

## **Review Report**

in connection with the competition for the occupation of the academic position of  
"Professor"

in higher education 4. Natural sciences, mathematics and informatics

Professional Direction 4.5. Mathematics

(major in Computational Mathematics)

for the needs of Shumen University "Bishop Konstantin Preslavski"

Faculty of Mathematics and Informatics

The competition is announced in the State Gazette, issue. 55 of 12/07/2019

**Reviewer:** Velizar Todorov Pavlov, Professor of Mathematical Modeling and Application  
of Mathematics, University of Ruse

### **Contest details**

This review was prepared on the basis of Order No. RD-16-090 of September 11, 2019 from the Rector of the University of Shumen, based on a decision of the Faculty of Mathematics and Informatics ( No. FC-02-01 / 10.09.2019). The competition is announced in the State Gazette, issue. 55 / July 12, 2019.

The only candidate in the contest is Assoc. Prof. Dr. Vejdi Ismailov Hasanov of the University of Shumen, Faculty of Mathematics and Informatics (FMI). No competition violations have been identified.

### **1. Brief biographical information**

Prof. Dr. Vejdi Hasanov graduated from Bishop Konstantin Preslavski University of Shumen in 1997 with a Master's Degree in Mathematics, and in 2003 received his Doctorate in Mathematics. From 1997 to 2007 the candidate was consecutively assistant, senior assistant and chief assistant at the University of Shumen, and in 2007 was elected associate professor in the field of Computational Mathematics.

Assoc. Prof. Hasanov has extensive administrative experience. He was the Vice-Dean of the Faculty of Mathematics and Informatics, Head of the Department of Economics and Mathematical Modeling, and from 08.2017 until now he is the Dean of the Faculty of Mathematics and Informatics at the University of Shumen.

## 2. General description of the presented materials

Assoc. Prof. Dr. Vejdi Hasanov participated in the competition with 12 scientific publications, 2 textbooks and 1 study guide. The publications can be classified as follows:

by type: 12 articles;

by relevance:

Impact Factor (IF) Articles - 6 Issues [1, 4, 5, 6, 7, 11],

Impact Rank (SJR) Articles - 4 issues [3, 8, 9, 12],

MathSciNet Indexed Articles - 1 issue [2],

articles in foreign editions - 1 issue [10];

by place of publication: all 12 articles have been published abroad;

in the language in which they were published: all 12 articles were published in English;

by number of co-authors: independent - 5 publications [1, 4, 8, 10, 11]; with one co-author - 7 publications [2, 3, 5, 6, 7, 9, 12].

## 3. Reflection of the candidate's scientific publications in the literature (known citations)

Assoc. Prof. Dr. Vejdi Hasanov has provided a list of 21 articles, which have been cited 327 times in total by bulgarian authors and foreign authors, with a strong predominance of citations by foreign authors. What is striking is the large number of citations to the following 4 articles:

I.G. Ivanov, V.I. Hasanov, B.V. Minchev, On matrix equations  $X \pm A * X^{-2} A = I$ , Linear Algebra and its Applications, 326, (2001), pp.27-44 – **cited of 45 times**;

V.I. Hasanov, I.G. Ivanov, Solutions and perturbation estimates for the matrix equations  $X \pm A * X^{-n} A = Q$ , Applied Mathematics and Computation, 156, (2004), pp.513-525 - **cited of 36 times**;

I.G. Ivanov, V.I. Hasanov, F. Uhlig, Improved methods and starting values to solve the matrix equations  $X X \pm A * X^{-2} A = I$  iteratively, Mathematics of Computation, 74, (2005), pp.263-278 - **cited of 50 times**;

V.I. Hasanov, Positive definite solutions of the matrix equations  $X \pm A * X^{-q} A = Q$ , Linear Algebra and its Applications, 404, (2005), pp.166-182 - **cited of 51 times**;

The above list is a solid proof that Assoc. Prof. Dr. Vejdi Hasanov is a well-established scientist in the field of Computational Mathematics with wide renown abroad.

#### 4. Reference for the fulfillment of the minimal scientometric requirements for occupation of the academic position of "professor" in Professional Direction (PD) 4.5 Mathematics

In the table below, I present a summary of the applicant's data, compared to the minimal scientometric requirements for occupying the academic position of "Professor" in PD 4.5 Mathematics, according to ZRASRB and PPRASRB, which shows that Assoc. Prof. Dr. Vejdi Hasanov degree fulfills or even exceeds these requirements.

Group	Content	Professor	Applicant's data
<b>A</b>	<b>Indicator 1</b>	<b>50</b>	<b>50</b>
	1. PhD thesis for the award of educational and scientific degree "Doctor"	50	50
<b>B</b>	<b>Indicators 3 or 4</b>	<b>100</b>	<b>123</b>
	4. Habilitation work - scientific publications in issues that are referenced and indexed in world-renowned databases of scientific information (Web of Science and Scopus). For PD 4.5 additional factor 3.	Publications in Q1–25 points per a publ. in Q2–20 points per a publ. in Q3–15 points per a publ. in Q4–12 points per a publ. issue with SJR without IF – 10 points 6 points for others	1 *25*3=75  1 *10*3=30 1 *6*3=18
<b>C</b>	<b>The sum of indicators from 5 to 9</b>	<b>200</b>	<b>351</b>
	7. Scientific publication in journals that have been referenced and indexed in world-famous scientific information databases (Web of Science and Scopus), outside the habilitation thesis. For PD 4.5 additional factor 3.	Publications in Q1–25 points per a publ. in Q2–20 points per a publ. in Q3–15 points per a publ. in Q4–12 points per a publ. issue with SJR without IF – 10 points 6 points for others	1*25*3=75 1*20*3=60 2*15*3=90 1*12*3=36 3*10*3=90 -
<b>D</b>	<b>The sum of indicators from 11 to 11</b>	<b>100</b>	<b>2616</b>
	11. Citations in scientific publications, monographs, collective volumes and patents, abstracted and indexed in world famous databases with scientific information (Web of Science and Scopus). For PD 4.5 additional factor 4.	2  1 others	21 publ. are cited 327 times*2*4= = 2616
<b>E</b>	<b>The sum of indicators from 12 to 20</b>	<b>150</b> <b>(100 for PD 4.5)</b>	<b>150</b>
	14. Participation in a national scientific or educational project	10	5*10=50
	19. Published university textbook or textbook used in the school network	40/n	2*40=80
	20. Published university study guide or study guide used in the school network	20/n	1*20=20

The above information is based on the information prepared by the applicant for the fulfillment of the minimal scientometric requirements for occupying the academic position of "professor" in the PD 4.5 Mathematics, the indicators of groups C and D are based on 11 of the submitted articles for participation in the competition. Publication [10] was not taken into account.

## **5. General characteristics of the applicant's activities**

### **5.1. Educational activity** (work with students and doctoral students)

The teaching and teaching activities of Assoc. Prof. Dr. Vejdi Hasanov are rich and varied. He is the holder and holds lectures in a number of compulsory subjects: Numerical Methods, Mathematical Optimization, Linear Optimization and Elective Courses: Matrix Analysis, Nonlinear Optimization, Optimization Methods for Economic Analysis, which are taught by students at the University of Shumen. Works actively with students and PhD students. Under his guidance, 10 students successfully defended their thesis. He is a scientific supervisor of two PhD students - one with a defense degree and one in the course of study. Under the Erasmus program, he has visited Aidan University in Istanbul - 2013 and 2015, and Namak Kemal University in Tekirda - 2014.

It is clear that Assoc. Prof. Dr. Vejdi Hasanov is not only an established scientist but also a highly qualified university lecturer and lecturer.

### **5.2. Scientific and applied scientific activity**

The applicant's scientific activity should be supplemented by his participation and project management in the internal research fund of the University of Shumen. The following projects have been successfully managed and implemented:

№ RD-05-473/07.05.2008 " Models of optimal control "

№ RD-05-285/11.03.2009 " Models of optimal control "

№ RD-08-123/06.02.2017 " Matrix equations in control theory "

№ RD-08-145/08.02.2018 " Nonlinear scalar and matrix equations and risk models "

### **5.3. Contributions** (scientific, scientific, applied)

The applicant's scientific results can be grouped thematically into the following two areas:

1. Investigations of some special classes of nonlinear matrix equations.

2. Convergence studies of some known iterative methods for solving nonlinear equations under certain conditions in the problem statement.

I would like to point out that **first-line research** has a decisive weight. In [1], a matrix equation of the type  $X \pm A^* X^{-1} A = Q$  is considered, where A and Q are complex square matrices,  $A^*$  is a conjugate matrix, Q is a positive definite matrix and the corresponding perturbed equation  $\tilde{X} \pm \tilde{A}^* \tilde{X}^{-1} \tilde{A} = \tilde{Q}$  for which conditions for the existence of a maximal positive definite solution are formulated and obtained relevant theoretical estimates. In [3] and [11] the matrix equation  $X + A^* X^{-1} A - B^* X^{-1} B = I$  is investigated where A and B are square matrices, and I is the identity matrix. Weakened sufficient conditions have been proposed for the existence of a positive decision. The necessary and sufficient conditions for the existence of positive definite solutions are derived, as well as the condition for the existence of a minimal positive definite solution. Author has described sets, in which the solutions are sought.

In [4], the Riccati matrix equations are considered, which are linearly perturbed with a linear positive operator. The c-stability of the perturbed solutions is proved. In [5] and [6], a generalized nonlinear matrix equation of the type  $X + \sum_{i=1}^m A_i^* X^{-1} A_i = Q$  is considered, for which the maximal positive definite solution by the Newton method is found. The global convergence of the used method has been proved. The rate of convergence of the method of successive approximations was investigated to find the maximal solution of the considered matrix equation. In addition, two modifications of this non-inverting matrix method have been proposed. Depending on certain conditions, R-linear convergence or sublinear convergence of the iterative process is proved. The studies made in [7] are similar to those in [6] for the same matrix equation  $X + \sum_{i=1}^m A_i^* X^{-1} A_i = Q$  in the case  $m = 2$ . A similar matrix equation  $X - \sum_{i=1}^m A_i^* X^{-1} A_i = Q$  and the corresponding perturbed equation are considered in [8], for which a theoretical estimate of its extremal solution is derived. In [9], the same matrix equation  $X + \sum_{i=1}^m A_i^* X^{-1} A_i = Q$  was considered, for which several perturbation estimates were obtained for its positive definite solution.

In [10], the perturbation estimate for the extreme solution obtained in [8] is considered, and the answer to the question posed in [1] and [8] is given to select a positive definite matrix  $P$  so that the condition  $\|PX_+^{-1}AP^{-1}\|_2 < 1$  is satisfied, where  $X_+$  is the extreme solution of the equation in question. In [12], the matrix equation  $X - A^* \hat{X}^{-1} A = Q$  is considered and a comparative analysis of some existing perturbation estimates for the only positive definite solution is made. The estimates of Sun, Yin and Fang, Konstantinov et al., Hasanov are considered and compared. The comparisons are based on numerical experiments that show that the estimates of Sun, Konstantinov, and Hasanov have similar efficiencies, whereby the estimates of Hasanov are based on relatively simpler computational formulas.

An important merit of all studies in this area is that they are accompanied by numerous numerical experiments that confirm the theoretical results.

**In the second area**, one work is presented [2]. It deals with a nonlinear equation of the general kind  $F(x) = 0$ , where  $F$  is an operator defined and differentiated by Frechet on an open subset  $D$  of Banach space  $X$  with values in Banach space  $Y$ . The rate of convergence of two iterative methods for solving is investigated: Newton's secant method and modification of this method. Some conditions introduced under which the cubic rate of convergence of the original Newton method and the quadratic rate of convergence of the modified method are proved. Numerical experiments are presented to confirm the theoretical results.

The Textbook of *Lectures on Numerical Methods*, ISBN 978-954-577-860-5, p. 139, 2014 is published electronically by the CDC of the University of Shumen. It contains eight chapters. It focuses on the following topics: interpolation; approximation of functions in normalized spaces; Newton-Coates quadrature formulas; solving nonlinear equations, numerically solving systems of linear equations; numerical methods for finding eigenvalues and vectors of matrices. The last chapter contains the necessary minimum of knowledge needed by the reader in mathematical analysis and linear algebra. At the end of each paragraph are included control questions and tasks to verify the theoretical material learned.

The Textbook of *Linear Optimization*, ISBN 978-619-201-327-1, pp. 192, 2019 is intended for students of specialties whose curriculum includes the discipline of the same name. Its content goes beyond the traditional undergraduate lecture course. Contrary to what is expected, saving much of the proof of the theorems, the author has included them here in

his quest to answer even the most inquisitive and pretentious reader. Numerous control questions and tasks for independent work are included.

The study guide of *Matlab Manual for Numerical Methods*, second revised and supplemented edition, ISBN 978-619-201-310-3, pp. 248, 2019, is consistent with the curriculum for the discipline of Numerical Methods. The guide is divided into paragraphs, which are grouped into six chapters and one application, Introduction to Matlab. It contains important theoretical notes, numerous solved examples, and independent work.

Assoc. Prof. Dr. Vejdi Hasanov's claims for contributions, in a volume of 15 pages, coincide with the abstracts of the submitted papers for participation in the competition. I do not think this is the best way to formulate contribution claims.

## **6. Assessment of the applicant's personal contribution**

There is no reason to believe that the results obtained are not a personal matter of the applicant and his co-authors. In terms of volume and quality, they fully satisfy, and in some cases exceed, the requirements of the ZRASRB, RASRRRB and the Rules of the University of Shumen for the development of academic staff for the occupation of the academic position of "Professor" in the PD 4.5 Mathematics.

## **7. Critical notes and recommendations**

As I have already noted, the applicant's contribution claims should be formulated in a more synthesized and refined form. The relationship of the studied matrix equations to practice is not indicated.

## **8. Personal impressions**

I know the applicant as a highly erudite person with extensive knowledge of various fields of mathematics and its applications.

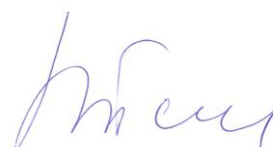
## **9. Conclusion**

From the foregoing it can be seen that Assoc. Prof. Dr. Vejdi Ismailov Hasanov is a highly valued specialist in the field of computational mathematics with considerable quantity and quality of achievements, as well as with extensive experience in this field. This gives me a reason to give a positive assessment and to conclude that the applicant's work, teaching and qualities satisfy the requirements of the ZRASRB, the Rules for its application

and the Rules of the University of Shumen for the development of the academic staff for the occupation of the academic position "Professor". That is why I am convinced that I propose Assoc. Prof. Dr. Vejdi Ismailov Hasanov to be selected as "Professor" at the Bishop Konstantin Preslavski University of Shumen, Higher Education Area 4. Natural Sciences, Mathematics and Informatics, Professional Direction 4.5. Mathematics, major in Computational Mathematics.

October 21, 2019

Signature:

A handwritten signature in blue ink, appearing to be 'V. Ismailov', written in a cursive style.