

REFeree REPORT

by Prof. Dr. Dr. Habil Nedyu Ivanov Popivanov,

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regarding an application in a competition for the academic position of "Professor"

at Plovdiv University "Paisiy Hilendarski" by field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.5. Mathematics (Differential Equations)

In the competition for "professor", announced in the State Gazette, no. 92 of 18.11.2022 as well as on the website of Plovdiv University "Paisii Hilendarski", for the needs of the Department of "Mathematical Analysis" at the Faculty of Mathematics and Informatics at Plovdiv University "Paisii Hilendarski", as the only candidate submitted documents Assoc. Prof. Atanaska Tencheva Georgieva from the Department of "Mathematical Analysis" at FMI at "Paisiy Hilendarski" PU.

1. General presentation of the received materials

By order PD-21-338 of 15.02.2023 of the Rector of the University of Plovdiv "Paisiy Hilendarski", I have been appointed as a member of the scientific jury of a competition for the above-mentioned position. At the first meeting of the jury, on the proposal of the newly elected chairman Prof. Dr. Hristo Kiskinov, I was designated as a referee for the competition. I received the following documents electronically:

01. Application for participation in the competition.
02. Resume in European format.
03. Complete list of scientific works.
04. List of scientific works for participation in the competition.
05. Certificate of compliance with the minimum national requirements.
06. Certificate of compliance with the additional requirements of the FMI.
- 10.1 Summaries of scientific works without addresses-BG.
- 10.2 Abstracts of scientific works without addresses-EN.
11. Author reference for the scientific contributions in the works for participation in the competition.
12. Habilitation certificate.
- 13.1 Reference for audit and non-audit activity.
- 13.2 List of published textbooks and study aids.

13.3 Reference for activities with students and doctoral students.

14.1 Research Reference.

14.2 Reference for participation with reports in international and national scientific forums.

14.3 Reference for participation in research and educational projects.

14.3 Reference for participation in research and educational projects.

14.5. List of references for MR.

14.6 Reference to membership in professional organizations.

16. List of citations for participation in the competition.

18. Declaration of originality.

The listed documents fully exhaust the list of documents required under the Law on the Development of the Academic Staff and the Rules for its Implementation, as well as according to the specific requirements adopted by the FMI at PU "Paisiy Hilendarski". The documents are well formatted and organized. For participation in the competition for the academic position of "professor", 23 scientific publications and 2 textbooks were submitted. The scientific publications are in editions referenced in at least one of the global databases Web of Science, Scopus and Zentralblatt Math and do not repeat those submitted for the acquisition of the educational and scientific degree "doctor", as well as for holding the academic position "associate professor". Of the publications presented, 8 are in journals with an impact factor.

I would like to point out here that the candidate fully satisfies the minimum requirements under PRZRASRB and the additional requirements of FMI at PU "Paisiy Hilendarski" for occupying the academic position "professor" in professional direction 4.5 Mathematics, which can be seen from the following table:

Indicator group	Assoc. Prof.Dr A. Georgieva	Number of points under PRZRASRB	Points by Accoc. Prof. Dr. A. Georgieva
A	Dissertation work for ONS "doctor"	50	50
B4	Habilitation thesis - scientific publications (5 publications presented)	100	150
G7	Scientific publications (18 publications presented)	200	678
D11	Citations - 32	100	256
E	Guidance of 2 successfully defended doctoral students, participation in 1 national scientific project, 2 university textbooks published	100	190

This review shows that all requirements are even exceeded. Candidate Assoc. Prof. Doctor Atanaska Georgieva graduated in Mathematics at the Faculty of Mathematics and Informatics at SU "St. Kliment Ohridski" in 1991. In 2009, she obtained the Doctorate of the National Academy of Sciences, and since 2012 she has held the academic position of "Associate Professor". in Mathematics 4.5 at PU "Paisii Hilendarski". I will note here that I was a reviewer for the competition for an associate professor, so I am aware of the development of the candidate for the current competition as a scientist.

2. General characteristics of the applicant's activity

2.1. Assessment of educational and pedagogical activity

Associate Professor Dr. Atanaska Georgieva has over 25 years of teaching experience. After being elected as an associate professor in 2012, she prepared and gave the following lecture courses to students from FMI: "Mathematical Analysis"; "School Course in Analysis"; "Applied Mathematics"; "Ordinary differential equations" and "Partial differential equations".

I have no specific observations about the scientific and methodical level of the lectures and exercises led by Prof. Georgieva. However, I will note that according to the attached references, she actively works with undergraduates, graduates and PhD students, and even has 3 joint publications with PhD students, which I greatly appreciate! There are also 7 successfully defended diplomas at FMI.

When choosing a teacher, I always pay extra attention to the documented teaching activity. Assoc. Dr. Atanaska Georgieva is the author of two textbooks, one of which was developed only by her and is intended for use by students studying at the Faculty of Mathematics and Informatics of PU "Paisiy Hilendarski". The level is good! The other textbook is "Mathematics" [E19.1] and contains a course of lectures and exercises, consistent with the program of the discipline "Higher Mathematics" for the bachelor's degree of the Faculty of Technology at the University of Food Technologies - Plovdiv.

Here I have **a practical piece of advice** for the candidate: for at least 10 years I have been leading an elective course for students of Informatics and Applied Mathematics who are not very familiar with the more serious parts of Mathematical Analysis, ODU and ChDU. How can such students be helped to get to the bottom line? My answer is: by introducing more practical applications into the material and by computer visualization of the corresponding real processes! A modern example from recent years: the study of the system of nonlinear ODEs describing Covid 19! Teaching methods have changed a long time ago, and according to the materials presented, Prof. Georgieva clearly has the potential and opportunity to cope with a similar approach at a level.

I will note here that the supervision of doctoral students is not a mandatory requirement according to the ŽARSRB and the Regulations for its application, but for me, building future researchers is the professional duty of every scientist! I positively assess the efforts of Associate Professor Georgieva: she is the only supervisor of two PhD students who successfully defended their PhDs at FMI, respectively in 2015 and 2022 (see Reference 13.3).

2.2. General characteristics of the candidate's scientific activity

The entire volume of scientific papers (see Full list of scientific papers) includes a total of 69 papers. Of these, the candidate submitted 23 scientific publications for participation in the competition. From them:

- 1 is independent, the others - with more authors. The author has convincingly proven her ability to work together with a number of colleagues, which is a definite positive quality of hers.

- 8 are in journals with an impact factor (total IF=7.02): 1 in Q1; 4 in Q2; 1 in Q3 and 2 in Q4;

I will also note that some of the above scientific journals are well placed in our college: Journal of Inequalities and Applications, Applied Mathematics & Information Sciences, An International Journal, Electronic Journal of Differential Equations, Electronic Journal of Qualitative Theory of Differential Equations, Mathematical Methods in the Applied Sciences; several in AIP Conference Proceedings.

- All 23 publications are indexed in Web of Science, SCOPUS and Zentralblatt. - -

Here I will note that according to a reference from the head of the "Mathematical Analysis" department Prof. Dr. Hristo Kiskinov, Assoc. Dr. A. Georgieva participated in a total of 4 national and university research or educational projects, of which: 1 national and 3 university projects in FMI at PU:

Contributions and citations

I will follow the thematic classification of the works proposed by Prof. Georgieva in the author reference. According to the candidate, thematically the main scientific and scientific-applied contributions can be tentatively divided into three areas:

• Approximate solutions of fuzzy integral equations.

In this direction are the publications [B4.1] - [B4.5], [G7.9]-[G7.11], [G7.13] - [G7.15], [G7.17] and [G7. 18].

Here I will note that unlike publications [B4.1] - [B4.5] and [D7.18], where homotopic techniques were used, in publications [G7.9]-[G7.11], [G7. 13]-[G7.15], numerical solutions of two-dimensional fuzzy integral equations and fuzzy functional-integral equations of Hammerstein and Urison-Volterra have already been studied. Sufficient conditions for the existence and uniqueness of the solution of the studied equations are obtained using constructed iterative methods for the successive approximations. Fuzzy cubic and quadrature formulas are also used. A good convergence of the proposed methods is shown. I also liked the fact that all the obtained results are illustrated with examples. This to me is a sign of a good understanding of the essence of the results!

• Ordinary differential equations.

Here is the most serious group of publications: [G7.1], [G7.2], [G7.6] and [G7.12]. [G7.3], [G7.4] and [G7.16].

I will pay some more attention on the paper:

G7.1. Georgieva A., Kostadinov S., Stamov G., Alzabut, J. O., On $L_p(k)$ -equivalence of impulsive differential equations and its applications to partial impulsive differential equations, *Advances in Difference Equation*.

In it, the Schauder-Tikhonov fixed point theorem was used, in which sufficient conditions were found for the existence of $L_p(k)$ -equivalence between a linear and a nonlinear perturbed impulse differential equation with an unbounded linear part in an arbitrary Banach space. The obtained theoretical results are illustrated with an example of the partial differential equations of the parabolic type. Although the connection between the two types of equations seems quite natural, applying a similar technique to me is at least non-trivial! The conditions of Theorem 1 seem rather severe, but the established equivalence gives good information! Momentum equations provide descriptions of real processes and such relationships are important enough in my opinion!

Using two dichotomy variants for homogeneous linear differential equations in a Banach space, sufficient conditions for the existence of ψ -bounded solutions of the inhomogeneous equations were found in [G7.2]. The corresponding roughness of the ψ -dichotomy was investigated, i.e. non-destruction of the picture with small perturbations.

Other types of equivalences are investigated in publications [G7.6] and [G7.12]. And here the results are confirmed with numerical examples!

In publication [G7.3], Razumihin's method for obtaining parametric stability for nonlinear differential equations with "maxima" is applied. Two different types of Lyapunov functions are applied.

In publication [G7.4] explicit sufficient conditions for the existence of several types of non-oscillating solutions of a linear system with a delay argument of neutral type with distributed delay are found. And here the results are obtained using numerical analysis technique.

• Integral equations.

In this direction are the publications [G7.5], [G7.7] and [G7.8].

In [G7.5] and [G7.7], a generalization of linear and nonlinear Volterra integral equations of the first and second order when the independent variable belongs to a rather wide class of spaces is considered. Sufficient conditions for the existence and uniqueness of the solutions of the considered equations have been obtained. Some applications of the obtained results for integral inequalities are given.

In [G7.8] a numerical method for finding a numerical solution of a perturbed linear integral equation of Volterra is proposed. Sufficient conditions for the existence and uniqueness of a continuous solution in a finite and closed interval of the studied equation are

found. The convergence of the used numerical method is proven. All obtained results are supported by examples.

2.3. General characteristics of the publications presented for the competition:

My general impression of the candidate's scientific and applied scientific contributions is that they are interesting, new and meaningful. Above, I gave a numerical expression of the number of independent citations - 32. Here, in addition, I will note that the citations are mainly from foreign authors. All of them are in journals indexed in Web of Science and/or SCOPUS.

2.4. Evaluation of the candidate's personal contribution

I have no doubt about the candidate's authorship of the publications and textbooks submitted for review. In joint publications, I take the participation of the authors as equal (by presumption). I have not detected any plagiarism.

2.5. Critical remarks and recommendations

I have no additional remarks and recommendations for the candidate, beyond those noted during the review. Here, however, I will recall a text from my review on the election of Dr. Atanaska Georgieva as associate professor in 2012:

"Here I want to make a more general recommendation. I personally appreciate some of the results obtained by the candidate and consider that they could be published in more prestigious places. I believe that in this regard, more could definitely have been done! Of course, this is just wishful thinking, but I wish the candidate would consider it for the future."

Studying the materials for the current competition, I would like to note with pleasure that the candidate in it, Assoc. Prof. Dr. Atanaska Georgieva, fully met my expectations for her more active work in the mentioned direction!

CONCLUSION

The documents and materials presented by Assoc. Prof. Dr. Atanaska Tencheva Georgieva meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of the ZRASRB and the Regulations for the Development of the Academic Staff of the Paisii Hilendarski University of Plovdiv " for occupying the academic position of "professor".

The results achieved by the candidate in the educational and research activities fully correspond to the additional requirements of the Faculty of Mathematics and Informatics.

After familiarizing myself with the materials and scientific works presented in the competition, analyzing their teaching, scientific and scientific-applied contributions, as well as their approval by the scientific community, I give my **positive assessment**. I recommend the Scientific Jury to prepare a report-proposal to the respected Faculty Council of the Faculty of Mathematics and Informatics for the election of **Assoc. Prof. Dr. Atanaska Tencheva Georgieva to the academic position of "Professor"** at PU "Paisiy Hilendarski" in: area of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.5. Mathematics (Differential Equations).

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Sofia

Prepared the Referee Report:

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