

REPORT

on a competition for occupying the academic position of “**professor**” in the domain of Higher Education:

4. Natural Sciences, Mathematics and Informatics,
Professional field: 4.6. Informatics and Computer Science,
Scientific speciality: Informatics (Information Modelling),
announced in SG, Issue 98/ 13.12.2019,
with the only candidate: Dr. **Zlatinka Svetoslavova Kovacheva**, Assoc. Prof. in St. Ivan Rilski University of Mining and Geology – Sofia.

Report from: Krasimira Stoyanova Prodanova, Ph. D., Professor, Technical University – Sofia.

By Order No. 36/05.02.2020 of the Director of the Institute of Mathematics and Informatics – BAS I was appointed a member of the scientific jury for the competition for occupying the academic position of “Professor” in the professional field: 4.6. Informatics and Computer Science, scientific speciality: Informatics (Information Modelling), announced in SG, Issue 98/ 13.12.2019. At the first meeting of the jury I was appointed an author of a report (opinion).

The present report is in compliance with the Law on the Development of the Academic Staff in the Republic of Bulgaria and with the Regulations on the Conditions and Procedure for Obtaining Academic Degrees and Occupying Academic Positions at the Institute of Mathematics and Informatics – BAS.

The only applicant in the competition thus announced is **Dr. Zlatinka Svetoslavova Kovacheva**, Temporary Scientific Unit “Information Modelling” of IMI – BAS.

The following documents required by the Law on the Development of the Academic Staff in the Republic of Bulgaria have been submitted: CV – European format, copies of Ph. D. and Assoc. Prof. diplomas, information on satisfying the minimal requirements for the position of “Professor” in IMI – BAS, 32 scientific publications which do not repeat the ones submitted for the acquisition of the educational and scientific degree “Doctor” and for the application for the academic position “Associate Professor”, summaries of the main results and scientific contributions, author’s statement on the scientific contributions and the citations noted.

Brief CV data

The brief CV data have been taken from the presented CV. Assoc. Prof. Dr. Z. Kovacheva graduated in 1981 the Faculty of Mathematics and Informatics – Sofia University. In 1987 she defended a Ph. D. Thesis in the scientific speciality “Informatics” at Sofia Technical University. In 2004 r. she was awarded by the Higher Attestation Council the academic position “Associate Professor” in the scientific speciality “Automated Systems for Information Processing and Control”. She has been doing teaching and scientific-research activity in the College of Telecommunications and Post – Sofia, University of Mining and Geology – Sofia, three universities in Muscat, Sultanate of Oman, and the Institute for Information, Communication and Automated Systems – Sofia. Since 2018 till now she has been working in the Temporary Scientific Unit “Information Modelling” of IMI – BAS. Since 2019 till now she has been working on a second labour contract in St. Ivan Rilski University of Mining and Geology – Sofia.

Description of the submitted materials

I take into consideration the 10 submitted publications constituting the habilitation work, as well as further 22 scientific publications. All publications are related to the professional field 4.6. Informatics and Computer Science. All publications are written in English. 17 of the publications have been refereed and indexed in world-known databases of scientific information, and their number for the respective database is as follows: in Web of Science – 10, in Scopus – 11, in MathSciNet – 11, in Zentralblatt – 8, in IEEE Xplore – 1, in ACM Digital Library – 1. The total number exceeds 17 since a part of the publications have been indexed in more than one of the databases. 27 of the publications are in international editions, and one of these is a chapter of a book published in Spain by IFSA Publishing. The publications with IF are 4, and those with SJR are 9.

A list of 9 papers by Assoc. Prof. Kovacheva has been submitted, all of which cited in publications from world-known databases of scientific information. The number of citations noted is impressive – 256, particularly of one of these, namely, of the paper:

Akça, H., Alassar, R., Covachev, V., Kovacheva, Z., Continuous-time additive Hopfield-type neural networks with impulses. Journal of Mathematical Analysis and Applications, 290, 2, Elsevier, 2004, ISSN:0022-247X, 436-451. (SJR: 0.966 – Q2, ISI IF: 0.49 – Q2)

The participations in conferences are, respectively: abroad – 19, in international conferences in Bulgaria – 4, in national conferences with international participation – 5.

2 textbooks have been submitted (Intermediate Calculus and Intermediate Mathematics), as well as electronic lectures (in Probability Theory and Laplace Transforms), used for the instruction in mathematics in Middle East College, Muscat, Oman.

Proofs have been presented for the participation of Assoc. Prof. Dr. Z. Kovacheva in 9 scientific projects, and of 6 of these she has been the leading scientist.

Before I present all materials with my opinion on them, I shall show in a table formal information on the scientometric minimal national requirements for the academic position “Professor” according to the Law on the Development of the Academic Staff in the Republic of Bulgaria, modified and supplemented in SG, Issue 15/ 19. 02.2019, as well as the Regulations on the Conditions and Procedure for Obtaining Academic Degrees and Occupying Academic Positions at the Institute of Mathematics and Informatics – BAS:

Group of indicators	Contents	Professor (Minimal required points)	Points of the applicant
А	Indicator 1	50	50
Б	Indicator 2	–	–
В	Indicators 3 или 4	100	102
Г	Sum of indicators from 5 to 10	220	235
Д	Indicator 11	140	1152
Е	Sum of indicators from 12 to the end	150	210

From the above table it is seen that the applicant Assoc. Prof. Dr. Z. Kovacheva not just satisfies the requirements, but her points considerably exceed the minimal. This refers particularly to Group Δ – citations of her scientific works, which proves convincingly her international prominence.

Survey, analysis and assessment of the contributions of the scientific publications

The scientific works of Assoc. Prof. Kovacheva are devoted to the information modelling of processes. The publications of the applicant are in five main areas:

- 1. On-line analytical processing (OLAP) development;**
- 2. Big Data;**
- 3. Data Mining;**
- 4. Neural networks;**
- 5. Second order impulsive differential equations with nonlocal conditions.**

In the first area 3 publications are presented. In [6] some unconventional approaches to modelling fact tables in data warehouse are discussed in order to ensure the multidimensional presentation of data. A comparative analysis of different methods for modelling on the base of the main approaches of Inmon and Kimbal is done. In [25] the tendencies of the data warehouse scope development are presented. The problems of requirements gathering, validating the model with the end users, identifying the sources of the data, adaptation to the ongoing changes, the life cycle and the integrity of the data are highlighted. In [30] an innovative model of a regular sparsity map is presented, which allows practical implementation of set operations between a map object and rectangular domains over a multidimensional space of the cube. To perform more efficiently set operations with rectangular domains, an algorithm that works with dimension subsets instead of dimension elements is proposed.

In the second area 4 publications are presented. In [2] the main methods of big data analysis for cyber-physical systems are compared. Some mathematical foundations of big data on the base of fuzzy logic are presented. In [13] a comparison of statistical analysis vs. machine learning is presented and the advantages of the neural networks are emphasized. In [19] some information management technologies for big data offered by Oracle are presented. A number of opportunities for the deployment of big data solutions with Hadoop framework and Oracle NoSQL Database have been demonstrated. In [28] some aspects of web services interoperability between Java and Microsoft .NET are discussed and some solutions have been suggested.

In the third area 3 publications are presented. In [8] a method of data mining over the existing academic database is presented. In [18] several opportunities for using data mining techniques provided by the analytical engine of RDBMS Oracle over data stored in Hadoop Distributed File System (HDFS) are presented. In this paper, different approaches for extraction of data over Hadoop for the needs of Oracle Data Mining models building are assessed, and a practical direction for using Oracle Big data decisions is given. In [9] the neural networks are compared with the other methods of data mining.

In the fourth area 19 papers are presented, distributed in four subareas. The first one is “Continuous neural networks” in which 7 publications are presented. Three of these are devoted to neural networks of Hopfield type. In [10] the global stability of a system of differential equations modelling the dynamics of additive networks with impulses in the continuous-time case is studied. Sufficient conditions for the global exponential stability are obtained. In [16] a sufficient condition is found for the existence of a periodic solution of a class of such networks

with bounded distributed delays and impulses in integral form. In [27] an impulsive network with a delay different from a constant by a small-amplitude periodic perturbation is considered. The perturbed system is proved to have a unique almost periodic solution. In [23] and [26] an impulsive Cohen-Grossberg neural network with time-varying and distributed delays of Stieltjes type and reaction-diffusion terms is considered. In [22] and [5] neutral-type neural networks are considered. Sufficient conditions for global asymptotical stability are obtained, more precise in comparison with C. J. Cheng et al. (2006). The second subarea is “Discrete neural networks and other discrete systems” represented by 10 publications. In [1] an age-dependent model with a dominant age class is considered. In [32], [31], [7], [29] and [24] discrete counterparts of additive Hopfield-type continuous-time neural networks are formulated. Sufficient conditions for the existence of a periodic solution of the discrete system thus obtained are found, as well as sufficient conditions for uniqueness and global exponential stability of the periodic solution. In [17] and [12] sufficient conditions for existence of periodic solutions of a cellular neural network are found. In [14] and [3] the discrete-time analogue of a complex-valued neural network of Hopfield type with time-varying delays and impulses is considered. It is proved that the system has at most one periodic solution with a given period, and this solution is globally exponentially stable. The last subarea is “Survey of continuous and discrete neural networks” presented in the works [11] and [15]. [11] contains results on existence and global exponential stability of a unique equilibrium point, and in [15] results concerning the existence and global exponential stability of an equilibrium point or a periodic solution for some models are generalized.

In the last – fifth area, 3 publications are presented, in which second order differential equations in Banach spaces are studied, such that the linear parts of their right-hand sides are given by the infinitesimal generator of a strongly continuous cosine family of bounded linear operators, and provided with impulse and nonlocal conditions. In [20], the nonlinear part depends on the solution and its first derivative, and satisfies a global Lipschitz condition. Therein, the notion of mild solution is defined as a solution of an integro-summary equation. The existence and uniqueness of a mild and classical solution of the problem considered is proved. In [4] and [21], the nonlinear parts depend on the solutions and their first derivatives, without and with time shift, but Lipschitz continuity is not required.

THE GENERAL ASSESSMENT of the results in the publications is that they have substantial theoretical and applied contributions. The applicant Assoc. Prof. Dr. Zlatinka Kovacheva demonstrates a profound knowledge of the investigated problems of a specific area of information modelling. The problems considered undoubtedly yield new contributions in this area of informatics, which is also confirmed by the **high citability (1152 points achieved at required minimum of 140 points)**.

27 of the presented 32 publications are joint. I assume that Assoc. Prof. Kovacheva has an equal participation in obtaining the results. Proofs for the participation of Assoc. Prof. Kovacheva in 9 scientific-research projects are presented, which is a certificate for Zlatinka Kovacheva’s ability to work in team and supervise doctoral students in the future.

I assess the publication, teaching и scientific-research activity of Assoc. Prof. Kovacheva as completely sufficient for the competition announced, in volume, scientific level, as well as in citations at an international level.

Critical remarks and recommendations

I have no critical remarks and recommendations.

Personal impressions of the applicant

I have good personal impressions of Assoc. Prof. Kovacheva as an Assistant Professor at the Faculty of Applied Mathematics and Informatics of Technical University – Sofia.

CONCLUSION

The quality publications presented for participation in the competition (1749 points achieved for required minimum of 660 points) and their citations justify me to highly assess the scientific contributions and pedagogical activity of the applicant.

The above stated, the Law on the Development of the Academic Staff in the Republic of Bulgaria and the regulations on its applications, as well as the specific requirements of the Regulations on the Conditions and Procedure for Obtaining Academic Degrees and Occupying Academic Positions at the IMI – BAS justify me to express my POSITIVE assessment that the scientific contributions and pedagogical competence of the applicant satisfy the conditions for occupying the academic position “Professor” and I will confidently join a decision of the Scientific Jury to suggest that the Scientific Council of IMI – BAS elect Assoc. Prof. Dr. Zlatinka Svetoslavova Kovacheva for the academic position “Professor” in the professional field: 4.6. Informatics and Computer Science.

Sofia,
22. 04. 2020

Jury member:
(Prof. Dr. K. Prodanova)