

OPINION

**for the competition for academic position of “Professor”
in the field of higher education
4. Natural sciences, mathematics and informatics,
in a professional direction: 4.5. mathematics,
scientific specialty "Algebra and number theory" (Semigroups of transformations)
announced in State Gazette No. 84 of 21.10.2022.
with candidate: Associate Professor Ph.D. Jörg Koppitz**

**Member of the scientific jury:
Professor D.Sc. Ivo Mihaylov Mihaylov
FMI at Konstantin Preslavsky University of Shumen**

On the basis of a decision of the Scientific Council of IMI-BAN (Protocol No. 12/16.12.2022) and order of the Director of IMI, No. 536/20.12.2022, I have been elected as a member of a scientific jury for the competition for academic position of “Professor” for the needs of the Institute of Mathematics and Informatics - BAS in the field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.5 Mathematics, scientific specialty "Algebra and number theory" (Semigroups of transformations) announced in SG no. 84/10/21/2022 By decision of the Scientific Jury (Protocol No. 1 of 01/03/2023) I have been chosen to write an opinion.

The submitted documents for participation in the competition for the occupation of the academic position "professor" for the needs of the IMI of the BAS are for the only candidate Assoc. Prof. Dr. Jörg Koppitz.

The documentation submitted by the candidate meets the requirements of both the Law on the Development of the Academic Staff in the Republic of Bulgaria - ZRASRB (with the amendments of 25 February 2020), the Regulations for the Application of the Law on the Development of the Academic Staff (PP ZRASRB, State Gazette of 19.02.2019 d.), as well as the Regulations for the Development of the Academic Staff of the BAS and the corresponding Regulations of the IMI - BAS.

Brief biographical reference

Jörg Koppitz graduated in 1989 from the Pedagogical University of Halle-Kötten, Germany with the qualification "Teacher of Mathematics and Physics". In 1992, he obtained the scientific and educational degree "Doctor" at the Martin Luther University, Halle, Germany. His teaching activity is carried out at the University of Potsdam as an assistant 1992-1995, 1999-2008, as a visiting professor at the University of Potsdam 2010-2015, as an associate professor at the BAS from 2017 until now. He speaks Russian and English.

General description of the submitted materials for the competition.

Jörg Koppitz has provided 22 documents that are required by law and regulations. In the current competition, Jörg Koppitz participated with 17 articles, which do not repeat those with which the academic title "Associate Professor" and the scientific-educational degree "Doctor" were acquired (Article 24, Paragraph 1, Item 3 of ZRASRB).

All 17 scientific publications submitted for participation in the competition are in refereed journals with an impact factor (total IF = 9.755). Of the scientific publications presented for the competition, 10 have one co-author, 5 - with two co-authors and 2 - with three co-authors. The participation of all co-authors is equal.

Data are provided for 26 citations of the articles proposed for the competition. Jörg Kopitz has 8 PhD students and 1 PhD candidate at the Institute of Mathematics of the University of Potsdam.

A table covering the requirements of a candidate in a competition for the academic position of "professor" at IMI-BAN, which are the same as in ZRASRB (with the amendments of February 25, 2020), is also provided. All requirements for the position "Professor" have been met.

General description of the candidate's works

The applicant has provided an author statement detailing the contributions of each article and the approbations of the results. My review confirms the applicant's opinion. Following is a brief description of the works. The articles submitted for the competition can be divided into the following 4 groups:

I. Transformation semigroups - publications 1, 2, 3, 4, 7, 9, 14, 15.

Semigroups of complete (partial) transformations with certain properties have been intensively studied by a number of authors, but there are still many important open questions that affect the study of both finite semigroups of transformations having certain properties and infinite semigroups of transformations. The author's research fills some of these gaps. For example, in [1,15] the rank of the semigroup FIn was obtained from all partial automorphisms preserving the zig-zag order of an n -element fence. In [14] the zig-zag order in the set of natural numbers N was considered and the relative rank of the semigroup PFN of all partial transformations of N preserving the zig-zag order was determined.

II. Doppelsemigroups - publications 8, 10, 11.

Doppelsemigroups were introduced by B. Richter in [R,97]. A doppelsemigroup is an algebraic structure of a nonempty set and two binary associative operations satisfying two additional axioms. In [8], the candidate contributes to this research by studying rectangular doppel-semigroups. The main result in [10] is the theorem for representations of ordered doppelsemigroups. In [11] a fundamental description of the manifold of all commutative n -ary semigroups is given.

III. Semigroups under point of view of Universal Algebra - publications 5, 6, 13, 16, 17.

Some subsets of the symmetric semigroup $T(X,Y)$ have an important interpretation in automata theory and thus in a broader sense also in theoretical informatics, namely the semigroups of non-deterministic conversions. In [6, 13, 16], the candidate is restricted to the case where Y is a two-element set. Green's relations are studied in [13]. In [6], all ideals, as well as all principal ideals, are characterized. In [16] regular elements and idempotents were studied. All maximal regular subgroups of $TP(X,Y)$ have been found.

IV. Semihypergroups - Publication 12.

In [12] the candidate proved that every semihypergroup can be considered as a semigroup. Using this fact, all second-order semihypergroups were characterized, and it was found that there are exactly 17 such.

Notes and recommendations

Candidate Jörg Kopitz has extensive teaching experience with 8 PhD students, and lectures on Algebra, Linear Algebra, Number Theory, Arithmetic, Semigroup Theory, Analysis, Graph Theory, etc., which he has given at the University of Potsdam and many other universities - Brno University of Technology, University of Szeged, South-West University Blagoevgrad, Universidade Nova de Lisboa, Luhansk Traras Shevchenko National University. I have no comments or recommendations on the documentation.

CONCLUSION

On the basis of what has been said so far about the materials presented, the scientific works, their significance and the scientific contributions contained in them, as well as the rich teaching experience, I believe that assoc. prof. Dr. Jörg Kopitz satisfies all the requirements of ZRASRB, the Rules of the Ministry of the Interior for the implementation of ZRASRB, the relevant Regulations of the BAS and the Regulations of the IMI-BAS on the conditions and procedure for occupying the academic position "professor" and I strongly recommend the honorable Scientific Jury for the announced competition to propose to the respected Scientific Council of the Institute of Mathematics and Informatics at the BAS to choose Jörg Kopitz, PhD, in the academic position of "professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.5. Mathematics, scientific specialty "Algebra and number theory" (Semigroups of transformations), for the needs of the Institute of Mathematics and Informatics - BAS.

09.02. 2023

Prepared the opinion:

X

(prof. D. Sc. Ivo Mihaylov Mihaylov)