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SPECIAL ISSUE: AAMP VIII AND ISCAMI 2011

KAREL KLOUDA, ZUZANA MASÁKOVÁ, RADKO MESIAR AND MARTIN ŠTĚPNIČKA

This special issue contains selected papers from two conferences, namely **AAMP VIII** and **ISCAMI 2011**. From the 25 submitted papers finally there were accepted 15 of them for this special issue. The first one of involved conferences, AAMP VIII, was held in Prague Villa Lanna, March 19–20, 2011, in the frame of “Algebraic and Analytic Methods” series of microconferences of the Doppler Institute for Mathematical Physics and Applied Mathematics and was devoted to language and automata theory and related topics. The particular aim of this meeting with subtitle “Strings meet words” was to bring together various Prague research groups working in this field.

The Theoretical Informatics Group at the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague is specialized in combinatorics on infinite words. This field finds its roots already in 19th century when Axel Thue considered the first example of a cube-free infinite word (a word not containing three consecutive copies of a finite factor). The so-called Thue–Morse sequence has appeared since then many times. A number of mathematical and physical questions can be reduced by a suitable coding to the study of properties of infinite words over finite alphabets. Fundamental characteristics of an infinite word are the factor or palindromic complexity, i. e. the number of factors or palindromic factors of a given length, frequency of factors, the balance property, return words, repetition threshold, and other. A non-trivial class of infinite words is given by fixed points or morphic images of fixed points of morphisms. Combinatorics on words has found such applications as describing the character of the spectra of Schrödinger operators with aperiodic potential, modelling various aperiodic dynamical systems and structures, like the behaviour of electrons in quasicrystals.

Another point of view on the theory of words is presented by *The Prague Stringology Club* at the Faculty of Information Technology of the Czech Technical University in Prague. The term Stringology (for the first time used by Zvi Galil in 1984) denotes a science on algorithms on strings and sequences. It solves such problems like exact and approximate pattern matching, searching for repetitions in various texts, etc. There are many areas that utilize the results of the Stringology, including data compression, information retrieval, computer vision, computational biology, or DNA processing.

The first paper related to **AAMP VIII** “*Generalized Thue–Morse words and palindromic richness*” by **Š. Starosta** treats the so-called generalized Thue–Morse words $t_{b,m}(n)$. They were first considered already by Prouhet in 1851, with the n th letter

defined as the digit sum of the b -ary representation of n modulo m . The famous Thue–Morse sequence is retrieved as $t_{2,2}$. The present paper shows that the language of a word $t_{b,m}(n)$ (the set of all its finite factors) is closed under action of all elements of the dihedral group D_m of order $2m$. Further, it is shown that the word $t_{b,m}(n)$ is D_m -rich, i. e. contains the maximal number of D_m invariants. This is then used for expliciting the factor complexity of the generalized Thue–Morse words $t_{b,m}(n)$.

The second paper “*Factor frequencies in generalized Thue–Morse words*” by **L. Balková** continues the study of generalized Thue–Morse words by determining frequencies of factors. A crucial tool is the study of symmetries of the language of an infinite word that reflect to symmetries of associated Rauzy graphs. The paper is a generalization of the result for classical Thue–Morse word obtained by A. Frid.

The third paper “*The Finite Automata Approaches in Stringology*” by **J. Holub** is a survey of applications of finite automata to various string processing problems. Four approaches of using finite automata in Stringology are presented: the direct usage of deterministic finite automata, the simulation of non-deterministic finite automata, the usage of finite automata as a model of computation and the composition of different automata for solving more complex stringology tasks.

In the fourth paper “*Arbology: trees and pushdown automata*” the authors **B. Melichar**, **J. Janoušek** and **T. Flouri** focus on Arbology, a new discipline that applies principles of algorithms from Stringology to trees, where the underlying tree structure is processed with the use of pushdown automata.

In the fifth paper “*Tree compression pushdown automata*” the authors **M. Poliak**, **J. Janoušek** and **B. Melichar** consider the problem of compression of ordered trees. They construct a “Tree Compression Automaton” which represents a complete compressed index of a set of trees for subtrees and accepts all subtrees of given trees.

Concerning the second conference, International Conferences for Undergraduate and Graduate Students of Applied Mathematics (**SCAM/ISCAM**) were organized by two faculties of the Slovak University of Technology in Bratislava. Professor Zdenka Riečanová from the Faculty of Electrical Engineering and Information Technology and professor Radko Mesiar from the Faculty of Civil Engineering were guaranties of these conferences in years 1999–2007. The original idea was to bring together graduate students in various areas of mathematics relevant for applications.

After one-year pause, the ISCAM is again organized in a new guise. Since 2009, the ISCAMI extends its scope by informatics and it is co-organized by the Department of Mathematics of Faculty of Civil Engineering (Slovak University of Technology in Bratislava) represented by Radko Mesiar and by the Institute for Research and Applications of Fuzzy Modeling (University of Ostrava) represented by Vilém Novák.

ISCAMI 2011 was organized in Malenovice – a beautiful village situated on the root of Lysá hora mountain, the highest mountain in Beskydy mountains in Czech Republic in the period May 6–8, 2011.

The first paper selected from the ISCAMI 2011 contributions is “*Generated fuzzy implicators and fuzzy preference structures*” by **V. Bība** and **D. Hliněná**. In this contribution, the authors investigate a special class of generated fuzzy implications and construction methods of monotone generators for fuzzy preference structures. The sec-

ond paper by the same authors “*Evaluating many valued modus ponens*” focuses on a generalization of the classical modus ponens rule to fuzzy logic. Two formulas for evaluation of modus ponens with implicative rules and with clausal rules are presented and the many valued modus ponens is investigated via discrete connectives.

The third paper from the ISCAMI conference is a paper “*Significance tests to identify regulated proteins based on a large number of small samples*” by **F. Klawonn**. This paper deals with a bio-statistical problem that stems from high-throughput experiments that yield regulation factors. In order to distinguish true regulation from noise and fluctuations, an appropriate significance test is highly desirable. This paper proposes a simple yet powerful and sufficiently general test for such situations.

The fourth paper “*C source code obfuscator*” written by the authors **L. Ďurфина** and **D. Kolář**, is a sort of short note article that discusses obfuscation, that is an automatic modification of a source code without any influence on the semantics of the code. This process may be successfully used for hiding the real content of the code which in hands of malware producers is a possible threat that is not faced sufficiently yet by the antivirus producers.

In the fifth paper of **M. Langer** and **A. Kelemenová** entitled “*Positioned agents in eco-grammar systems with border markers and pure regulated grammars*” authors follow their previous research in the field of positioned agents in the eco-grammar systems and pure grammars. They extend model of the positioned eco-grammar systems by boundary markers and introduce bordered positioned eco-grammar systems (BPEG systems, for short) and that way they show generative power of the BPEG systems with three types of pure regulated grammars with appearance checking.

The sixth paper “*A construction of large graphs of diameter two and given degree from Abelian lifts of dipoles*” is due to **D. Mesežnikov** and it is devoted to the study of special graphs obtained as lifts of dipoles with voltages in cyclic groups, generalizing the known results for Cayley Abelian graphs of diameter two.

The seventh included paper “*On the suitability of the internet multimedia storage for steganographic information transfer in mp4 files*” is co-authored by **M. Jókay** and **J. Baroš**. The aim of this work is to analyze suitability of existing internet multimedia storage services to use as a covert (steganographic) transmission channel. After general overview authors focus on the YouTube service. In particular, they study the feasibility of a recently proposed new steganographic technique of hiding information directly in the structure of the mp4-encoded video file. Their statistical analysis of the set of 1000 video files stored by this service show the practical limitations for this type of information hiding.

The eighth paper “*Different approaches to weighted voting systems based on preferential positions*” is due to **R. Bystrický** and it deals with voting systems producing an aggregated result of the individual preferences of the voters. To avoid some undesirable effects of several voting systems, author deals with preferential voting systems where the distances between the preferences are understood as a function of the position in the sequence of preferences. This approach allows to avoid the worst paradoxical situations or to design a voting system containing some special needs.

In the ninth paper “*Copula approach to residuals of regime-switching models*” the authors **A. Petričková** and **M. Komorníková**, inspired by some ideas of P. Rakonczai,

model the residual dependence of the regime-switching models (SETAR, LSTAR and ESTAR) with the autocopulas (Archimedean, EV and their convex combinations) and construct improved quality models for the original real time series.

Finally, the tenth paper related to ISCAMI 2011 of **Z. Zíková** and **B. Stehlíková** “*Convergence model of interest rates of cks type*” deals with convergence model of interest rates, which explains the evolution of interest rate in connection with the adoption of Euro currency. Its dynamics is described by two stochastic differential equations – the domestic and the European short rate. Bond prices are then solutions to partial differential equations. For the special case with constant volatilities closed form solutions for bond prices are known. Substituting its constant volatilities by instantaneous volatilities authors obtain an approximation of the solution for a more general model. They compute the order of accuracy for this approximation, propose an algorithm for calibration of the model and they test it on the simulated and real market data.

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