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 8/29.01.2021 for the needs of the Institute of Mathematics and Informatics – BAS, with a single applicant Dr. Venelin Lyubomirov Todorov, Chief Assistant Prof. at IMI-BAS

Reviewer: Prof. Dr. Zlatinka Svetoslavova Kovacheva,

Institute of Mathematics and Informatics – BAS

The present review has been prepared based on Order No. 47/ 26.03.2021 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. 5/19.03.2021). 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).2, the applicant for the academic position of Associate Professor has to present at least 5 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

Chief Assistant Prof. Venelin Todorov graduated with excellent grades and a master's degree in Applied mathematics in 2011 at Sofia University "St. Kliment Ohridski" (Diploma No 203060/ 29.08.2011). In 2017 he defended a thesis on the topic

“Monte Carlo methods for multidimensional integrals and integral equations and applications” for acquisition of the scientific degree “Ph.D.” at the Institute of Information and Communication Technologies - BAS (Diploma No. 000934/23.10.2017).

In the period 2015-2016 he worked as a part-time assistant at the University of National and World Economy. Since 2014 he has been working in the Institute of Information and Communication Technologies - BAS. Since 2017 he has been working in the Institute of mathematics and informatics – BAS, as Assistant Chief Assistant Prof. (since 2019), thus exceeding the required minimum period of 2 years (Certificate No.116/ 09.02. 2021).

He is a winner of the Grand Prize of BAS „Professor Marin Drinov“ in 2019, Award for the most successful project for young scientists of BAS in 2019, Award for the best young scientist of BAS in 2018, First prize at the XVI National Youth Scientific and Practical Conference 2019. He was nominated by IMI – BAS for the John Atanassov Presidential Award in 2020.

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

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

- list of all scientific publications, including 78 titles;
- list of 20 scientific publications selected for participation in the competition for associate professor;
- abstracts in Bulgarian and English and copies of scientific papers for participation in the competition;
- list of 14 citations of 10 scientific publications;
- list of 3 research projects for participation in the competition (out of a total of 12 projects with the participation of the candidate);
- author's report on the achieved results for each of the scientific papers and the main contributions;
- reference for fulfillment of the minimum requirements for holding the academic position “associate professor”;

The diligent, comprehensive and professional design of the presented materials is impressive.

All submitted publications are written in English. Eighteen (18) publications are in international publishing houses or abroad. Two publications (B7 and B8) are in national academic publishing houses.

Seventeen (17) publications are in editions with SJR (6 in the American Institute of Physics series, 5 in Springer series in Q4 of Scopus Studies in Computational Intelligence and 6 in Springer series in Q2 of Scopus Lecture Notes in Computer Sciences). One publication (B6) is in the database IEEE Xplore and it is indexed in Scopus.

For participation in the competition, chief assistant Venelin Todorov presented instead of a habilitation thesis - 8 publications, 5 of which are with SJR (2 in the prestigious American Institute of Physics series and 3 in the Springer series Studies in Computational Intelligence), one in the IEEE Xplore database and indexed in Scopus and 2 papers, which do not fall into the world-famous databases. All these publications

fall under the thematic area "Modeling of complex systems with large dimensions"

From the scientific works submitted for the competition by Ch. Assistant Dr. Venelin Todorov found that they do not repeat the publications used to obtain the scientific degree "PhD".

From the list of cited articles: 2 articles (the second and the eighth) are cited 3 times, and the remaining 8 - 1 time.

All 14 citing articles have been published in international journals with SJR (of which: 4 in Q1, 2 in Q2 and 4 in Q3). Five citing articles also have an impact factor - IF (4 in Q1 and 1 in Q2).

From the presented 3 research projects with the participation of Chief Assistant Prof. Dr. Venelin Todorov, two have been completed and one is ongoing. The completed projects were funded by the National Research Fund, and the current one is funded by the Ministry of Education and Science. It started in 2019 and is expected to end in 2021.

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 Ch. Assistant Prof. Dr. Venelin Todorov

Group of indicators	Minimum number of points	Number of points of the applicant
А	50	50
Б	-	-
В	100	112
Г	220	240
Д	70	84
Е	20	30
Total	**460**	**516**

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

I have not noticed any plagiarism or self-citations.

4. Main scientific and applied scientific contributions

The scientific contributions from the 20 publications with which Venelin Todorov participates in the competition for associate professor are grouped in his "Author's reference for original scientific contributions in the publications for participation in the competition for associate professor" in the following main directions:

1) Development of new advanced stochastic approaches to sensitivity analysis of a large-scale complex system, describing long-range transport of air pollutants – [В1, В2, В3, В4, В7, В8, Г1, Г2, Г3, Г4, Г5];
2) Development of a new stochastic method for large linear systems with application in ecology – [В5, В6];
3) Development of new stochastic approaches to evaluating multidimensional European options with high dimensions - [Г6];
4) Development of new stochastic approaches for estimating multidimensional integrals with high dimensions in statistics with application in neural networks - [Г7];
5) Construction of new high - order numerical methods for large-scale air pollution model problems in ecology – [Г8, Г9, Г10];
6) Other contributions – [Г11, Г12].

In my opinion, they correctly reflect the content of the publications with which he participates in the competition and this grouping is appropriate.

The most numerous are the studies from the first group. The sensitivity analysis of a complex system of large dimension, describing the long-range transport of air pollutants is an up to date and promising topic. For the research, it was chosen an Unified Danish Eulerian Model, UNI-DEM, developed by prof. Dr. Zahary Zlatev and his colleagues from the Danish National Institute for Environmental Research.

The spatial area of the model includes the whole of Europe, the Mediterranean, as well as parts of Asia and Africa. The model provides an opportunity to study over time the concentrations of the main types of pollutants (sulfur and nitrogen compounds, ammonia, ammonium ions, nitrogen, free radicals, hydrocarbons), which is essential for environmental safety, agriculture and health.

In the sensitivity analysis, the lattice type point sets with generating vector the generalized Fibonacci numbers, Latin hypercube sampling, the original and modified van der Corput sequence and others are applied for the first time by the author (in a team). To analyze the sensitivity of a complex system, comparisons were made for the first time between the quasi-random sequences of Faure, Halton, and Sobol, the adaptive approach, and the lattice type point set with an optimal generating vector.

The second group includes the development of a new Monte Carlo method for large linear systems, based on the "walk on equations" algorithm. The performed numerical experiments confirm the efficiency of the method, which does not depend on the dimension of the system and the density of the matrix. For the matrix NOS4 with fundamental application in ecology, it was found that the developed Monte Carlo method achieves better accuracy than the conjugate gradient method.

In the third group, a lattice point set with a generating vector has been developed using the reflection method and it has been applied for the first time to the evaluation of European options. For the first time, a comparison of lattice point sets with different generating vectors was made to evaluate the options. The best results for high dimensions were achieved by the optimal generating vector.

In the fourth group, for the first time, stochastic approaches based on the Sobol sequences with Matousek linear scrambling, the adaptive approach and the Fibonacci lattice rule are applied to multidimensional integrals with application in statistics and artificial intelligence.

In the fifth group, a new compact difference scheme with fourth order of accuracy for large-scale air pollution model has been developed and a comparison is made between the two different approaches to obtaining schemes of the fourth order of accuracy - a compact difference scheme and a standard difference scheme with increased order of convergence with Richardson extrapolation. New compact difference schemes with a fourth order of accuracy on the spatial variable have been developed for an atmospheric model based on the Chapman cycle. A new second-order numerical method has been developed based on the immersed interface method for a complex ecological model describing the interaction between a pollutant and the living environment. The problem of solving the right-hand side of parabolic systems of equations with over determinations, given by point measurements, is considered. An implementation of the decomposition algorithm to parabolic systems has been proposed.

In the sixth group, a method for improving the accuracy of numerical solutions of ordinary and partial linear fractional differential equations with singularities using Taylor's fractional polynomials is proposed. New numerical methods with a second order of accuracy for the first derivative based on different generating functions were also obtained.

The presented 8 publications instead of a habilitation paper can be formed in a monograph entitled "Advanced stochastic approaches to modeling complex large-scale systems in ecology".

Definitely, the originality and the wide applicability of the developments is impressive. The scientific and scientific-applied contributions of the candidate are highly appreciated, as evidenced by the received awards and nominations.

5. Personal impressions, opinions and recommendations

I have known Dr. Venelin Todorov as a colleague since 2018 and as head of the Temporary Scientific Unit "Information Modeling" since 2020. 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. Performs quality and on time tasks assigned to him.

I have no questions or critical remarks to the candidate. I appreciate the advantages of working in a team, but I recommend him to also publish independent articles and to enrich his professional experience with teaching.

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 (2) 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.

Almost 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 Ch. Assistant Professor Dr. Venelin Todorov 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 Ch. Assistant Professor Dr. Venelin Todorov.

07. 05. 2021 г. Reviewer:

/prof. Dr. Zlatinka Kovacheva/