REVIEW

of the application for academic position "Professor" at the Institute of Mathematics and Informatics at Bulgarian Academy of Science

Research area: 4. Natural Sciences, Mathematics and Informatics,

Professional field: 4.5. Mathematics

Scientific specialty: Mathematical Analysis (Special Functions)

by prof. Snezhana Georgieva Hristeva-Kraeva, DSc, Faculty of Mathematics and Informatics, Plovdiv University "Paisii Hilendarski"

The position was announced in State Gazette No 52 from 02.07.2019 and on the official web site of the Institute of Mathematics and Informatics (IMI) at Bulgarian Academy of Science (BAS). With order 321/02.09.2019 of the director of IMI at BAS I was appointed as a member of the academic board for the professorship at IMI. With order No. 1 from 16.09.2019 I was appointed as a reviewer. The current review is written in accordance with the law for development of academic staff in the Republic of Bulgaria (LDASRB) and complies with the rules for the implementation of the LDASRB, and the guidance of development of academic staff in BAS (from 20.05.2019) and in IMI-BAS (from 19.07.2019).

There was only one candidate for the position of "Professor" at IMI at BAS.

Associate Professor Jordanka Paneva-Konovska, DSc, from Technical University, Sofia.

The following documents were presented as part of the application of Assoc. Prof. Paneva-Konovska, DSc for the position:

- CV (in Bulgarian and in English)
- Higher education graduation certificates for BSc and MSc degrees
- PhD qualification certificate
- DSc qualification certificate
- A list of published scientific papers
- A list of scientific papers to be considered for the professorship position

- Annotations of the materials including self-assessment of contributions
- A list of citations
- Copy of protocol for initiation of the recruitment procedure
- Copies of scientific papers to be considered for the professorship
- Copy of State Gazette issue 52 from 02.07.2019
- Teaching certificate
- Certificates for scientific projects
- Certificate for academic position "Associate Professor"

The documents submitted are clearly organized and professionally curated showing a high degree of care and competency.

Based on the evidence submitted, I conclude that there were no violations of the procedure. All of the requirements of LDASRB, guidance of implementation of LDASRB, and the rules for development of academic staff in BAS and in IMI-BAS have been complied with.

1. Brief Biodata of Applicant.

The applicant, Assoc. Prof. Paneva-Konovska, DSc graduated with BSc and MSc degrees from The High Pedagogical Institute in Shumen. She defended her PhD in 1999 in front of the Higher Attestation Commission. In 2018 the applicant received her DSc degree at IMI- BAS. The applicant has been an university lecturer since 1977. She started as an assistant professor at The High Pedagogical Institute in Shumen and in 1983 was promoted to a senior assistant professor and then later to an associate professor at the Faculty of Applied Mathematics and Informatics(FAMI) at TU-Sofia. Assoc. Prof. Paneva-Konovska, DSc became a vice dean of FAMI in 2013, a position she still holds.

In 2013 Assoc. Prof. Paneva-Konovska, DSc became a member of the editorial board of International Journal of Applied Mathematics (IJAM), indexed in Scopus since 2017. She has reviewed over 10 papers in Mathematics, some of which are published in journals with impact factor.

Assoc. Prof. J.Paneva-Konovska has lead seminars and delivered lectures for BSc and MSc students at TU-Sofia covering all core Mathematics modules. She also served as an advisor for several MSc and BSc degree theses and was an advisor-consultant of one PhD student.

2.   Description of Applicant's documents

The applicant's documents include 26 scientific publications, one of which is the monograph authored by Assoc. Prof. Paneva-Konovska, DSc. Three papers of the total of 25 are published in journals with impact factor (total **IF= 3,937)**, and 10 papers are published in journals with SJR (total **SJR = 1,646).** The candidate's documents include 4 textbooks for students from TU, two of which are with one author, one was published by Avangard-Prima and three are published by Publishing House of TU-Sofia. All textbooks are published after 2012. Two abstracts of Theses are also included - one is the abstracts of PhD thesis (1998) and the other is the abstracts of the thesis for DSc. (2017, BAS).

All publications are directly connected with the Professional field 4.5. Mathematics , Scientific Specialty Mathematical Analysis. All scientific documents (publications and textbooks) are published after her PhD thesis and they are not used for the competitions for an occupation of the academic position „Associate Professor"and the scientific degree „DSc". All scientific documents will be reviewed. All 25 papers and the monograph are published in English. Alost all of them have only one author- the candidate. It proves additionally that the applicant has a scientific potential and research abilities for investigations in the field of Mathematical Analysis.

I accept the applicant's publication activity as fully sufficient for the announced competition, both in number and in citations.

The table below presents the formal reference to the minimum scientific requirements of the IMI at the BAS for the academic position of "Professor" under the professional field 4.5. Mathematics and all relevant points of the candidate:

Groups of Indicators	*Content*	*Minimal points for "Professor"*	Points of Paneva-Konovska
A	Indicator 1	50	50
C	Indicator 4	100	104
D	Sum of points of Indicators 5 and 7	220	314
E	Indicator 11	140	342
F	Sum of points of Indicators 12,14,15,18.19.20	150	321.33

It is clear to see that the candidate has more than fulfilled the minimum requirements. Sections D through F are well above the requirements demonstrating the quality of the current application.

According to the additional requirements of IMI-BAS regarding the occupation of academic position "Professor" on Research area 4. Natural Sciences, Mathematics and Informatics, the candidate has to have at least 10 papers published in Journals with Impact Factors/SJR. Assoc. Prof. J.Paneva-Konovska has 13 papers published in Journals with Impact Factors/SJR. Therefore, the candidate satisfies the minimal requirements.

3. General characteristics of the applicant's scientific activity

The research of Assoc. Prof. Paneva-Konovska is deeply connected with Mathematical Analysis. The referenced academic work of Assoc. Prof. Paneva-Konovska can be grouped in the following four main areas:

I. **Inequalities, asymptotic formulas and 3D-maps**- It is investigated the properties of various types of Bessel functions as well as Mittag-Leffler functions. The results are published in 6 papers and one monograph. In book [1], by the help with the CAS "Maple", several examples about 3D graphs of the generalized functions of Bessel-Maitland type functions are presented. In paper [2] it is proved a theorem of the type of Littlewood's Theorem for summation of divergent series among the functions of Bessel-Maitland. In [3] and [4] some theorems of the type of Cauchy- Hadamard, Abel, Tauber and Littlewood theorems about the series with Mittag-Leffler functions are proved. Asymptotic formulas for these functions for "big" values of indices are obtained. These formulas are applied to prove the convergence of the studied series. In paper [5] some families of 3-indices generalizations of first order Bessel functions are studied. The behavior of these functions in the domains of complex plane is studied. Asymptotic formulas for "big" values of the indices of these functions are also obtained. Similar theorems are proven for Bessel functions and for Bessel-Maitland functions.

II. **Convergence of series** - with the help of bilinear series it is proven that the system of Bessel functions is a basis in the space of complex valued functions, holomorphic in a

circular region. The series of Bessel type and Mittag-Leffler type are also studied. The classical functions are slightly modified by a multiplication by the power of the variable and by an appropriate coefficient.

The most important results in this area are:

- *The convergence and the behavior of the series in the convergence cirle*: they are studied both for series with various kind of Bessel-type functions ([1,14,16]) and for series with different kind of Mitag-Leffler-type functions ([5,15,19]). In papers [13,14,15] the convergence of series with Mittag-Leffler type with one and two indices, series with Bessel functions, series with generalized Mittag-Leffler functions are studied. Also, the obtained results are compared with the classical results for some power series.

- *The behavior of the studied series along the contour* of its area of convergence: The results are published in 11 papers. In paper [7] the area of convergence of series with Mittag-Leffler type functions is obtained. The behavior of the series on the boundary of the obtained area is studied. Cauchy-Adamar, Abel, Tauber, and Littlewood type theorems have been proven. Asymptotic formulas have been obtained for the "big" values of the indices. These results are used in the convergence proofs.

- *Results analogous to the classical Fatou theorem* for power series ([12, 14, 16, 20]). Analogues of the classical Cauchy-Adamar, Abel, and Fatou theorems for power series, which are necessary for studying the behavior of the series by Mitag-Leffler functions on the boundary of their domain of convergence in the complex plane, are proved in [12]. In [16], it is proved Fatou theorem for series with Bessel multi-index functions.

- *Superconvergence of series*: it is related to the concept of "gaps". Analogues of the Adamar theorem for Bessel type series ([17]) and Mitag-Leffler type series ([18,20]) have been proved. In [23], the inverse theorem of Ostrovsky's theorem about superconvergence was proved.

III. **Integrals and fractional derivatives-**In the paper [25] a formula for the n-th derivatives of Bessel-Mateland functions with two indices by generalized Bessel-Mateland functions with 3 indices is obtained. The properties of Mitag-Leffler's multi-index functions, their derivatives and fractional integrals have also been investigated

([11, 24, 26]). Seven publications are included in this area - three textbooks, a monograph and two books.

IV. **Integral Transformations** - Research in this area is mainly related to finite Hankel transformations. The fifth chapter of the monograph [1] is devoted to this topic. The asymptotic behavior of zeros of a class of integer functions of exponential type given by Hankel transform is studied. It is impressive that the theoretical results are applied to a real mathematical model of unsteady heat transfer in unmanned aerial vehicles. The applicant successfully implements and develops methodological guidelines for the application of the Laplace transform and its application by CAS MAPLE for solving some classes of integral equations of any order.

I will note that in 2011, Assoc. Prof. Paneva-Konovska introduced the 3m-index Mitag-Leffler functions and she investigated the basic properties of these functions. A huge part of the results in this area are included in her DSc Thesis. But there are also some results that are outside the aforementioned dissertation, such as [11]. In this article, Assoc. Prof. Paneva-Konovska studied the so-called 3-multi-index Mitag-Leffler functions. These functions are 3m-index generalizations of both the classical Mitag-Leffler function and Prabhakar's 3-index function. The applicant studied the basic properties of these integer functions: their order and type, asymptotic estimation, and representations by means of the generalized Wright hypergeometric functions and Fox's H function. Formulas for integrating and differentiating of both integer and fractional order are obtained. Some interesting special cases of Mitag-Leffler's 3-index functions are also presented. The areas of convergence of series by such functions are obtained in the complex plane and their behavior along the contour of the area of convergence is studied. Analogues of the Cauchy-Adamar, Abel, Tauber, and Hardy-Littlewood theorems for power series have been proved.

As a summary of the written above, I would like to point out my personal opinion. It is quite impressive the consistent and comprehensive study of the subjects investigated by the applicant, namely generalizations of the classical Mitag-Leffler and Bessel functions and their applications to the power series. Certainly, Paneva-Konovska's research is a major contribution to the theory of special functions as a part of Mathematical Analysis.

I will also mention the educational literature presented. The applicant presents two textbooks. One is dedicated to the integral transformation of Laplace and its use in theory and

practice. The other is mainly devoted to the applications of mathematics in the engineering sciences. The application of the CAS MAPLE for solving and visualizing the tasks under consideration is very skillful in both textbooks. The other two textbooks are also presented, which are closely related to the students' training programs at TU-Sofia. One of them is devoted to complex analysis and the other- to differential and integral calculus of functions of two variables.

The applicant's documents contain a list of citations of the results of Assoc. Prof. Paneva-Konovska. The list contains two types of citations:

- Citations of results from the papers included in the documents of the completion

- Citations in the last two years of another applicant's results

All these citations are not included in any documents for another competition such as for academic degree DSc, Phd, or scientific position "Associate Professor"

I would like to mention the most impressive citations from the given list:

- paper [5], which is cited totally 8 times and 6 of them are in papers published in Journals with IF;
- paper [4], which is cited totally 8 times and 5 of them are in papers published in Journals with IF;
- paper [10], which is cited totally 9 times and 4 of them are in papers published in Journals with IF.

Total number of citations in the given list is 69 times; from them 37 are in Journals with IF and 8 are in Journals with SJR.

I would also remark that 8 papers from the documents on this competition are cited totally 37 times and 22 of the citations are in papers published in Journals with IF and 2 of them are in papers published in Journals with SJR.

The above written additionally proves the applicant's scientific activity, the significance of the mathematical results obtained by Assoc. Prof. Paneva-Konovska, as well as their international recognition.

4. Remarks and suggestions

I have no negative remarks on the documents. They are well organized and it is a pleasure to work with them.

I would like to recommend to Assoc. Prof. Paneva-Konovska, DSc., in her future scientific work to pay more attention to working with young potential scientists (especially PhD students) in order to impart on them her great scientific experience.

5. Conclusion

Documents on the competition of Assoc. Prof. J.Paneva-Konovska, DSc. contain more than enough number of scientific publications, which are published after the PhD Thesis and they are not used for the competitions for an occupation of the academic position „Associate Professor" and the scientific degree „DSc". In the publications of the candidate there are original scientific results and applications, which are internationally recognized. There is no doubt of the scientific abilities and lecturing qualification of Assoc. Prof. J.Paneva-Konovska, DSc..

I have not found any "plagiarism" in the candidate's work as defined in the law for development of academic staff in the Republic of Bulgaria.

All of the arguments above are the reasons for **my strictly positive assessment** of the applicant Assoc. Prof. Paneva-Konovska, DSc.. I would like to recommend to the honorable academic board to prepare a report-proposal to the Honorable Scientific Board at IMI at BAS for **the election of Assoc. Prof. Jordanka Paneva-Konovska**, **DSc., for the academic position "Professor"** at BAS on Research area 4. Natural Sciences, Mathematics and Informatics, Professional field 4.5. Mathematics, Scientific Specialty Mathematical Analysis (Special Functions).

19 October, 2019   Signature:
                                                    /Prof. Snezhana Hristeva-Kraeva, DSc/