REPORT

by Prof. PhD Georgi Venkov, FAMI, TU – Sofia

at the competition for the academic position "Professor"

in direction of higher education 4 Natural sciences, mathematics and informatics

Professional field 4.6. Informatics and Computer Sciences

Specialty Informatics (Information modeling),

for the needs of the Institute of Mathematics and Informatics, Bulgarian Academy of Sciences, announced in SG No. 98/13.12.2019

with candidate: Assoc. Prof. PhD Zlatinka Svetoslavova Kovacheva

I present my report on this competition as a member of the Scientific Jury, determined by the Order No. 36/05.02.2020 of the Director of Institute of Mathematics and Informatics (IMI), Bulgarian Academy of Sciences (BAS).

The report was prepared in accordance with the requirements of:

- the Law for the Development of Academic Staff in the Republic of Bulgaria (ZRASRB),

- the Rules for the Implementation of the ZRASRB,

- The Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at BAS and at IMI of BAS.

1. General information for the candidate

According to the documents submitted for participation in the competition, Assoc. Prof. Zlatinka Kovacheva obtained a Master's Degree at the Faculty of Mathematics and Mechanics, Sofia University in 1981. In the period 1983-1987 she is a PhD student at Technical University - Sofia and defends a thesis on the topic "Automation system for spelling mistakes detection in Bulgarian texts". Assoc. Prof. Kovacheva's teaching experience began in 1984 as a part-time assistant at the Center of Applied Mathematics (now FAMI), Technical University - Sofia, and since 2004 she holds a position of Associate Professor at High College of Telecommunications and Posts. In 2005 she became an instructor in Mathematics at Sultan Qaboos University, Muscat, Sultanate of Oman, in the period 2006-2013 she is assistant professor at Higher College of Technology, Muscat, Sultanate of Oman, and in the period 2014-2018 she was elected to the academic position Professor and Head of the Department of Mathematics and Applied Sciences, Middle East College, Muscat, Sultanate of Oman. Since 2019 Dr. Kovacheva holds a position of Associate Professor at the Department of Mathematics, Sofia University of Mining and Geology. As a long-time lecturer at High College of Telecommunications and Posts, she teaches lectures and tutorials in the fields of Information technologies, Information systems in communications, Marketing of telecommunication services, Management of operators in communications. Her teaching experience in Middle East College, Muscat, Oman covers courses as Calculus, Mathematical Analysis, Engineering Mathematics, Applied Mathematics, while in Sofia University of Mining and Geology she teaches lectures and tutorials in the fields of Mathematics 1, 2, and 3 part, Numerical methods and basics of programming and Applied Statistics. In addition to being an excellent teacher, Assoc. Prof. Kovacheva is also distinguished for her active

research. She participates in the editorial board of two international scientific journals and several international conferences, she is a reviewer for the needs of the National Science Fund of the Ministry of Education and Science of Bulgaria.

2. General characteristics of the works submitted for the competition

For participation in the competition, Assoc. Prof. Kovacheva presented 31 articles and a chapter of a book that were not used for the acquisition of the PhD, or for the position of the Associate Professor. 17 articles have been published in international refereed and indexed journals, of which 5 are solo, 4 have impact factor (IF) and 6 have impact rank (SJR). Therefore, the additional IMI – specific requirement to have at least 10 IF or SJR publications has been complied (regarding applicants going to occupy the academic position of Professor in Area 4 - Natural Sciences, Mathematics and Informatics). On the other hand, according to the Annex 1 to Rules of BAS for the Implementation of the ZRASRB, giving the minimal scientific indicators to applicants going to occupy the academic position "Professor" in professional field 4.6. Informatics and Computer Sciences, the following table is indicative:

	Q1	Q2	Q3	Q4	SJR	indexed	sum
public.	-	1	1	2	6	7	17
points		40	30	48	120	84	322

It is clear, that the presented publications of the candidate exceed the minimum requirement of 100 points in Group of indicators V and 220 points in Group of indicators G of the Annex 1 to Rules of BAS for the Implementation of the ZRASRB. Moreover, the total IF and SJR of Assoc. Prof. Kovacheva's articles are respectively 1,667 and 1,311, indicating a high level of results presented in them.

According to the attached list, 7 of the candidate's entries for this competition are cited in 202 scientific publications, 192 of which are in international journals, referenced and indexed in Web of Science and / or Scopus. According to Indicator D.11 of the Annex 1 to Rules of BAS for the Implementation of the ZRASRB, the citation index of Assoc. Prof. Kovacheva equals 1152 points, which far exceeds the minimum requirement of 140 points.

3. General characteristics of the applicant's research and pedagogical activity

Assoc. Prof. Zlatinka Kovacheva is distinguished for her research and publishing activities at a national and international level. She has participated in numerous international scientific forums in Bulgaria and abroad, and has participated in editorial boards and research projects.

Furthermore, Assoc. Prof. Kovacheva has a highly appreciated pedagogical activity. She conducts lectures and tutorials in various mathematical disciplines of engineering specialties at High College of Telecommunications and Posts, Sofia University of Mining and Geology and Middle East College, Muscat, Oman. She has four textbooks, of which two are electronic.

4. Basic scientific and applied contributions

Assoc. Prof. Zlatinka Kovacheva's main scientific interests are in the field of OLAP (on-line analytical processing), knowledge extraction from big data, neural networks, as well as the modeling of delayed processes. The main scientific and applied scientific contributions in these fields can be grouped as follows:

- **OLAP developments**

This group includes the results contained in publications [6, 25] and [30]. Paper [6] discusses various approaches (of Inmon and Kimbal type) for modeling of fact tables in data warehouses aiming to provide multidimensional presentation of the data. It is presented a new architectural approach for building consistent data warehouses that gives possibility for monitoring of the relationships and the duplication of data. Paper [25] considers the range of data warehouse, from the point of view of the requirements, the validation of the model with the final users, the identification of the data sources, the adaptation and life cycle of the data. Paper [30] considers the problem, caused by the presence of dispersed data in OLAP hypercubes.

- **Big data**

These are the results given in papers [2, 13, 19] and [28]. Work [2] considers some problems, related to the processing and analysis of big data on cyber-physical systems based on fuzzy logic. Paper [13] considers the basic advantage of neural networks in the big data analitics. In work [19] are presented information management technologies for big data, based on Oracle. Options for implementing solutions for big data with Hadoop Framework and Oracle NoSQL database are considered. Questions and possible solutions related to the language compatibility of WEB services between Java and Microsoft .NET are discussed in paper [28].

- **Knowledge extraction**

This group includes the results contained in publications [8, 9] and [18]. Paper [8] presents a concrete method for knowledge extraction from the existing academic database of Middle East College, Muscat, Oman. The application of neural networks for knowledge extraction is discussed in paper [9]. Here the neural networks are compared with other adequate methods for knowledge extraction and some examples for implementation of artificial intelligence are proposed. Paper [18] evaluates different approaches for extraction of data, stored in Hadoop for construction of Oracle Data Mining models.

- **Neural networks**

This group includes the papers [1, 3, 5, 7, 10, 11, 12, 14, 15, 16, 17, 22, 23, 26, 27, 29, 31] and [32]. Paper [10] studies the global stability of a system of differential equations with delay, which models the dynamic of Hopfield neural networks with impulses in the continuous-time case. Paper [16] propose a sufficient condition for existing of periodic solutions to a class of Hopfield neural networks with bounded delays and impulses in integral form, while paper [27] considers an impulsive Hopfield neural network with delay, which differs from a constant by a small amplitude periodic perturbation. Papers [23] and [26] study impulsive Cohen-Grossberg neural network with time-varying and S-type (or Stieltjes type) distributed delays and reaction-diffusion terms. In papers [5] and [22] are considered neural networks of neutral type. Here by exploiting an appropriate Lyapunov functional are obtained sufficient conditions for the existence and global asymptotic stability of a unique equilibrium point for Cohen-Grossberg neural network.

Papers [1, 3, 7, 12, 14, 17, 24, 29, 31, 32] study discrete Hopfield neural networks, cellular neural networks, complex-valued neural networks and other discrete systems. The obtained

results are related to the problem of existence of periodic solutions and the global exponential stability of the unique equilibrium point. Papers [11] and [15] are survey papers and provide information on the history and operation of neural networks and, more precisely, of impulsive Hopfield neural network in continuous time with constant and with both constant and infinite distributed delays.

- **Second-order impulsive differential equations with nonlocal conditions**

These are the results given in papers [4, 20] and [21]. These works study second-order differential equations in Banach spaces, with linear parts of the r.h.s. given by the infinitesimal generator of a strongly continuous cosine family of bounded linear operators, and provided with impulse and nonlocal conditions, while the nonlinear parts satisfy the global Lipschitz condition. The results obtained here are related to the problem of existence of mild and classical solution, which is achieved by exploiting the fixed point theorem.

6. Critical notes and recommendations

I have no critical comments on the materials of Assoc. Prof. Zlatinka Kovacheva for participation in this competition. To the best of my knowledge, there is no suspicion of plagiarism in the submitted papers of the candidate. A possible recommendation for the future development of the candidate is that she intensifies her publication activities in more prestigious journals and her work with graduates and PhD students.

7. Conclusion

In conclusion, I think that the submitted materials of Assoc. Prof. Zlatinka Svetoslavova Kovacheva on this competition fully meet the requirements of the ZRASRB, the Rules for its implementation and the Regulations on the conditions and procedures for acquiring academic degrees and for occupying academic positions in the Bulgarian Academy of Sciences and at Institute of Mathematics and Informatics (IMI-BAS).

Therefore, I strongly suggest to the Honorable Scientific Jury to positively evaluate the candidature of Assoc. Prof. Zlatinka Kovacheva and to unanimously recommend to the Scientific Council of of IMI-BAS her choice for the academic position “Professor” in the direction of higher education 4. Natural sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Sciences, specialty “Informatics (Information modeling)”.

04.05.2020 г. Assessor:

Sofia (Prof. PhD Georgi Venkov)