



OPPINION

by Corresponding Member of BAS, DSc. Svetozar Dimitrov Margenov,
Professor at IICT - BAS

on the procedure for obtaining the scientific degree

“Doctor of Sciences”

in professional field 4.6 “Informatics and Computer Sciences”

by Assoc. Professor Dr Stoyan Milkov Mihov with a Dissertation entitled

“Finite-State Automata, Transducers and Bimachines: Algorithmic Constructions and Implementations”

In accordance with Order № 346/30.12.2019 of the Director of IICT – BAS, I am appointed as a member of the scientific jury under this procedure.

1. Biographical information

Assoc. Prof. Dr Stoyan Milkov Mihov has graduated from the National Gymnasium of Mathematics in 1986. In 1993 he has got his MSc from the Faculty of Mathematics and Informatics at Sofia University “St. Kliment Ohridski”, holding a Master's Degree in Mathematics, specializing in 1993 in TU-Munich under the TEMPUS program. In 2000 he defends a PhD thesis and in 2006 is elected associate professor. The entire work experience of Stoyan Mihov is in IICT-BAS.

2. General description of the presented materials

The materials presented by Assoc. Prof. Stoyan Mihov are prepared in accordance with the Development of Academic Staff in the Republic of Bulgaria Act (DASRBA), the Regulations for the Application of DASRBA (RDASRBA), as well as with the specific requirements of the Regulations of BAS and IICT - BAS. They include: 1) dissertation in English; 2) abstract in Bulgarian and English; 3) copy of Diploma for the educational and scientific degree “Doctor”; 4) list of scientific publications on the topic of the dissertation; 5) copies of scientific publications on the topic of the dissertation; 6) reference for the fulfillment of the minimum requirements of IICT; 7) list of scientific publications with IF/SJR; 8) letter from Prof. Klaus Schultz declaring the individual contributions to the joint monograph.

The presented dissertation is directly related to the monograph: Mihov, S. and Schulz, K. (2019), Finite-State Techniques: Automata, Transducers and Bimachines, Cambridge Tracks in Theoretical Computer Science, Cambridge University Press. Results on the dissertation are published in 11 papers and 1 book chapter, including 3 in journals with IF and 7 in editions with SJR. There are 227 citations of these works in Scopus, excluding the selfcitations.

The reference for compliance with the minimum requirements for the scientific degree “Doctor of Sciences” in professional field 4.6 “Informatics and Computer Sciences” contains in a table form data for the groups of indicators A, B, Г, Д and E. The points

for last two of the indicators significantly exceed the required, as for indicator E, at minimum required 100 points, 318 points are shown, obtained from 56 citations of 1 paper only.

3. General characteristics of the applicant's activities

Assoc. Prof. Stoyan Mihov is an established scientist in the field of linguistic modeling and computational linguistics. His research interests include the theory of finite-state automata and their applications in approximate search, synthesis and speech recognition.

4. Scientific and applied scientific contributions presented in the dissertation

The dissertation consists of 8 chapters, Introduction, Conclusion and Bibliography (48 titles) with a total volume of 226 pages.

The research methodology includes: a) Theoretical generalizations aimed at widening the scope of the results obtained; b) Abstract constructions that allow for natural algorithmic and software implementation; c) Applicability of the obtained abstract constructions and theoretical results for solving important classes of applied problems.

The first chapter is introductory. The main contributions of the dissertation are presented in the next chapters, as follows. Chapter 2 is devoted to generalizing the concept and the corresponding results for monoidal finite-state automata. Properties related to the determinization and minimization of classical finite-state automata are explored in Chapter 3. The next chapter discusses multi-tape finite-state automata, and here I would note the results for monoidal finite-state transducers. Deterministic on the input tape transducers are explored in Chapter 5. The results obtained are related to text processing and speech recognition, and in this sense are crucial for the focus of the thesis. In Chapter 6 are studied bimachines defined as deterministic finite-state devices, representing the class of regular string functions. The last two chapters present the C(M) programming language and 45 implementations in C(M) of finite-state automata, transducers, and bimachines, respectively. These results are very important for the scope and completeness of the dissertation. It is important to note that the C(M) language compiler is authored by Assoc. Prof. Mihov, and is freely available at the website: [http://lml.bas.bg/~stoyan/lmd/C\(M\).html](http://lml.bas.bg/~stoyan/lmd/C(M).html). The abstract of the dissertation (in Bulgarian and English) has been prepared in accordance with the RADASRBA and the applicable regulations for its application. It correctly reflects the basic data on the procedure, as well as the content of the dissertation and the results obtained therein.

I accept the scientific and applied contributions included in the author's statement. The theoretical contributions are formulated specifically and clearly in the context of previously known results. Strongly impressive are the results leading to improvement of the computational efficiency. For example, it has been shown that the developed construction of bimachines from a finite-state transducer can achieve an exponential decrease in computational complexity for a certain class of tasks.

Using the newly developed C(M) programming language, real-world program implementations have been created based on finite-state automata, transducer, and bimachines for a number of important tasks for the practice. For example, in the spell checking, when determining dictionary words that are "close" to a given one, a Levenstein distance is used, which is equal to the minimal number of symbol substitutions, deletions and insertions required for transforming the first word into the second one. I will also mention the phonetization code that can be used in speech analysis and synthesis.

5. Evaluation of the applicant's personal contribution

Attached is a letter from Prof. Klaus Schultz, declaring the leading contribution of Assoc. Prof. Stoyan Mihov in the joint monograph. I accept that in the attached papers in which he is co-author, Assoc. Prof. Stoyan Mihov has a leading or at least equal role.

6. Critical remarks

The dissertation and the abstract are structured and shaped very well. At the same time, the relatively large number of cases where formulas or parts of the text are out of the page frame is impressive. This applies to both the dissertation and the abstract.

7. Personal impressions

I have known Stoyan Mihov since 1994 and I highly appreciate his scientific and applied achievements, academic ethics and responsibility in daily work, as well as his proven team work opportunities. Strongly impressive is the combination of in-depth theoretical research, abstract constructions and results, with the development of extremely high-value software applications, including the use of state-of-the-art scientific infrastructure.

8. Conclusion

After getting acquainted with the materials of the procedure, the complex evaluation of the scientific and applied results presented therein, and taking into account the personal qualities of the applicant, I strongly recommend that **Dr. Stoyan Milkov Mihov be awarded the scientific degree "Doctor of Sciences"** in professional field 4.6 "Informatics and Computer Sciences" with a Dissertation entitled "Finite-State Automata, Transducers and Bimachines: Algorithmic Constructions and Implementations".

20.03.2020

Sofia

Member of the Scientific Jury:

**NOT FOR
PUBLIC RELEASE**

Prof. DSc Svetozar Margenov