Dolićanin-Đekić[2,3] and Dženis Pučić[3]
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[2]*Faculty of Technical Sciences, University of Priština, Serbia*
[3]*Department of Mathematics, State University of Novi Pazar*

A stochastic description of the ablation problem based on a deterministic Stephan model is proposed. This description is based on the generalized Fokker-Planck Kolmogorov equation. The basic proposal is this: deterministic equations and their solutions have the average values of the stochastic model of the ablation problem. The problem of deformation of the phase transition front is considered. The study is carried out by using the introduced stability position for the dispersion of solutions for mean values. The result of the study is the conclusion that the influence of the Markov diffusion coefficient leads to distortion of the original shape of the boundary phase transition front. The effect of the initial aspiration to resist changing the shape of the phase transition front was found.

***

MATHEMATICAL MODEL FOR SECTORIZATION PROBLEM

Đorđe Dugošija[1] and Aleksandar Savić[2]
[1,2]*State University of Novi Pazar, Serbia*
[2]*Faculty of Mathematics, University of Belgrade, Serbia*

In this paper we proposed novel mathematical model for the problem of dividing a teritory on sectors (connected parts), so they deviate as little as possible from the defined values. Obtained model is a mixed linear programming type, which facilitates the application of known optimization packages, for the small scale problems, as well as designing new heuristics for large scale problems.

***

A SIMPLER PROOF OF THE PALEY-WIENER-ZYGMUND THEOREM

Jovan Vukmirović
Faculty of Mathematics, University of Belgrade, Serbia

Theorem. Almost all of the trajectories of a Wiener process $\{W(t), t \geq 0\}$ are not differentiable at every point. Three mathematicians, A. Dvoretzky, R. Erdos and S. Kakutani, have given a shorter proof of this theorem defining a set

$$A = \bigcup_{l=1}^{\infty} \bigcup_{m=1}^{\infty} \bigcap_{n=m}^{\infty} \bigcup_{i=1}^{n} \bigcap_{j=i+1}^{i+3} A_{l,n}^{i,j}$$

where $A_{l,n}^{i,j}$ is a set of all $\omega \in \Omega$ such that

$$\left| W\left(\frac{j}{n}, \omega\right) - W\left(\frac{j-1}{n}, \omega\right) \right| \leq \frac{7l}{n} \quad (i, j, l, n \in N)$$

They have proven that P(A) = 0. In this paper another proof has been derived without using a set with such a complicated definition and as difficult to comprehend as set A.

***

VISUALIZATION OF THE SPACES Cp AND THEIR DUALS

Vesna Veličković
Faculty of Sciences and Mathematics, University of Niš, Serbia

We consider the matrix domains of the Cesaro matrix of order one in the spaces of absolutely p-summable sequences and their β-duals. The duality of the spaces is visualized in threedimensional real space by representing the norm as a potential surface and the dual norm as the corresponding Wulff's crystal.

***

THE EXISTENCE OF A POSITIVE SOLUTION FOR NONLINEAR FRACTIONAL DIFFERENTIAL EQUATIONS WITH INTEGRAL BOUNDARY VALUE CONDITIONS

Suzana Aleksić, Slađana Dimitrijević and Tatjana Tomović
Faculty of Science, University of Kragujevac, Serbia

In this paper, we consider the existence of a positive solution for the nonlinear fractional differential equation boundary-value problem. Using some cone theoretic techniques, we deduce a general existence theorem for this problem. We also consider two following more general problems for arbitrary $\alpha, 1 \leq n < \alpha \leq n + 1$. For these problems we give existence results, which improve recent results in the literature.

***

STATISTICAL METHODS IN MEDICAL RESEARCHES: TRENDS, ERRORS, AND GUIDELINES FOR APPROPRIATE USAGE

Dragan Bogdanović, Konstansa Lazarević and Zana Dolićanin
State University of Novi Pazar, Serbia

Background: Over the past decades, a great increase in the use of statistics has been documented, for a wide range of medical journals. Although, favored by the availability of manifold statistical software packages, a trend towards usage of more sophisticated techniques can be approved, a growing body of literature points to persistent statistical errors, flaws and deficiencies in most medical journals.

Objective and Methods: We investigated trends of statistical methods in medical researches, and presented a comprehensive review of common statistical pitfalls which can occur at different stages in the scientific research process, ranging from planning a study, through conducting statistical data analysis and documenting statistical methods applied, to the presentation of study data and interpretation of study results. We also presented a set of statistical reporting guidelines

for authors, journal editors, and reviewers. Although these guidelines are limited to the most common statistical analyses, they are nevertheless sufficient to prevent most of the reporting deficiencies routinely found in scientific articles.

Results and Conclusions: There is a trend of increased awareness and attempts to use varied statistical methods in medical journal articles. Statisticians should be involved early in study design, as mistakes at this point can have major repercussions, negatively affecting all subsequent stages of medical research.

Keywords: statistical analysis, journal article, evidence-based medicine, common pitfalls and errors, presentation, interpretation

***

A VARIANT OF MCDOUGALL-WOTHERSPOON METHOD FOR FINDING SIMPLE ROOTS OF NONLINEAR EQUATIONS

Nataša Glišović[1], Nebojša M. Ralević[2] and Dejan Ćebić[2]
[1]*State University of Novi Pazar, Novi Pazar, Serbia*
[2]*Faculty of Technical Sciences, University of Novi Sad*

Recently, McDougall and Wotherspoon have developed a simple modification to the standard Newton method for finding simple roots of nonlinear equations. Their method is based on the arithmetic mean and achieves approximately 2.4 convergence order. This research presents a new iteration scheme based on the harmonic mean with the same convergence order and the comparison with the original McDougall-Wotherspoon method. Several test examples have been used and the results show good numerical behavior of the new method.

***

A SECOND ORDER PROBLEM WITH NONLOCAL BOUNDARY CONDITIONS

Todor D. Todorov
Department of Mathematics and Informatics, Technical University Gabrovo, Bulgaria

A second order elliptic problem with nonlocal boundary conditions is the object of interest in this paper. The strong problem is reduced into a unconstrained minimization one. Sufficient conditions for existence and uniqueness of the weak solution are proved. A priory estimates for the weak solution are obtained.

Keywords. well-posedness, unconstrained minimization problem, nonlocal boundary conditions.

***

SESSION 2
CPMMI 2018

A MACHINE LEARNING APPROACH FOR STUDENT ENGAGEMENT AUTOMATIC RECOGNITION FROM FACIAL EXPRESSIONS

Vladimir Soloviev
Financial University under the Government of the Russian Federation, Russia

Digital revolution can significantly improve the quality of education. There have been already discussions for a long time about the advantages, disadvantages and opportunities for transforming traditional classroom activities. Today's students "from birth" use smartphones and tablets, and on the Internet for the majority of theoretical and practical disciplines, students can often find more complete, accurate and up-to-date information than from lectures. Is it interesting for students? Are they in time with the teacher? Is the presentation clear? How much are students engaged in the educational process in the classroom? These issues come to the fore in the era of digital education. However, it was almost unrealistic to control the level of student engagement, for example, only in the Moscow campuses of the Financial University classes are held daily from 8.30 to 22.00 in more than 500 classrooms.

Existing information systems for student engagement automatic recognition are focused on analyzing the individual involvement of students and schoolchildren. We propose a system that constantly analyzes the flow of data from cameras installed in classrooms, using machine learning models to identify students' faces, recognize their emotions and determine the level of engagement, and then aggregates data on student groups, faculties, courses, etc. and visualizes the final results in the form of a system of interactive dashboards. Training dataset consisted of 2,000 faces was used for a machine learning model identification with boosted decision trees algorithm (ADABoost). The quality metrics (Accuracy, Presision, Recall, AUC) on a test dataset of 500 students' faces were all above 0,84.

The system is an elastically scalable cloud service that automatically collects video streams from cameras installed in classrooms and forms the resulting metrics of the students' and groups' engagement in the Microsoft Azure cloud.

***

ANALYSIS OF STRUCTURE FORMATION FOR THE RUSSIAN SEGMENT OF WIKIPEDIA

Sergey Makrushin
Financial University under the Government of the Russian Federation, Russia

Information about 5.3 million of Wikipedia pages and more than 150 million of links between them was gathered for the analysis of the Russian segment of Wikipedia. The dump of Wikipedia database distributed by Wikimedia Foundation was used as a data source. Wikipedia is considered as a network, where articles and categories (special pages used for thematic structuring of Wikipedia) are nodes, and links between articles are directed links in the network. Links between categories and links from articles to categories are considered to be bi-directed links in the Wikipedia network. The network of the Russian segment of Wikipedia consists of 3 305 000 articles, 92 167 000 links between them, 405 000 categories, 9 187 000 links between articles and categories, and 770 000 links between categories. All this data was imported, stored, and analyzed in a Neo4j graph database using Cypher query language.

Analysis of nodes degree distributions has been done for the Wikipedia network. For improving the quality of analysis, we used a special technique, estimating the probability of rare events in tails of empirical distributions. Our analysis showed that exponential law fits the nodes of in-degree distribution (both for articles and categories of Wikipedia). But out-degree distribution is sufficiently different to in-degree distribution and does not agree with the exponential law model. It means that a basic scale-free model, like Barabási–Albert model, could be adopted for in-degree modelling, but must be extended to fit an out-degree distribution. We propose to adapt Barabási–Albert model for the case of the Wikipedia network by considering a multi-step process of Wikipedia articles formation, instead of a single-step process of adding a node to a network, which the Barabási–Albert model is based on.

***

MACHINE LEARNING MODELS OVERFITTING AND GENERALIZATION IN VERY BIG DATASETS

Mikhail Koroteev
Financial University under the Government of the Russian Federation, Russia

In recent years some big shifts had happened in the field of machine learning due to increasing capabilities in computing power and possibility of big datasets processing. Generative adversarial networks, increasing use of reinforcement learning, artificially generated/expanded datasets, neuroevolutionary methods throw a new light on problems of estimating generalization capabilities. Model selection becomes more subtle process and model interpretation becomes more complicated when not unnecessary.

Here we would like to address the question of generalization capabilities of complicated machine learned models due to possible overfitting risk with respect to very big training datasets and computer-assisted model selection process.

***

A MACHINE LEARNING APPROACH FOR COMMERCIAL BANKS FINANCIAL STABILITY IDENTIFICATION AND EVALUATION

Vadim Feklin and Olga Bondarenko
Financial University under the Government of the Russian Federation, Russia

Approaches to the use of different classification methods (logistic regression, Bayesian classifiers, boosted decision trees, decision forests, and neural networks) are proposed to assess the financial stability of commercial banks.

Based on statistical data on 641 commercial banks of the Russian Federation, models for default risk forecasting as of December 2017 are developed. Based on the statistics for the end of 2017 - beginning of 2018, the results of the models' validation and their comparative analysis are obtained.

***

PHASE MODEL OF ASSET CRISES IDENTIFICATION

Vera Ivanyuk
Financial University under the Government of the Russian Federation, Russia

The study is devoted to an econometric model development for the asset crises identification. Unlike the classical approach, the economic crisis is considered not as a one-time state (for example, the point of bifurcation in Krugman's equilibrium crisis model or the market oversaturation moment in Marx's theory), but as a process that continues in time. A method for crisis initial phase early identification is developed. To identify a systemic crisis, an ANOVA based indicator is proposed.

Analysis of 1,198 time series of Russian and global investment assets confirmed the hypothesis of crisis invariance wit $p < 0.05$.

***

MACHINE LEARNING TECHNIQUES FOR STOCK MARKET TRENDS IDENTIFICATION

Ekaterina Zolotareva
Financial University under the Government of the Russian Federation, Russia

The research concentrates on recognizing stock markets long-term upward and downward trends. The key results are obtained with the use of gradient boosting algorithms, XGBoost in particular. The raw data is represented by time series with basic stock market quotes with periods labelled by experts as «Trend» or «Flat». The features are then obtained via various data transformations, aiming to catch implicit factors resulting in change of stock direction.

Modelling is done in two stages: stage one aims to detect endpoints of tendencies (i.e. “sliding windows”), stage two recognizes the tendency itself inside the window. The research addresses such issues as unbalanced datasets and inconsistent labels, as well as the need of specific quality metrics to keep up with practical applicability.

The model can be used to design an investment strategy though further research in feature engineering and fine calibration is required.

***

ANGLE ESTIMATION OF A SINGLE COMPLEX EXPONENTIAL SIGNAL USING ANGLE INVARIANT COMBINING

Veljko Stanković
State University of Novi Pazar, Serbia

In this paper we introduced two novel angle estimators of a single complex exponential signal. The first algorithm is using an angle invariant combination of autocorrelation samples that provides significant SNR threshold improvement over weighted linear predictor. The second algorithm is iterative, that is using the average periodogram to initialise the second step that also uses angle invariant combiner to reduce the influence of the estimation error of the initialisation step on the maximum lokelihood based cost function. Both estimation algorithm are low complexity, with improved SNR threshold, and approach the Cramer-Rao bound.

***

ANNOTATING THE NEGATION SCOPE IN THE SERBIAN LANGUAGE FOR DETERMINING THE POLARITY OF SHORT TEXTS

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Negation is a phenomenon that deals with logic, mathematics, and linguistics. Negation denies some statement, expression or term (sometimes the whole sentence). Logic and mathematics have their own methods for treating negation. In the linguistics, especially for the Serbian language, the existence of negation and detection of its scope is not easy to determine, given the morphological complexity of the Serbian language. With the increase in the amount of textual data available, natural language processing (NLP) areas and its subfields, such as text mining and sentiment analysis, are gaining more examples of applications. In machine text processing, even using lexical resources, there may be a misinterpretation of parts of the sentence or even whole sentences if negation, irony,sarcasm, speculative instances are not processed. In this paper, we deal with problems of detecting negation and determining its scope of action.

Negation is processed using lexical resources (negation signal, grammatical rules). The presence of a negation signal does not necessarily mean that the content of the text is negated but can instead express the confirmation or even the intensification of what is initially claimed. Problems that reverberate in the treatment of negation generally come to light in syntactic and especially double negations. The grammatical rules that determine the scope of negation are used. This work presents on-going research in the process of the negation scope annotation for short informal texts in the Serbian language (tweets). The annotation takes into account the linguistic rules of the syntactic negation that are further elaborated in detail. The corpus will be publicly available and will be the first annotated corpus of this kind for the Serbian language.

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SESSION 3
CPMMI 2018

ON SOME RESULTS USING MEASURES OF NONCOMPACTNESS

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We review some results on measures of noncompactness, including an axiomatic introduction, a study of the Kuratowski, Hausdorff, inner Hausdorff and separation measures of noncompactness, a survey of their most important properties and their roles in fixed point and operator theory. We also determine the Hausdorff measure of noncompactness of matrix operators and, more generally, of bounded linear operators between some BK spaces. Among other things we present many of our results (with co–authors) involving the classical sequence spaces, matrix domains of triangles in certain sequence spaces, and spaces of strongly summable and bounded sequences.

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DISTANCE IN THE ABSOLUTE PLANE AND CAUCHY FUNCTIONAL EQUATIONS

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We consider two well-known models of the absolute plane which we call E-model and H-model. The E-model is actually the standard model of the Euclidean plane and the H-model is the Poincare disk model of the hyperbolic plane. We used same proposition that states that there is a distance d_a (which is in accordance with the relations between and congruence) on the absolute plane and that it is unique up to a multiplicative constant. Let d_e and d_h be the interpretations of d_a in the E-model and in the H-model, respectively. We consider a fixed half-line l ($l = [0,1)$ in the H-model and $l = [0, +\infty)$ in the E-model) and a function $f: l \to [0, +\infty)$ with some additive properties.

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WAVES IN VISCOELASTIC MEDIA DESCRIBED BY FRACTIONAL DERIVATIVES WITH REGULAR KERNELS

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In this presentation we investigate propagation of waves in Zener-type viscoelastic media, where the model involves fractional derivatives with regular kernels. The restrictions on the coeficients that follow from the weak dissipation principle are obtained. The existence and the uniqueness of distributional solution are proven, followed by the analysis of its regularity. Numerical results are provided, illustrating the presented theory.

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PARAMETRIC ANALYSIS OF THE MODEL OF BRAY-LIEBHAFSKY NON-LINEAR REACTION SYSTEM

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In this paper the model (see Eq. 1) of non-linear Bray-Liebhafsky oscillatory reaction (Kolar Anić and Schmitz; Stanković et al) was analyzed by using bifurcation analysis (Maćešić et al; Kuznetsov). Considered model is capable to exhibit various types of dynamics (stable stationary state, regular oscillations, mix mode oscillations, chaos) which all have been detected in experiments (Pejić et al). Knowing how kinetics and dynamics of the model depend on different parameters is of extreme importance for efficient model optimization especially in the case of complex models such as the model of Bray-Liebhafsky oscillatory reaction. Thus, in this paper we determined how certain model parameters affect its stability and oscillatory dynamics.

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VIBRATION OF MASS-IN-MASS UNITS OF THE ELASTIC METAMATERIAL

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Recently, significant investigations are done in developing materials for vibration absorption. One of type of these materials is the so called 'elastic metamaterial' which eliminates vibrations at certain frequency range. It is a kind of composites where in the basic material mass-in-mass units are incorporated. These units act as vibration absorbers. They are two-degree-of-freedom oscillatory systems with strong nonlinear elastic and damping properties. Mathematical model of the unit is a system of two coupled non-homogenous second order differential equations. The aim of the paper is to solve equations and to analyze the influence of the nonlinear properties of the system on the wideness of the stop frequency bands. We developed a new analytical solving procedure for treating of equations. The method is based on the perturbation of the exact solution for the truly nonlinear oscillator. To prove the correctness of the computed results, they are compared with numeric ones. The difference is negligible.

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SESSION 4
CPMMI 2018

SOME NEW BOUNDS ON RANDIĆ ENERGY

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Let G = (V, E) be a simple graph of order n with vertex set V = V (G) = {v_1, v_2, ..., v_n} and edge set E = E(G). Let d_i be the degree of the vertex v_i in G for i = 1, 2, ..., n. The Randić matrix $R = R(G) = \|R_{ij}\|_{nxn}$ is defined by

$$R_{ij} = \frac{1}{\sqrt{d_i d_j}}, if\ the\ vertices\ v_i\ and\ v_j\ are\ adjacent,$$

$$R_{ij} = 0, otherwise$$

The eigenvalues of matrix R, denoted by $\rho_1, \rho_2, \ldots, \rho_n$ are called the Randić eigenvalues of graph G. The Randić energy of graph G, denoted by RE, is defined as

$$RE = RE(G) = \sum_{i=1}^{n} |\rho_i|$$

Some new upper and lower bounds on Randić energy are obtained.

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RANDIĆ DEGREE-BASED ENERGY OF GRAPHS

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Let G = (V, E), V = {1, 2, ..., n} be a simple graph of order n and size m, without isolated vertices. Denote by $\Delta = d_1 \geq d_2 \geq \cdots \geq d_n = \delta > 0, d_i = d(i)$, a sequence of its vertex degrees. If vertices i and j are adjacent, we write $i \sim j$, or $ij \in E$. With TI we denote a topological index that can be represented as $TI = TI(G) = \sum_{i \sim j} F(d_i, d_j)$, where $F(d_i, d_j)$ is an appropriately chosen function with the property $F(x, y) = F(y, x)$. Randić degree-based adjacency matrix RA =(r_{ij}) is defined as $r_{ij} = \frac{F(d_i, d_j)}{\sqrt{d_i d_j}}$ if $i \sim j$, and 0 otherwise. Denote by f_i , i = 1,2,...,n the eigenvalues of RA. The Randić degree-based energy of graph could be defined as $RE_{TI} = RE_{TI}(G) = \sum_{i=1}^{n} |f_i|$. Upper and lower bounds for RE_{TI} are obtained.

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ON SOME LOWER BOUNDS FOR THE KIRCHHOFF INDEX

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Let G = (V, E), V = {1, 2, ..., n} be a simple connected graph of order n and size m, with sequence of vertex degrees $\Delta = d_1 \geq d_2 \geq \cdots \geq d_n = \delta > 0, d_i = d(i)$. Denote by $\mu_1 \geq \mu_2 \geq \cdots \geq \mu_{n-1} > \mu_n = 0$ the Laplacian eigenvalues of G. Further, denote with $Kf(G) = n\sum_{i=1}^{n-1}\frac{1}{\mu_i}$, and $t = t(G) = \frac{1}{n}\prod_{i=1}^{n-1}\mu_i$, the Kirchhoff index and the number of spanning trees of G, respectively. In this paper we determine several lower bounds for $Kf(G)$ depending on $t(G)$ and some of the graph parameters n, m or Δ.

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ON ATTITUDE MOTION OF ELECTRODYNAMIC SPACE TETHER SYSTEM

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The paper deals with an electrodynamic tether system (EDTS) in a near-Earth circular orbit. EDTS is carrying electric current. As a result of the interaction of the current with the geomagnetic field, Ampere and Lorentz forces are excited, which affect the dynamics of the conducting tether. EDTS are considered as very promising for solving a number of problems in the exploration of outer space. In particular, the possibilities of using EDTS for removing satellites from near-Earth orbits and for space debris mitigation are actively explored. In this case, the tether can be used as an electrodynamic drag of the orbital motion, working on the basis of the drag effect of Ampere forces. So operating, the conductive tether is most effective if oriented along the local vertical in near-Earth space. This orientation is stable in the central Newtonian gravitational field. At the same time, it is established that under the action of the moment of Ampere forces the vertical orientation of the tether is destroyed. The problem of EDTS

instability is known. A number of works have been devoted to solving this problem. Among the possible approaches to its solution, it is proposed to use control of the current strength flowing along the tether.

In this paper, we analyze the possibility of providing a vertical position of a conducting tether using the moment of Lorentz force, whose influence under certain conditions is orienting. It is shown that the Lorentz torque can be used to stabilize a conducting tether in near-Earth space along the local vertical. At the same time, the complexity of EDTS construction is not significant, since it does not imply the introduction of fundamentally new devices in its structure in comparison with those normally used in EDTS.

The reported study was partially supported by the Russian Foundation for Basic Research, research projects No. 16-01-00587-a, 16-08-00997-a and 17-01-00672-a.

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ANALYTICAL STUDY OF THE MOTION OF PARTICLES WITH VARIABLE ELECTRIC CHARGE

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It is known that a particle which moves in magnetosphere's plasma get electric charge which depends on density and temperature of surrounding plasma, a stream of sunlight and speed of the particle. If the motion of a particle from a material with a low photoemission yield is slow enough, we may believe that its electric charge is locally equilibrium in some areas of the circumterraneous space, i.e. the electric charge depends only on particle's position on a trajectory.

We had been determined conditions of applicability of the canonical formulation of a problem of the motion of micro-particle (MP) with locally equilibrium electric charge in the near-Earth space (NES) [1]. The general condition of a correctness of the canonical formulation of a problem of the motion of a micro-particle in the NES is possibility to represent all forces reacting upon a micro-particle by usual or generalized potential. At the same time the Lorentz force acting upon the variable electric charge of a MP from the side of the

magnetic and electric fields of near-Earth space admits representation with the help of a generalized potential, if appropriate constraints are imposed on the character of the variation of the MP charge in the process of its orbital motion and also on the geometrical features of the magnetic and electric fields of the NES. These conditions are satisfied in the Earth's plasma-sphere due to specific features of spatial distribution of the plasma in this area. This distribution is known to be described by the model of the two-component plasma.

The specified approach has allowed us to carry out analytical consideration of a problem of the motion of MP with variable electric charge in superposition of the central field of gravitation and Lorentz force acting on a MP's electric charge from the dipole magnetic field of the Earth and electric field of co-rotation [2-4]. The received results correspond to results of numerical simulations of the motion of the micro-particles mentioned above and confirm the data of natural experiments.

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PREISACH MODEL OF HYSTERETICAL BEHAVIOUR OF MILD STEEL UNDER AXIAL CYCLIC LOADING

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Hysteresis occurs in many different phenomena such as magnetism, plasticity, absorption, and conductivity. Mathematical definitions of hysteresis and accompanying hysteresis loops are provided by elementary hysteretic operators. Combining these operators, Preisach model is defined. Although, this model describes quite numbers of physical phenomena, its nature is pure mathematical. Preisach model maps function of inputs into function of outputs, concidering past local extremas of input function (memory effect). Description of mild steel constructions behavior, under axial, cyclic loading is conducted using newly developed Preisach model. Complex multilinear σ-ε diagram of mild steel elements under axial load is defined using model upgrade, so it could describe transformation of material behaviour due to cyclic loading.

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A PENTERACT PARTITION BY MEANS OF THE OPTIMAL SUBDIVISION OF CELLS

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Freudental's algorithm obtained way back in early forties have been traditionally used for simplicial triangulating of the hypercube. The main advantage of this algorithm is that it only generates one congruence class. Unfortunately, Freudental's algorithm is not optimal with respect to the measure of degeneracy. The multigrid methods require the degeneracy measure to be as small as possible. The minimal subdivision in the 3-dimensional case and the uniform tesseract corner subdivision in the 4-dimensional case are optimal in regards the measure of degeneracy and multigrid applications. The question about the optimal refinement strategy in more dimensional cases is still an open problem. This paper deals with a penteract subdivision with degeneracy measure much better than one obtained by the Freudental algorithm.

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SESSION 1

Second day

CPMMI 2018

PASSIVE RANGING IN SINGLE-BAND INFRARED VIDEO SEQUENCE

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The new passive ranging method combining object size and contrast measurements is presented. The proposed method relies on object size and object contrast changes, with assumption that size- and contrast-based passive ranging methods provide the same initial distance estimation. The advantages from the well know methods are concerted in order to enable distance estimation with unknown initial distance. The proposed method is verified using real infrared image sequences and obtained results shows satisfactory estimations convergence.

Keywords: passive ranging, image processing, contrast measurements, size measurements, extinction coefficient

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OBSTACLE AVOIDING ROBOT

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Robots are machines which reduce the human efforts in heavy works by automating the tasks in industries, factories, hospitals etc. Most of the robots are run by using some control unit or components like a push button, remote, joystick, PC, gestures and by executing some command by using controller or processor.But today we are here with an Automatic Robot which moves autonomously without any external events avoiding all the obstacle in its path, we talking about Obstacle Avoiding Robot. Fixed obstacle avoidance vehicles are especially important for vehicle systems that move on their own in other words self-driven. In fact, there is a major deficiency in these systems. This lack is that the moving objects are ignored.

In this project, we will have offer a new algorithm and a robotic vehicle to try avoiding from moving objects and to implement we will use Arduino and Motor driver to drive the robot and Ultrasonic sensor for detecting objects in the path of Robot.

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CLUSTERING INCOMPLETE DATA BY BEE COLONY OPTIMIZATION: TWO CASE STUDIES

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Clustering is a decision making problem that appears in many practical applications, such as medicine, industry, transport and many others. In the majority of clustering problems it can happen that some of the data is missing. There are several reasons why some (or most of) data describing objects to be classified are missing. Many researchers proposed methods for determining the values of the missing attributes, however, non of them are applicable in all required situations. In the recent literature a new distance function, based on the propositional logic, is proposed. This function does not require to determine the values of missing attributes, and therefore, enables to calculate distance between any two objects to be clustered. We used it within Bee Colony Optimization (BCO) approach applied to two real-life problems: classification of patients who suffer from some auto-immune diseases, stored in the database of Clinical Centre of Serbia and classification of data for the mail service contained in seven

databases of the European Commission (Board). The obtained experimental results show that the considered data can be classified with a high precision.

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TOWARDS THE LEXICAL RESOURCES FOR SENTIMENT-REACH INFORMAL TEXTS - THE SERBIAN LANGUAGE CASE

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A modern way of life and competitive market require faster access to information about a new product, public personality, or a popular topic. Sentiment analysis represents a branch of the _eld of natural language processing (NLP) that determines the sentiment that is expressed in some text. Like other areas of the NLP, it is most developed for the English language. Information on social networks is related to a specific geographic and speaking area, and so the developing tools need to be tailored to specific languages. Significant resources have been created for the processing of texts written in Serbian, such as: wordnet, morphological dictionary, stemmer, the stop word dictionary, etc. However, text processing in the Serbian language is hampered by the lack of adequate specific lexical resources as sentiment dictionary.

In this paper, the sentiment dictionary is presented as one of the lexical resources necessary for the sentiment analysis. The use of this resource is related to the existence of other speci_c resources that are adapted to the ultimate goal - in this case, sentiment analysis. Thus, in order to normalize documents for sentiment analysis, a specific stop word dictionary is needed (for example, it does not contain negation signals), then a stemmer or a lemmatizer to transform the word to the basic form, to which the words from the sentence must be reduced. Informal writing on social networks leads to the impossibility of applying standardized lexical resources. Therefore, in order to improve the results parallel lexical resources are made. These new resources are based on n-gram analysis and some rules for detecting common mistakes that occur when writing on social networks. Our contribution is manifold: (1) requirements analysis for creating sentiment dictionaries under diversity of informal data; (2) suggested methodology, algorithms for creating such dictionaries, and their structure, as well; (3) validation of the dictionary on the set of several hundred tweets and (4) evaluation of results via future research topics.

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RECONFIGURATION AND INTEGRATION OF IOT IN THE CONTEXT OF BUSINESS PROCESS MANAGEMENT

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The abundance of Internet of Things (IoT) devices has enabled their massive use and adoption almost everywhere due to their small size, processing power, availability, and afordability. IoT is one of main driving wheels of a Smart City that produces data and offers services that could improve the quality of citizens' life. Besides technology, Smart City also needs smart governance and smart people. Any citizen with a social media account may act as a social sensor capable to produce data and respond to relevant events on social media.

The aim of this paper is to describe a possible solution for allowing a business process (BP) of an ecosystem of a smart city to crowdsource visitors' and citizens' opinions, and, based on their feedback, automatically reconfigure a BP-relevant IoT devices. In that direction we have extended our Business-to-Social (B2S) platform

with ability to reconfigure IoT devices and serve as a two-way bridge between social and IoT world. IoT devices used in our experiments are low cost wireless microcontrollers that are open-source, extensible, cross-platform devices without operating system capable to control sensors and to actuate with low power consumption. Under certain conditions devices are recon_gured using OTA (Over The Air) approach which allows fast deployment of new functionalities to remote devices. Communication between these devices and B2S is through secured MQTT protocol and HTTP REST. We present an application of this system with managing touristic events in a Smart City by allowing citizens and visitors to shape Smart City services.

Keywords: Smart City, IoT, Social media, Business processes

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HEALTHCARE IN SMART CITIES – PRIVACY AND SECURITY ISSUES

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In the era of analyzing data on users of computer systems, nothing is assumed anymore, but all possible steps are taken to get the most precise information about the user and his environment. Any, seemingly insignificant data can contribute to some new knowledge and facilitate interaction with the user. These contextual data can be used to improve the health of the users. The use of smart phones for the purpose of improving the health status of the user led to the formation of a new area in the field of e-Health, which is mobile healthcare. With the existence of various wearable devices, considering the IoT, this is just one of the ways to collect sensor data about the user.

Parallel with the increase in the use of mobile and ubiquitous computing, there is also an increase in the urban population with modern technology available. Accordingly, companies and administrations are making efforts to exploit the possibilities of IC

technology in order to improve the quality of life of their citizens in terms of better use of resources, education, health, economy, transport, etc. All this makes the idea of smart cities possible.

The natural synergy of mobile and electronic healthcare with the concept of smart cities has created a new term - smart health (s-Health). This paper describes the concept of smart cities, with an emphasis on smart healthcare, and then provides an overview of implemented smart healthcare services, as well as privacy and security challenges in creating s-Health applications.

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ARTIFICIAL INTELLIGENCE IN HUMAN RESOURCES MANAGEMENT

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Main aim of artificial intelligence is study of intelligent agents. Those agents are machines which perceive environment and act on that way to maximize chance of success in achieving some goal. Application of AI systems and devices started to influence on process of management of human resources. Since main aim of human resources is to provide insight knowledge of employment in organization combing those two approaches can provide new ways to manage HRM.

Main objective of this paper is providing insight in role and importance of application of AI in HRM. Special emphasis will be put on Ai usage in recruiting, selection, development, and performance and compensation problems. This will give wider picture how AI will change HRM in future.

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FEASIBILITY OF COMPROMISING LEDGER SYSTEM BASED ON P2P BLOCKCHAIN TECHNOLOGY

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Modern application of the blockchain technology was nib the center of attention of technology and economy sectors. Proper usage of blockchain is based on peer to peer (p2p) network to coordinate a worldwide, universal ledger where all transactions on the bitcoin network are recorded. This ledger is called the blockchain. In order to provide security and veracity of ledger system blocchain systems uses hash function. By hashing the block sent by the member of P2P network and checking if it still fits the pattern for the next block, the network can easily prove that the miner did in fact find a block.

Complicity and redundancies of system provide high level of resistance on unauthorized attacks, and compromising ledger system. One of the feasible attack is 51% attack is a potential attack on the network whereby an organization is able to control the majority of the network computing power (hash rate). In this case the majority owner of network they would have the power to (or at least attempt to)

decide which transactions get approved or not. This would allow them to prevent other transactions, and allow their own coins to be spent multiple times - a process called double spending.

In the paper we analyzed technical resources needed for this type of attack, feasibility and the cost analysis of this type of attack. Analysis is completed on three blockchain ledger systems which provide high level of privacy.

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OPTIMAL PATH PLANNING FOR MOBILE ROBOT USING BSO ALGORITHM

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Unmanned aerial vehicles (UAV) represent remotely piloted or self-piloted aircrafts. They have numerous advantages such as low cost, good maneuvering ability, high survival rate etc. Initially, they were used for military purposes, known as unmanned combat aerial vehicles (UCAV), but today the use of the unmanned aerial vehicles is rapidly growing in ever wider range of applications. The UCAV path planning problem is one of the most important parts of the autonomous control model for the UCAV. It refers to the problem of providing an optimal path from starting point to the final destination, considering several objectives and constraints. Path planning can be understood as a multi-objective optimization problem that can include objectives such as minimizing fuel consumption, path length, exposure to threat, path smoothness, etc.

In this paper, we proposed a very recent swarm intelligence brainstorm optimization algorithm for finding the optimal path

considering fuel consumption and safety degree. The proposed method was tested and compared to ten different optimization algorithms from literature. Based on the simulation results, it can be concluded that our proposed approach exhibits superior pefromanse in almost all cases.

Keywords: unmanned combat aerial vehicle, path planning, swarm intelligence, brainstorm optimization.

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APPLICATION OF MULTIFRACTALS FOR COPY-MOVE FORGERY DETECTION

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Digital images and videos are powerful media for communication. With the development of high resolution cameras, software is also being developed that makes it easy to change the content of the digital image. It is therefore clear how important are methods for identifying manipulations on existing images. Copy-move is one of the most popular methods for image forgery. It is a process in which a part of the image is copied and pasted to another part of the same image, in order to hide the specific content of the image, or transmit false information about the content of the image. Such copied areas are difficult to detect. The aim of this research is to show the ability to detect images over which such changes were made, using the multifractal spectrum, as well as the parameters describing the multifractal spectrum of original and modified images.

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DEVELOPMENT OF SOFTWARE SUPPORT FOR ELECTRONIC TIMETABLES

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Computers are used today everywhere, even in education. After analyzing several solutions for time scheduling applications, we came to the conclusion that the timetable should be viewed as one function that has multiple parameters: T = f (FTP, BP, AP, SP, RP, WP, FTSP, BSP, SNS, FTS, TS, NP, NS) where T - the timetable, FTP - the free time of the professor, BP - the burden of professors in that day, AP - the age of the professor, RP - the rang of professor, WP - the wish of the professor in which day he wants to have instruction, FTSP - free time of study program, BSP - burden of study program for that day, SNS - is there someone with special needs among students, FTS - free time sale, TS - type of sale, NP - number of places in the hall, NS - number of students. Each parameter has its own weight factor.

The paper presents a description of how it can contribute to the development of education using software applications and

describes one solution for the scheduling application that we realized by solving this function. Using the mathematical procedure we will show if there is a difference between our and the already existing solutions.

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About Novi Pazar

The Conference will take place on the State university of Novi Pazar. The city of Novi Pazar is a significant economic, cultural and educational center in the southwest of Serbia and the city where the State University of Novi Pazar is situated. The location where it is placed is surrounded by the mountain Rogozna in the south and southeast, the river Ibar valley, mountain Golija in the north and northwest, Sjenica-Pester plateau in the west, and Mokra Gora and river Ibar valley, in the south.

The city is an area where various civilizations alternated from the prehistoric period to the present. It is particularly important its medieval heritage, since the first Serbian statehood and spirituality were born here, with cultural and historical

monuments: Monastery of the Holy Apostles Peter and Paul from the 9th and 10th century, the monastery The Pillars of Saint George from the 12th century, the Sopocani Monastery from the 13th century, the old town of Ras etc.

Novi Pazar is also rich in cultural and historical monuments from the Ottoman period, when the city was one of the most important and largest trade centers in the Balkans: the Altun Alem mosque, which was built between 1516 and 1518, the Lejlek Mosque, Arab Mosque, Turkish bath, Novi Pazar Fortress etc.

The Altun Alem

The Sopocani Monastery

Turkish bath in N.Pazar