

R E V I E W
on a competition for academic position of Associate Professor
in professional field 4.6 “Informatics and Computer Science”, scientific
speciality “Informatics (Modeling of complex systems with large
dimension)”, announced in SG, issue 14/10.02.2023
for the needs of the Institute of Mathematics and Informatics – BAS,
with a single applicant
Dr. Ivan Radoslavov Georgiev

Reviewer: Prof. Dr. Zlatinka Svetoslavova Kovacheva,
Institute of Mathematics and Informatics – BAS

The present review has been prepared based on Order No. 186/ 07.04.2023 of the Director of the Institute of Mathematics and Informatics - BAS, Prof. Doctor of Mathematical Sciences Peter Boyvalenkov on the grounds of Art.4, (2) of LDASRB and a decision of the Scientific Council of IMI - BAS (protocol No. 3/17.03.2023). It is in compliance with the requirements of the Law for the Development of the Academic Staff in Republic of Bulgaria (LDASRB), the Regulations for its Application (RALDASRB) and the Regulations of IMI - BAS.

1. Requirements to the applicant

By Art. 24 (1) of LDASRB, the applicants to occupy the academic position of Associate Professor must meet the following conditions:

- to have been awarded the educational and scientific degree of Doctor;
- for minimum two years to have occupied the academic position of Assistant or Chief Assistant Prof.;
- to have presented a published monograph or equivalent publications in specialized scientific issues which do not reproduce those presented for awarding the educational and scientific degree of Doctor and for awarding of the scientific degree of Doctor of Science;
- to meet the minimum national requirements under Art. 26, Para 2 and 3, respectively the requirements under Art. 26, Para 5;
- to have no plagiarism proven as per the legally established order in the scientific works.

By the Regulations for the application of LDASRB in IMI-BAS, in Art. 3(1).3 (add. – 25.03.2022), the applicant for the academic position of Associate Professor has to present at least 7 publications in scientific issues with IF or SJR.

According to the presented materials and documents, the applicant meets completely all requirements, and exceeds some of them.

2. Short biographical data

Dr. Ivan Georgiev graduated with excellent grades and a master's degree in Information and educational technologies in 2007 at “Angel Kanchev” University of Ruse. In 2015 he obtained the educational and scientific degree "doctor" in the doctoral

program "Mathematical modeling and application of mathematics" at "Angel Kanchev" University of Ruse, after defense of a dissertation on the topic "Immersed interface method of finite elements for elliptic and parabolic problems" (Diploma No. RU-NS-2015-53/ 25.11.2015).

From 2005 until now, he has been working at the "Angel Kanchev" University of Ruse, successively as: part-time assistant professor (2005-2009), assistant professor (2009 - 2016), chief assistant professor (2016 - 2022) and associate professor in professional direction 4.5. "Mathematics" (from 2022). From 2023 until now, he has been working at the Institute of Mathematics and Informatics - BAS, at the Temporary Scientific Unit "Information Modeling" as a half-time mathematician.

3. General characteristics of the research and applied research activities of the candidate

The following table presents the total number of points of the candidate and the required minimum number of points in the groups of scientometric indicators, according to Art. 1a (1) and (2) of RALDASRB and Art. 2(1) of the Regulations on the terms and conditions for obtaining scientific degrees and for holding academic positions of IMI – BAS:

GENERALIZED TABLE
for the number of points
for the field 4. Natural sciences, mathematics and informatics
for the academic position of "Associate Professor"
of Dr. Ivan Georgiev

Group of indicators	Minimum number of points	Number of points of the applicant
A	50	50
Б	-	-
B	100	144
Г	220	269
Д	70	246
E	20	80
Total	460	789

The table shows that the candidate exceeds the required number of points on 4 of the 5 indicators.

The following materials are provided, presenting the research and applied research activities of the candidate:

- list of all scientific publications, including 39 talks at scientific forums, 46 articles, 4 monographs and one textbook.
- list of 23 scientific publications selected for participation in the competition for associate professor (8 in group B and 15 in group Γ);
- abstracts in Bulgarian and English and copies of the scientific papers for participation in the competition;
- list of 41 citations selected for participation in the competition for associate professor of 21 scientific publications;
- list of 5 research projects for participation in the competition (4 national and one international), out of a total of 13 projects with the participation of the candidate;
- one textbook;
- author's report on the achieved results in the scientific papers and the main contributions;
- reference for fulfillment of the minimum requirements for holding the academic position "associate professor";

The presented materials are designed in accordance with the requirements of the LDASRB, as well as the regulations for its implementation.

One publication is in a national publishing house, in the Bulgarian language, and all the other publications submitted for participation in the competition are in international publishing houses, written in English.

Sixteen publications are in editions with SJR (6 in group B and 10 in group Γ). From them, 13 publications are in the American Institute of Physics series (5 from group B and 8 from group Γ). The other 3 publications with SJR are in Journal of Transport Problems (Q3 in Scopus), ACM International Conference Proceedings Series and Proceedings of Engineering for Rural Development. Four publications are in the database IEEE Xplore and they are indexed in Scopus (2 in group B and 2 in group Γ). Three chapters of books are also presented (in group Γ).

For participation in the competition, Dr. Ivan Georgiev presented instead of a habilitation thesis - 8 publications, 6 of which are with SJR (5 in the American Institute of Physics series, 1 in Journal of Transport Problems), and 2 are in the IEEE Xplore database and indexed in Scopus. All these publications fall under the thematic area "Modeling of complex systems with large dimensions".

From the scientific works submitted for the competition by Dr. Ivan Georgiev found that they do not repeat the publications used to obtain the scientific degree "PhD", as well as for the academic position of Associate Professor at "Angel Kanchev" University of Ruse.

All 41 citing articles have been published in international editions, indexed in Scopus.

I have not noticed any plagiarism or self-citations.

4. Main scientific and scientific-applied contributions

The scientific and scientific-applied contributions from the 23 publications with which Dr. Ivan Georgiev participated in the competition for Associate Professor are mainly in the field of informatics modeling, mathematical modeling and optimization, numerical methods for differential equations, and probabilities and statistics. In almost all proposed publications, informatics models based on mathematical models and algorithms have been built. Informatics models often refer to complex high-dimensional systems. Each informatics model is implemented in a programming environment (most commonly Matlab) in a high-level programming language.

The publications considered in B4.1, B4.2, B4.3, B4.5, B4.7, Г7.8, Г7.9, Г7.11, Г8.1 and Г8.3 concern problems from the single-criteria and multi-criteria linear and non-linear optimization. Problems from the scheduling theory (B4.1 and Г7.11) also belong to this class, in which a valid schedule that meets certain conditions is essentially sought, rather than an optimum of an objective function. Such type of problems are reduced to optimization problems. In some of the optimization problems, the admissible domain is non-convex and/or the objective function is of minimax type (B4.1, B4.2, B4.3, Г7.11, Г8.1). Using additional integer variables, these problems are reduced to high-dimensional partial-integer linear optimization problems (MILP-- Mixed-Integer Linear Programming). It is known that such type of tasks are NP-complete (nondeterministic polynomial time) and due to their large dimension, the application of exact methods is inappropriate. Heuristic, genetic and Monte Carlo methods are used for their approximate solution. Non-linear single-criteria optimization is implemented in B4.5, Г7.8. In the case of multi-criteria tasks (B4.7, Г8.3), the Pareto optimal set of solutions is found, after which one of them is selected.

The publications in which time series are considered and forecasted are B4.4, B4.5, B4.6, B4.8, Г7.1, Г7.3, Г7.4, Г7.6, Г7.7, Г7.8, Г8.2. Forecasting is done using various methods and techniques. Different techniques based on classical methods, ARIMA approaches, approaches by means of numerical solution of differential equations are considered.

Differential equations and numerical solutions of differential equations are applied in Г7.7 and Г7.10. In Г7.10, a mass service systems problem is considered, leading to a system of ordinary differential equations. Such type of systems are usually of high dimension, and sometimes they are also differential-algebraic systems of equations. Specific numerical methods were used for their numerical solution. In Г7.7, a time series forecasting approach based on numerical methods for differential equations is developed. The proposed approach gives a large choice of settings, which makes it sufficiently flexible in the prediction of substantially different types of stochastic phenomena. An informatics model was created, which was successfully programmed in the Matlab environment. This makes it possible to quickly and easily adjust various parameters in the model, given the specifics of different time series. The informatics model has been successfully tested and used in various fields: in finance (for forecasting financial instruments), in ecology and transport (for forecasting the levels of some dust particles), etc.

The developed models and the results of the conducted research are widely used in

practice. The following main applied contributions can be outlined:

- Measuring and predicting the temperature in different points of a room, in real time. Based on the predictions, different temperature surfaces are modeled in different sections of the room. Based on a developed computer model, software is implemented for forecasting and managing the temperature in the room, which helps to improve energy efficiency.
- Assessment of the location of apiaries in flat and hilly areas. The effectiveness of the proposed approach is reported in two directions. On the one hand, the benefit for beekeepers in their selection of suitable locations for apiaries, guaranteeing optimal nutrition of the bee colonies. On the other hand, the benefit for farmers growing flowering agricultural crops in the respective area is expressed in guaranteeing better pollination of the crops, which is a prerequisite for higher yields.
- Forecasting, optimization and diversification of heterogeneous financial portfolios. The optimization is based on the modern Markowitz portfolio theory. Various single-criteria and multi-criteria diversification tasks are considered. Various program codes have been implemented, with the help of which various configurations of financial wallets have been successfully tested.
- In the field of intermodal and multimodal transport, a multi-criteria mathematical model with different performance indicators has been proposed. The model is reduced to a multi-criteria partial-integer optimization problem. Such type of problems are high-dimensional NP-complete. Various heuristic and stochastic techniques are used to solve them.
- In the field of transport, various types of incoming flows of requests for a certain type of service (auto repair shops, public transport stops, etc.) have been modelled. Taking into account the specifics of the given problem, it is modeled with the means of queuing theory. An informatics model has been implemented for solving systems of differential-algebraic equations with a large dimension with specific numerical methods. The results of this model show the weaknesses of the service process. This allows the process to be adjusted and improved.
- Based on real data and problems from the transport business, various logistics and optimization tasks have been examined. Suitable optimization models (linear, non-linear, single-criteria, multi-criteria) are proposed for these tasks. The solution of these models is implemented in the Matlab environment using modern numerical methods.

Definitely, the originality and the wide applicability of the developments is impressive.

5. Personal impressions, opinions and recommendations

I know Dr. Ivan Georgiev from the beginning of 2023, when he started working part time at the Temporary Scientific Unit "Information Modeling". I have excellent impressions of his professional competence, diligence, perseverance and efficiency. He is actively involved in the work of the unit and his relations with colleagues are ethical, correct and well-meaning.

I have no questions or critical remarks to the candidate. In my opinion, he has great potential for development and I recommend him to publish in journals with an impact factor on Web of Science.

Conclusion

From the inspection of the submitted materials for the competition no violations in the procedure have been established. All requirements of Art. 24 (1), (2), (3), Art. 26 of LDASRB, Art. 53 (1) (2) and Art. 54 of RALDASRB, Art. 2 (1) and Art. 3 (1), (3) of the Regulations on the Conditions and the Procedure for Acquisition of Scientific Degrees and for Occupation of Academic Positions in IMI – BAS have been observed.

All publications of the candidate, presented for participation in the competition have been refereed in the world-known scientific databases and have got recognition, which is proved by the numerous citations by foreign authors. The results obtained, the contributions to science and the implementations into up to date and promising areas justify me to claim that Dr. Ivan Georgiev is an ambitious and productive young scientist in the field of information modeling, with great potential for development.

I believe that his scientific work deserves to be highly assessed, and I suggest to the members of the respected jury to vote on a proposal to the Scientific Council of IMI - BAS to assign the academic position of "Associate Professor" to Dr. Ivan Georgiev.

22. 05. 2023 г.

Reviewer:

/prof. Dr. Zlatinka Kovacheva/