

A Review Report

on the competition for the occupation of the academic position PROFESSOR in the Bishop Konstantin Preslavski University in the State Gazette, issue 55 of 12.07.2019 in the field of higher education: 4. Natural sciences, mathematics and informatics, professional field: 4.5 Mathematics, scientific specialty: Computational Mathematics with a single candidate Assoc. Prof. Vejdi Ismailov Hasanov

by a member of the Scientific Jury: Prof. Dr.Sci. Ivan Ganchev Ivanov - Dobrich College of the Bishop Konstantin Preslavski University

1.General description of the materials presented

By Order No. RD - 16 - 090 of September 11, 2019 of the Rector of the University of Shumen, Bishop Konstantin Preslavski (SU), I was appointed a member of the scientific jury for conducting the announced in the State Gazette, issue. 55 of 12.07.2019 competition for occupation of the academic position of "Professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.5. Mathematics (Computational Mathematics). The only candidate for the competition is Assoc. Prof. Dr. Vejdi Ismailov Hasanov, under a permanent employment contract at the Department of Economics and Mathematical Modeling of the Faculty of Mathematics and Informatics, University of Shumen, Bishop Konstantin Preslavski. At the first meeting of the Scientific Jury (Protocol No. 1) I was selected as the reviewer of the applicant.

The presented set of materials on the competition in electronic and hard copy is in accordance with Art. 3, 3 of the ZRASRB and Art. 60, paragraphs 1, 2 and 3 of the PPZRASRB. The applicant meets the minimum national requirements under Art. 3, 3 of the ZRASRB and Art. 60, paragraphs 1 and 2 of the PPZRASRB. I accept the submitted reference for original scientific contributions in accordance with Art. 60, para 3 of the PPZRASRB.

Twelve scientific publications have been attached, of which 5 are independent and 7 are co-authored. Of those co-authored - two with S. Hakayev, two with PhD student Aynur Ali, one with Gyurhan Nedzhibov and two with PhD student Desislava Borisova. Of the

publications, six were published in the impact factor journals, four were in SJR journals, one was indexed in MathSciNet and one was in a non-indexed journal.

The competition materials are accompanied by 3 teaching aids - one electronic textbook, and two textbooks, respectively by linear optimization and numerical methods. The materials offered - publications and teaching aids - have not been used by the applicant in previous competitions: to obtain a PhD degree and to hold an academic associate professor position.

Currently, Assoc. Prof. Hasanov is working with two PhD students.

The scientific problems discussed in the submitted scientific publications are within the scientific specialty of the announced competition in Computational Mathematics. Scientific publications clearly outline the main purpose of the candidate's research work - the search for new iterative methods (for solutions of nonlinear matrix equations and scalar nonlinear equations) and to derive more effective perturbation estimates of the solutions of special nonlinear matrix equations.

2. Short biographical details of the applicant

Prof. Dr. Vejdi Ismailov Hasanov was born in May 29, 1971. He received his mathematical education at the Faculty of Mathematics and Informatics of the Bishop Konstantin Preslavski University of Shumen, majoring in Mathematical Analysis, Master of Mathematics. He defended his doctoral thesis in 2004 at the Bishop Konstantin Preslavski University of Shumen with a dissertation topic "Solutions and perturbation theory of nonlinear matrix equations". In the period 1997-2007 he worked consecutively as an assistant, senior assistant and chief assistant at the Bishop Konstantin Preslavski University. In 2007 he was habilitated as Assistant Professor of Computational Mathematics at the same workplace. Assoc. Prof. Dr. Vejdi Khasanov has a 22-year teaching experience at the Bishop Konstantin Preslavski University and has conducted exercises and lectures on numerical methods and linear optimization.

3. Scientific papers

The main scientific contributions of the applicant can be conditionally divided into the following main areas:

a) Derivation of iterative methods for finding special solutions for nonlinear matrix equations presented by publications [3,5,6,7,11];

- b) Investigating and deriving new perturbation estimates of special solutions for nonlinear matrix equations presented through papers [1,4,8,9,10,12];
- c) Iterative methods for solving nonlinear scalar equations – paper [2].

3.1. The publications [3,7, 11] discuss the matrix equation

$$X + A^*X^{-1}A - B^*X^{-1}B = I. \quad (1)$$

Hasanov, in collaboration with his PhD student, Aynur Ali, explores some iterative methods for a positive definite solution. Sufficient conditions have been proved for the convergence of the iterative methods. As a next step in studying the solutions of (1) in [11], sufficient conditions are obtained for the positive definite solutions of (1) and for the minimum positive definite solution. Here, the author has listed the sets in which the solution is sought. The paper [11] was published in the journal with an impact factor of 0.964, which confirms the importance of the properties proved by the author in the paper.

The publications [5,6] are devoted to the matrix equation:

$$X + \sum_i A_i^*X^{-1}A_i = Q, \quad (2)$$

which analyzes several iterative methods for finding its maximum solution. Theorems on the convergence nature of the considered iterative methods are proved.

3.2. Publications dedicated to perturbation analysis of special solutions for nonlinear matrix equations are [1,4,8,9,10,12].

In the first paper [1], the author improves previously obtained perturbation estimates for the maximum positive definite solution of the matrix equation $X + A^*X^{-1}A = Q$ and for the only positive definite solution for the equation $XA^*X^{-1}A = Q$. In [1] Assoc. Hasanov raises the question of the choice of a matrix that transforms the given equation so that the condition of convergence is fulfilled. Although this article has so far been quoted 12 times, this question is answered in article [10]. The article [8] summarizes the result of [1] and provides an effective evaluation that improves the result of other authors. [4] derive perturbation estimates for the classical Riccati equation. This article summarizes the perturbation analysis technique derived from Sun 1998. Publication [9] supplements publication [6] because it provides perturbation estimates for the maximum positive definite solution of the equation (2). At the same time, the authors of [9] summarize the results of other authors. In [10 and 12], perturbation estimates for the solutions of the equation $X - \sum_i A_i^*X^{-1}A_i = Q$ are again derived.

3.3 Publication [2] presents two iterative methods, which are generalizations of the Newton method, for the search for the root of a nonlinear scalar equation. Although on this topic the author has submitted one publication from the general list of publications,

it is evident that it is not isolated in his scientific research and the results obtained by him for significant and cited by other researchers.

Teaching materials offered by Assoc. Prof. Vezhdi Hasanov - provides a textbook and a teaching tool showing the profound knowledge of Assoc. Prof. Hasanov and skills to shape my knowledge and present it to my students in an intelligible form and form.

4. Scientific contributions

I regard the applicant's contributions as scientific and applied. In the research work of Assoc. Prof. Hasanov, groups of related articles are observed, which trace a sequence of stages on the study of a particular mathematical object, in this case, the corresponding nonlinear matrix equation. The existence of a specific solution, an iterative method for finding it, deducing the conditions for convergence of an iterative method are consistently analyzed, and at the last stage an assessment is made for a possible deviation of the calculated solution from the exact solution, ie. perturbation estimates are derived. So far, the following related series of scientific publications have been formed with the participation of Assoc. Prof. Hasanov [5-6-9], [8-10-12], [3-11]. The presence of related scientific publications on a particular mathematical object indicates that Assoc. Prof. Hasanov **creates** a methodology and an approach for the study of various nonlinear matrix equations. In implementing this methodology, Prof. Hasanov manages to combine classical mathematical theory and creatively apply it in the study of new nonlinear matrix equations. Example in this direction is article [5] and the formulated Theorem 3.1, whose proof uses a basic theorem of functional analysis, namely the Crane-Rutman theorem. At the same time, condition (4) of Theorem 3.1. summarizes the result of Guo and Lancaster (for reference Remark 2.1 of paper [6]).

5. Effect of the applicant's scientific activity

According to the Scopus database the scientific papers of Assoc. Prof. Hasanov have been cited 399 times in scientific publications in the same database. The number of citations without all citations of all publications is 356. After 2006 citations without citation are 318.

The citations of the articles proposed by the author in the professor competition which are reflected in the Scopus database is the following. Article [1] has 12 citations and 4 auto-citations. Article [3] has 1 citation and 1 auto-citation. Article [4] has 2 citations. Article [5] has 2 citations and 2 auto-citations. Article [6] has 3 citations and 1 auto-citation. Article [7] has 1 citation and 2 auto-citation. Article [11] has 1 citation.

The low number of citations to the publications on the candidate's professor list is due to the fact that the articles have been published in recent years and are not sufficiently popular with the scientific experts in the subject. The Scopus h-index of Assoc. Prof. Hasanov is equal to 10. It is a strong evidence of the importance of Assoc. Prof. Hasanov's research.

6. Conclusion

The analysis of the applicant's scientific and teaching activity shows that he has proven scientific contributions in the scientific field of the competition, as well as very active teaching activity. The applicant's results have been published in prestigious magazines, many of which have an impact factor. The works of the candidate are well cited in the scientific literature at home and abroad. No violations were found under the competition procedure.

I strongly recommend to the Faculty Council of Mathematics and Informatics Faculty of the Bishop Konstantin Preslavski University to choose Assoc. Prof. Vezhdi Ismailov Hasanov in the academic position of "Professor" in the professional field 4.5 Mathematics, scientific specialty "Computational Mathematics".

27 October 2019

Scientific Jury's member

Prof. Ivan Ivanov

