

REVIEW

by Prof. Dr. Vejdi Ismailov Hasanov
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on the materials submitted for participation in a competition
for an occupation of the academic position "Associate Professor"
at Plovdiv University "Paisii Hilendarski"

in the field of higher education 4. Natural Sciences, Mathematics and Informatics,
professional field 4.5. Mathematics (Approximation models and applications).

In the competition for "Associate Professor", announced in the State Gazette, 96 of 17.11.2023 and on the website of Plovdiv University "Paisii Hillendarski" (PU) for the needs of the "Computer Technologies" department at the Faculty of Mathematics and Informatics, as a candidate Ch. Assistant Professor Dr. Maria Tonkova Vasileva-Chilibinova from Plovdiv University.

1. General presentation of the received materials

By order No. PD-21-389 of 16.02.2024 of the Rector of Plovdiv University "Paisii Hilendarski", I have been appointed as a member of the scientific jury of a competition for the academic position of "Associate professor" at the PU in the field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.5. Mathematics (Approximation models and applications), announced for the needs of the "Computer Technologies" department at the Faculty of Mathematics and Informatics (FMI) of the PU.

To participate in the announced competition, **the only candidate** Ch. Assistant Professor Dr. Maria Tonkova Vasileva-Chilibinova from PU has submitted documents.

The set of competition materials provided to me includes the following documents:

- Order of the Rector of the PU – RD-21-389/16.02.2024;
- Application form to the rector for admission to participate in the competition;
- Curriculum vitae in European format;
- Diplomas for higher education with an acquired master's degree from 2012 and for doctor's degree from 04.15.2016;
- Lists of scientific works and teaching aids – the all and those on the competition;
- Lists of citations – after occupation of the Academic position "Ch. Assistant Professor" and the publications on the competition;

- References for the implementation of the minimum national requirements and the additional requirements of the FMI at the PU;
- Annotations of the materials under Art. 65. from RDASPU and self-assessment of contributions in Bulgarian and English languages;
- Declaration of originality and authenticity of the attached documents;
- Certificate of work experience;
- References for educational and research work - classroom and outside classroom employment, work with students, participation in research projects and scientific forums;
- Copies of monograph, university textbook and scientific publications (14 pcs.) for participation in the competition.

The set of materials presented to me of Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova, is in accordance with the Regulations for the Development of the Academic Staff of the PU (Art. 65, Para. 2). For participation in the competition, 12 articles, one monograph and one textbook are included. It is clear from the attached full list of scientific works that Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova is author or co-author of a total of 40 publications, of which 14 are submitted for the current competition, 3 are submitted for the acquisition of the doctorate degree (PhD), 3 are for the Academic position of "Ch. Assistant Professor". The 14 publications included in the current competition do not repeat those for obtaining the doctorate degree and for occupying the academic position "Ch. Assistant Professor".

2. Brief biographical data

Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova completed her secondary education at the "St. Kliment Ohridski" in Silistra in 2007. During the period 2007 – 2016, Dr. Maria Vasileva studied at the Plovdiv University "Paisii Hilendarski", majoring in "Informatics", master's program "Applied Mathematics" and doctoral program "Mathematical Analysis", in as a result of which, in 2011, she obtained the Bachelor's degree with the professional qualification "informatics", in 2012 - the Master's degree with the "mathematician" qualification, and in 2016, after successfully defending a dissertation on "Accelerated Convergence of a Family of Iterative Methods for Simultaneous Approximation of Zeros of Polynomials' has been awarded the Doctorate degree.

The teaching and research work of Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova, are closely related to the PU. In January 2016, she was appointed to the academic position of "Assistant", and from October 2017 until now she holds the academic position of " Ch. Assistant Professor". She has over 8 years of teaching experience, of which over 6 as a Ch. Assistant Professor.

3. General characteristics of the candidate's activity

Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova has extensive teaching experience. She is the co-author of a textbook on the discipline of the same name "Insurance Mathematician", published by Plovdiv University Publishing House, 2023, 188 pages. Since 2017, after taking the academic position of " Ch. Assistant Professor ", until now Maria Vasileva has led lectures and exercises in a number of disciplines: Insurance mathematics, Practical applications of insurance mathematics, Discrete mathematics, Information technologies in mathematics, Introduction to information technologies and Informatics. The candidate also has active extracurricular work with students from various majors, which consists of conducting consultations, assigning coursework and homework and their verification, she was the supervisor of four successfully defended diplomas (two each in the Bachelor's and Master's degree).

Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova, has a total of 38 scientific publications, of which two are monographs. She participated in the competition with 13 scientific publications, one of which is a monograph. All 13 publications are in English, 4 of them are in scientific journals with high impact factor (IF), 5 are in scientific journals with impact rank (SJR) and 3 in scientific conference proceedings, of which two are with impact rank (SJR). The monograph "Approximation models and applications" was published by the Plovdiv University Publishing House and has 141 pages.

The publications and citations submitted for evaluation satisfy and to some criteria significantly exceed the minimum national requirements and the additional faculty requirements of the FMI at PU for professional field 4.5. Mathematics. The following is a comparative characteristic by group of indicators of the minimum national and additional faculty requirements of FMI:

- Group "A" – Presence of acquired doctorate degree – **50 points**;
- Group "B" – Availability of habilitation work (requirement for min. points – 100). A monograph "Approximation models and applications" is presented. Due to some overlapping of the content of the monograph with the presented publications, I would consider three publications - [4,5 and 11] with a total number of **120 points**;
- Group "Г" – Availability of scientific publications in publications that are refereed and indexed in world-databases with scientific information (Web of Science and Scopus), etc. (requirement for min. points – 200). 11 publications with a total number of points – 480 are presented (two in Q1 – 2x75 points, two in Q2 – 2x60 items and seven with SJR in Scopus – 7x30 points); I accept **360 points** (120 transferred to group "B");

- Group “Д” – Citations in refereed and indexed in world databases with scientific information (Web of Science and Scopus) (requirement for min. points – 50). A list of 32 citations for the contest is presented (32x2x4) – **256 points**;
- **13** publications were submitted for evaluation, including one monograph under minimum faculty requirements – 8;
- Of the 13 publications presented, **9** are in scientific journals, of which **4** are with IF, and 5 are with SJR, with a requirement of 5 in journals, of which 3 are with IF.
- A list of all 149 cited citations is presented, of which **96** are in refereed and indexed editions. The citations of the publications participating in the competition are **44**, of which 29 are in Web of Science and/or Scopus. 32 citations are submitted for participation in the competition, with a requirement for evidence of at least 5.
- One textbook is presented, as is the requirement.

In addition to the above-mentioned results of the scientific research activity of Ch. Assistant Professor Maria Vasileva-Chilibinova, it should be noted her involvement in 5 research projects, participation in national and international scientific forums and review of over 40 manuscripts proposed for publication in a number of refereed and indexed journals.

The presented scientific publications in the competition, thematically, can be grouped in two directions: iterative methods for simultaneous approximation of polynomial zeros [1-3] and approximation of classes of sigmoidal functions with respect to the Hausdorff metric [4-13].

The publications in the first thematic direction of Dr. Vasileva are a continuation of the research on the topic of her doctoral studies. They are for iterative methods with accelerated convergence for simultaneous approximation to zeros of algebraic polynomials. A paper [1], published in the prestigious journal Applied Mathematics and Computation, is dedicated to a family of iterative methods for simultaneous approximation of polynomial zeros (with known multiples), which was proposed and studied by the Bulgarian mathematicians Kyurkchiev, Andreev and Popov and includes the Gargantini – Farmer – Loizou method. For the considered family of methods and for the Gargantini – Farmer – Loizou method, theorems for local convergence with different initial conditions and an estimate for the error of each iteration are respectively proved. In paper [2], a new family of iteration methods for simultaneous approximation of the zeros of an algebraic polynomial by combining the classic Ehrlich’s method with an arbitrary iteration function is proposed. For the considered family, local and semi-local convergence theorems have been proved for a wide class of iteration functions under different initial conditions. In addition, the rate of convergence was investigated, the Q-order of convergence and an estimate for the

asymptotic error constant were obtained. In paper [3] Nouredin's method for simple zeros and its generalization to multiple zeros are studied. Theorems for local and/or semi-local convergence with different initial conditions have been proved for the considered methods.

The research and results on the approximation of classes of sigmoidal functions to the Hausdorff metric show a certain independence and development of Dr. Vasileva. The first publications on approximations of functions concerning the Hausdorff metric were by the Bulgarian mathematician Blagovest Sendov. Other Bulgarian mathematicians - Vasil Popov, Nikolay Kyurkchiev and others - also contributed in this direction. A major goal of research on the topic is approximating classes of sigmoidal cumulative functions of distributions with the Heaviside function on the Hausdorff metric. Among the investigated functions are families of probability functions of distributions based on the auxiliary function

- $\omega_m^{(\alpha,\beta)}(x) = \left(\frac{m^\beta+x^\beta}{m^\beta-x^\beta}\right)^{\frac{\alpha m^\beta}{2}}$ (omega function) [5], of the inverse trigonometric functions – arctangent [4] and arcsine [11], of the exponential function [8,9,12], etc. In paper [6] a Hausdorff approximation of the Haar scaling function by sigmoidal scaling functions is considered. Lower and upper bounds on the Hausdorff distance are obtained.

In all publications, theoretical results are supported and illustrated with numerical examples.

The monograph [13] is devoted to approximation models, consisting of two parts. The first part deals with models based on probability distributions. The "saturation" characteristic to the horizontal asymptote regarding the Hausdorff distance is investigated. The content of this part is based on the results of the publications described above. In the second part of the monograph, some new classes of activation functions are analyzed. An approximation with smooth functions depending on the Gaussian error function is considered. The obtained theoretical results have been tested with public datasets. The experiments were implemented with the Wolfram Mathematica.

In addition to the quantitative fulfillment of the minimum national and faculty requirements, the level and significance of the studies is evidenced by the level of the editions in which they were published and the response they received in the impressive number of citing articles. Of the 13 publications presented, 4 are with IF, of which 1 in Q1 (first quartile of WoS), 2 in Q2 and 1 in Q3 and 7 publications are indexed in Scopus. A Scopus reference shows that the papers of Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova have received a response in 75 publications.

4. Assessment of the candidate's personal contribution

Of the presented 13 scientific publications of the candidate, 4 are independent and 9 are co-authored. Of the collective publications, 4 have one co-author (3 with P. Proynov

and 1 with N. Kyurkchiev) and 5 have three co-authors. I have no reason to doubt the personal contribution of the candidate in the individual publications, and for the collective publications I assume that the authors have equal contributions. I believe that the literature used is correctly cited and I have not found any signs of plagiarism in the candidate's works.

5. Critical remarks and recommendations

It is noteworthy that the content of the monograph in the first part largely repeats the content of already published results in articles [4, 5, 7, 8 and 11]. For example: Theorems 2.2 and 2.3 repeat respectively Theorems 1 and 2 of [5]; theorem 3.1 repeats theorem 1 of [11]; theorems 3.2, 3.3 and 3.4 repeat respectively theorems 1, 2 and 3 [4], etc. The author's used literature is noted at the beginning of the corresponding chapter, in contrast to the more precise way of citing sources with foreign authors. I note that the above note in no way detracts from the results obtained from Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova and does not change the fulfillment of the minimum national and additional faculty requirements.

CONCLUSION

The documents and materials submitted by Ch. Assistant Professor Maria Vasileva-Chilibinova, meets all the requirements and criteria of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the implementation of LDASRB, the relevant Rules of the PU "Paisii Hilendarski" and the Specific requirements of the Faculty of Mathematics and Informatics of the PU.

After the analysis of the achieved results in the educational and research activity, the received international response of the scientific results Ch. Assistant Professor Dr. Maria Vasileva-Chilibinova give me reason to give **my positive assessment and to recommend** to the honorable Scientific Jury to prepare a report-proposal for the election of Ch. Assistant Professor Dr. Maria Tonkova Vasileva-Chilibinova for the academic position of "Associate Professor" at the Plovdiv University "Paisiy Hilendarski" in the professional field 4.5. Mathematics (Approximation Models and Applications).

29.03.2024

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Reviewer:

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