

REVIEW

By Prof. Evdokia Nikolaeva Sotirova, PhD,
University "Prof. D-r Asen Zlatarov" - Burgas

on the documents submitted by
Assoc. Prof. Olympia Nikolaeva Roeva, PhD
for participation in the competition
for acquiring the academic position "Professor",
in the field of higher education: 4. Natural Sciences, Mathematics and Informatics;
Professional field 4.6. Informatics and Computer Science;
Scientific specialty "Informatics"
for the needs of the "Bioinformatics and Mathematical Modelling" Department
Institute of Biophysics and Biomedical Engineering,
Bulgarian Academy of Sciences,
announced in the Government Newspaper 98 /17 Nov 2020.

The reason for writing the present review is Order № 20/15.01.2021 г. of the Director of the Institute of Biophysics and Biomedical Engineering (IBPhBME), Bulgarian Academy of Sciences (BAS) for selecting the members of the Scientific jury and Protocol №1/14.01.2021 from the session of the Scientific jury. The present review is prepared according to the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, the Regulations for the terms and conditions for acquisition of scientific degrees and taking an academic position in the Bulgarian Academy of Sciences, and the Regulations for its applying in the IBPhBME.

Assoc. Prof. Olympia Nikolaeva Roeva, PhD is the only participant in the competition.

1. General information about the candidate

In 1998 Olympia Nikolaeva Roeva graduated the Technical University of Sofia with a master degree on bioelectroengineering. In 2007 she is awarded the educational and scientific degree Doctor of Philosophy (PhD) in Central Laboratory of Biomedical Engineering (CLBME) "Prof. Ivan Daskalov"- BAS and Technical University - Sofia.

From the submitted documents it is clear that the candidate started his work experience as in the Institute of Microbiology "Stefan Angelov" as a specialist (1998-2001), after that as a PhD student in CLBME "Prof. Ivan Daskalov"- BAS, (Department Mathematical modeling, optimization and process management) (2001-

2004), Research Associate (2004-2009) in the same Institute and from 2009 until now he has occupied the position of Associate Professor in the IBPhBME (“Bioinformatics and Mathematical Modelling” Department).

2. Description of the submitted materials

The submitted materials and documents for participation in the competition are in accordance to the Regulations for the terms and conditions for acquisition of scientific degrees and taking an academic position in the IBPhBME and includes:

- Copies of the diploma for the educational and scientific degree “Doctor of Philosophy” and a certificate for the scientific title “Senior Research Fellow second degree”, issued by the Higher Attestation Commission (respectively 2007 and 2009);
- Document for work experience in the field for more than 19 years;
- Four separate lists of the candidate's publications: for participation in this competition, for holding the academic position of “Associate Professor”, for acquiring the educational and scientific degree “Doctor of Philosophy” and a complete list of all publications;
- Copies of the publications, including the acquisition of the educational and scientific degree “Doctor of Philosophy”;
- Summaries of publications in Bulgarian and English;
- Personal list of scientific achievements;
- References to the candidate's citations from Scopus, Web of Science and Google Scholar;
- Information for participation in research projects; in scientific forums; for defended doctoral students;
- Statement of the fulfilment of the minimal nationwide requirements and the requirements of the Regulations for the terms and conditions for acquisition of scientific degrees and taking an academic position in the IBPhBME-BAS.

All documents and references required for the academic position of “professor” are presented.

The presented documents and materials are very well described and arranged.

Assoc. Prof. Olympia Nikolaeva Roeva has submitted for participation in the competition 29 scientific works, all after acquiring the scientific title “Associate Professor” by the Higher Attestation Commission:

- 15 publications with Impact Factor (IF), 2 of them in quartile Q1 ([11, 12]), 4 in quartile Q2 ([1, 2, 13, 14]), 9 in quartile Q4 ([3, 4, 15, 16, 17, 18, 19, 20, 21]), total IF=21.495;
- 12 publications with SJR, 5 of them in quartile Q2 ([8, 9, 10, 24, 25]), 4 in quartile Q3 ([5, 22, 23, 27]), and 4 in quartile Q4 ([6, 7, 26]);
- 2 chapters of books ([28, 29], [29] have SJR, and is in Q4);

- in 20 publications the candidate is on the first place ([1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 14, 16, 21, 22, 23, 24, 25, 26, 28, 29]);
- all publications are in English.

All presented publications are directly related to the professional field 4.6 Informatics and Computer Science, scientific specialty Informatics. All of them are published after acquiring the scientific title “Associate Professor” and are subject to review.

2. General description of the scientific and applied research and assessment of the personal contribution of the candidate

The scientific interests of Assoc. Prof. Olympia Roeva are in a very interesting thematic area – study of metaheuristic techniques, aiming to construct optimal algorithms in terms of computational complexity and used memory.

10 publications (4 in journals with Impact Factor, and 6 in journals with SJR-rank) are listed as a habilitation thesis ([1-10]). These publications amount to 124 scores in *Indicator B4* with a minimum requirement of IBPhBME-BAS of 100 points. These scientific publications are related to the development, analysis and implementation of metaheuristic algorithms, mainly related to their application for tasks for modeling and control of fermentation processes.

The publications presented outside the habilitation thesis include 17 scientific publications in *Indicator G7* [11-27] (11 in journals with Impact Factor, and 6 with SJR-rank) and 2 chapters of books in *Indicator G8* [28] and [29] (one with SJR-rank). According to *Group of indicators G* Assoc. Prof. Roeva has 264 points with a minimum requirement of IBFBMI-BAS of 220 points. These publications continue and build on research related to habilitation work.

For participation in the competition, under *Group of indicators D* 136 citations noticed in Scopus with excluded self-citations were presented. These citations amount to 816 scores with a minimum requirement of IBPhBME-BAS of 220 points.

Assoc. Prof. Roeva has 188 points in *Group of indicators E* with a minimum requirement of IBPhBME-BAS of 150 points. In the period 2014-2016 she was the supervisor of one doctoral student of independent training in the professional field 4.6. “Informatics and Computer Science”, which successfully defended its dissertation on 12.05.2017. For the documents for the competition, the candidate provided information for participation in the teams of five national research projects to the Research Fund and three international research projects - two FP7 of the European Commission and one international project funded by DFG, together with the Institute of Technical Chemistry at the University of Hanover, Germany, in the period 2009-2013 she was the leader of a national project.

In general, Assoc. Prof. Roeva has 1442 scores, with a requirement for 640 points, that exceed more than 2.25 times the minimum number in the Regulations of IBPhBME-BAS.

The achievements of Assoc. Prof. Roeva can be defined mainly as a scientific and applied in the following way:

- For the parametric identification of non-linear models of fermentation processes of *E. coli*, seven meta-heuristic algorithms have been adapted: genetic algorithms (GA), firefly (FA), bat (BA), cuckoo (CS), artificial bee colony (ABC) algorithms, of the water cycle (WCA) and the ant method (ACO), [1-9]. Adapted algorithms without GA were applied for the first time and mathematical models with higher accuracy were obtained;
- To improve the accuracy of solutions and reduce computational resources five hybrid algorithms (ACO – GA, BA – SQP, GA – SQP, GA – FA, FA – GA) have been developed [4, 8, 9, 10]. These algorithms have been shown to be more productive and more efficient in the task of parametric identification of nonlinear models of *E. coli* cultivation;
- A procedure for setting the parameters of a metaheuristic algorithm is proposed, examining their influence on the efficiency of the GA and ABC algorithms ([2]);
- A general cascade scheme of software sensors for monitoring the kinetics of biotechnological processes has been developed and an algorithm for setting its parameters through stability analysis has been proposed [13];
- A universal generalized net model (GN) model, describing an arbitrary population metaheuristic algorithm has been constructed. The model has been verified with developed GN models of the CS, BA and FA algorithms [14, 25];
- An GN model of a standard wastewater treatment plant has been developed [20];
- Approaches for optimization and management of processes for obtaining bioproducts have been applied and an increase in productivity and at the same time a decrease in the concentration of the residual substrate has been proven [15, 16, 17, 18, 19, 21, 24, 26, 27, 28];
- The approach of the method of intercriteria analysis for analysis of the relationships of key parameters in tasks for parametric identification, etc. is applied. [11, 12, 22, 23].

The program implementations in Matlab of all adapted metaheuristic algorithms, as well as of the proposed hybrid techniques, can be defined as applied contributions.

The separate scientific and scientific-applied contributions prove the serious scientific potential and possibilities for research and critical analysis of Assoc. Prof. Roeva.

According to the “*Extended habilitation statement*” Assoc. Prof. Olimpia Roeva has a total of 223 scientific papers. 6 of them are monographs; 174 are articles in peer-reviewed international and national journals (19 of them are in journals with

Impact Factor and 43 with SJR-rank); 49 are reports from scientific conferences, published in full. In addition, for the period 2010-2020, 38 participations in scientific forums were presented, of which 34 international forums abroad and in Bulgaria and 4 participations in national forums with international participation.

The presented statements for citations show that Assoc. Prof. Olimpia Roeva has 402 citations with excluded self-citations in Scopus and h-index 11; 189 citations excluding self-citations of 61 publications in Web of Science and 1527 and h-index 20 in Google Scholar.

The candidate in the competition was awarded with 3 prizes for participation in scientific sessions, and in 2008 and 2014 with a diplomas of the Union of Scientists in Bulgaria for high scientific achievements for a young scientist and a scientist over 35 years. He is a member of two sections of the USB, the Union of Mathematicians in Bulgaria, the Union of Automation and Informatics, also, the IEEE Control Systems Society and the Scientific Monitoring and Advisory Committee to the Australian Institute of High Energetic Materials.

According to the provided information I can evaluate Assoc. Prof. Olimpia Roeva as an established scientist with proven scientific achievements in the field of application of artificial intelligence methods for mathematical modeling, control and optimization of processes. Excellent knowledge of the problems of metaheuristic algorithms and techniques and the combination with modern tools for determining the optimal algorithm confirms her as a successful and competent researcher.

4. Teaching activity of the candidate.

According to the attached autobiography of Assoc. Prof. Olimpia Nikolaeva Roeva, her teaching experience can be outlined in conducting courses of exercises in the discipline „Systems with intelligent behavior“ at the University „Prof. Dr. Asen Zlatarov“- Burgas and the discipline “Generalized Nets“ at the Technical University - Sofia.

5. Recommendations

My personal impressions of Assoc. Prof. Olimpia Nikolaeva Roeva are very good. She has serious scientific and applied scientific achievements and I would recommend to summarize in a monographic work her research and the results obtained from the analysis and adaptation of metaheuristic algorithms, the creation of hybrid algorithms to improve the accuracy of decisions and reduce computational resources, etc.

I believe that Assoc. Prof. Olimpia Roeva has enough scientific experience, and I would recommend her to focus her efforts on working with doctoral students and young researchers.

6. Conclusion

The materials and documents presented by Assoc. Prof. Olimpia Roeva are in full compliance with the Law on the Regulation of the Republic of Bulgaria and the Rules for its implementation. The number of points in the groups of scientometric indicators satisfies and exceeds the minimum number of points according to the Regulations for the Conditions and Order for Acquiring of Scientific Degrees and Academic Positions of BAS. Furthermore, in *Group D* the number of points exceeds 6.8 the minimum required number. The additional requirement and the Regulations in IBPhBME - BAS for professional field 4.6. "Informatics and Computer Science" for 15 publications in Impact Factor journals for the academic position "Professor" is also satisfied.

With all said above, I have a good reason to evaluate positively the presented materials for participation in the competition and to recommend to the honorary members of the Scientific jury to vote on a proposal to the Scientific Council of the Institute of Biophysics and Biomedical Engineering at the Bulgarian Academy of Sciences to appoint Assoc. Prof. Olympia Nikolaeva Roeva, to the academic position "Professor" at the "Bioinformatics and Mathematical Modelling" Department, in the field of higher education: 4. Natural Sciences, Mathematics and Informatics; professional field 4.6. Informatics and Computer Science; scientific specialty "Informatics".

13.03.2021
Burgas

Signature:.....
(Prof. E. Sotirova)