REER REVIEW

by Associate Professor, PhD Ilinka Andonova Dimitrova
Department of Mathematics, Faculty of Mathematics and Natural Sciences
South-West University “Neofit Rilski”, Blagoevgrad

for the competition for the academic position of “Professor”
Field of Higher Education: 4. Natural Sciences, Mathematics and Informatics
Professional Field: 4.5. Mathematics
Scientific Specialty: Algebra and Number Theory (Non-commutative Rings and Algebras)

1. Data for the competition.

The competition is announced by the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences in the State Newspaper, No. 69 of 11.08.2023. Documents were submitted within the deadline by the only candidate DSc Peter Vassilev Danchev, Associate Professor at IMI-BAS. The set of documents submitted by the only candidate for the competition is complete. The Scientific jury for the selection was appointed by Order No. 466/10.10.2023 of the Director of IMI-BAS.

2. Biographical data.

The candidate Associate Professor DSc Peter Danchev was born in 1970. He graduated from the Faculty of Mathematics and Informatics of the University of Plovdiv "Paisiy Hilendarski", majoring in "Mathematics", specializing in "Mathematical Structures/Algebra" in 1996. He defended his PhD thesis in 2018 in the doctoral program "Algebra and Number Theory" on the topic "Associative Rings with Unit and Weakly Unipotent Multiplicative Groups" at IMI-BAS, where two years later he also defended a dissertation for a Doctor of Science in the scientific specialty "Algebra and Number Theory" on the topic "Some Classes of Non-commutative Rings and Abelian Groups". In 2018, he started working as an Assistant Professor at the "Algebra and Logic" section at IMI-BAS, where a year later he became a Chief Assistant Professor, and in 2021 he was elected Associate Professor. The attached curriculum vitae does not contain any information about his work from the time he graduated from the university until he started working at IMI-BAS, but from the service record of work experience attached to the competition documents, it can be seen that Associate Professor DSc Peter Danchev has more than 24 years of work experience.

3. Compliance with minimum national requirements.

According to the reference for the fulfillment of the minimum requirements by a candidate in the competition for the academic position of "Professor" at IMI-BAS (Appendix 2.1), the documents for participation in the competition presented by Associate Professor DSc Peter Danchev contain 50 points under group A for the acquired educational and scientific degree "Doctor" (PhD), 140 points under group B for habilitation work /replaced with scientific publications that are referenced and indexed in world databases with scientific information/ (with a minimum of 100 points), 274 points under group D for scientific publications that are referenced and indexed in world databases with scientific information (with a minimum of 220 points), 171 points under

group D for citations (with a minimum of 140 points), 165 points under group E of which 75 points for the acquired scientific degree "Doctor of Science" and 90 points for participation in national and international projects (with a minimum of 150 points).

Obviously, the candidate fully satisfies the minimum national requirements, as well as the additional requirements of IMI - BAS for occupying the academic position of "Professor" in the scientific field and professional direction of the competition.

4. General characteristics of the candidate's research activity.

The scientific interests of Associate Professor DSc Peter Danchev are mainly in three areas of algebra – Commutative and Non-commutative Rings and Group Theory. His scientific productivity is truly impressive. According to the presented total list of publications, he is the author or co-author of 402 scientific publications in 195 journals, of which 103 publications in 54 journals with an impact factor. Total impact factor – 54.326. The publications are for the period from 1993 until now.

It is noteworthy that out of 378 scientific works for the period 1993-2021, only 50 are co-authored with other scientists, and the remaining 328 are independent. In contrast, in the last two years, all but one of the candidate's publications have been co-authored with colleagues from different countries working in the field. The presence of joint articles speaks of the candidate's teamwork skills and contacts with mathematicians from other universities and scientific organizations.

The list of publications contains incorrect information about 4 articles that are claimed to have been published in 2024. This raises slight doubts about the correctness of the information provided in this list.

The applicant's total citation report lists between 561 and 752 citations in various databases, such as Scopus, Web of Sciences, Mathematical Reviews/MathSciNet, and zbMATH Open. However, this number also includes self-citations. The reference lacks information on the number of citations of the applicant without self-citations, which according to the Scopus and Web of Sciences databases are 204.

5. General description of the materials submitted for participation in the competition.

The applicant submitted for participation in the competition 15 scientific publications published in the period 2019–2023. In the list of publications, an article [4] was erroneously submitted with a publication year of 2020 instead of 2021, as well as an article [15] which was given with publication year 2024 instead of 2021.

Of the scientific publications, 4 are in quartile Q2 journals, 4 are in quartile Q3 journals, 3 are in quartile Q4 journals, and 4 are indexed in Scopus. Two of the publications were co-authored by J. Cui and two by E. Garcia and M. G. Lozano. Associate Professor DSc Peter Danchev has a joint publication each with D. Anderson, T.-K. Lee, A. Cimpean, and J. Bell. The remaining 7 papers are with the applicant as the only author. Of the scientific publications submitted for the competition, 7 are short notes with a volume between 3 and 8 pages, 6 are articles with a volume between 10 and 15 pages and 2 are studies with a volume of 32 and 46 pages, respectively. Some of the scientific works have been published in high level journals such as Proceedings of the American Mathematical Society, Communications in Algebra, Ricerche di Matematica, Israel

Journal of Mathematics, Linear and Multilinear Algebra, Journal of Algebra and its Applications, International Journal of Algebra and Computation, Turkish Journal of Mathematics.

The applicant has declared that these 15 publications have not previously been used for other procedures and the participation of co-authors in joint publications is equal.

For the competition, Associate Professor DSc Peter Danchev presented a list of 9 citations to 5 of the articles submitted for the contest, and 20 citations to an article from 2013, which is similar in subject matter.

Given the applicant's impressive total number of scientific publications and citations, I believe that he could have submitted a more impressive number of articles and citations suitable for participation in a competition of "Professor".

6. Main scientific and scientific-applied contributions.

I will briefly discuss the main results contained in the applicant's scientific works submitted for the competition. All 15 scientific papers presented in the applicant's scientific contribution report are in the field of Non-commutative Rings and Algebras.

The publications [1], [14], and [15] are related to the study of π-regular rings. The paper [1] is devoted to some non-trivial generalizations of classical regular and π-regular rings. A class of so-called regularly nil-clean rings is introduced and some of their fundamental properties are studied. It is proved that π-regular rings are always regularly nil-clean and also that there exists a regularly nil-clean ring that is nil-clean but not π-regular. In [14], π-*-regular rings, which are the *-version of strongly π-regular rings and which were introduced by Cui-Wang in 2015, were studied. Various well-known results for π-*-regular rings and *-periodic rings are generalized. In the paper [15], some non-trivial generalizations of classical regular and π-regular rings are obtained. The so-called D-regularly-nil-clean rings are introduced and the relationship between them and some well-known classes of rings such as clean rings, nil-clean rings and others is shown. A variety of methods from Ring Theory were used to prove the obtained results.

The papers [2], [3], [4], and [7] are short notes and consider possible decompositions of arbitrary (nilpotent) square matrices as a sum of special elements over algebraically closed or arbitrary finite fields. The article [2] is a short note in which a special property of the ring R of all square matrices of arbitrary size over an algebraically closed field is considered according to which for each square matrix A of this ring there exists an idempotent $B \in ARA$ such that $((I - B)A)^2 = 0$. In [3], it was proved that every square matrix over an arbitrary infinite field is a sum of a nilpotent matrix of a special type (whose square is equal to zero) and a diagonalizable matrix. These two extremely short papers consist of a short proof of one property each of square matrices of arbitrary size over an algebraically closed field and they are published in Chebyshevskii Sbornik. In the article [4], representation of nilpotent square matrices over an arbitrary field as a difference of idempotent matrices are considered, as well as representation of arbitrary square matrices over an algebraically closed field as a sum of a nilpotent square-zero matrix and diagonalizable matrix. Some direct applications of these properties to Ring Theory and in particular to some types of π-regular rings are also considered. In the article [7], it was proved that an arbitrary square matrix over an algebraically closed field or over a finite field can be represented as a sum of one potent matrix and one nilpotent square-zero matrix. The question of when an arbitrary square matrix over an infinite field can be represented as a sum of a periodic

matrix and a nilpotent square-zero matrix is also considered. The abstracts of the publications [2], [4], and [7] are absolutely identical and do not provide the necessary information about the results obtained in the respective article, and thus also about the contributions of the author.

The papers [11] and [12] investigate and extend the possibility of representation of arbitrary square matrices as a sum of potent or diagonalizable matrices with nilpotent matrices. In [11], it was shown that in some more special cases, namely for some classes of finite commutative rings, a suitable expression of an arbitrary square matrix can be found as a sum of a potent matrix and a nilpotent matrix of order at most two when the Jacobson radical of the ring has zero-square. In the article [12], it is proved that every square matrix over an arbitrary infinite field is always representable as a sum of a diagonalizable matrix and a nilpotent matrix of order less than or equal to two. These results enhance the candidate's previous research in this area and have been used in his subsequent works.

The publications [5] and [9] summarize well-known classical results, such as Jacobson's theorem [Ann. of Math. 46 (1945), p. 695–707], on commutativity of potent rings/algebras. The paper [5] is a short note extending Jacobson's theorem from the point of view of periodic rings. It is proved under which conditions a given periodic ring is potent, and more specifically it is obtained that every periodic ring whose elements have equal degrees of different parity is in fact a potent ring. Applications of finitary version of the Affine Representability theorem, which follows on from recent work by Belov-Kanel, Rowen, and Vishne, are considered in [9]. Using this result the authors have given a practically realizable algorithm for ring commutativity, i.e. they have shown that when given a finite set of polynomial identities, there is an algorithm that terminates after a finite number of steps which decides whether these identities force a ring to be commutative. Several examples are discussed to show how this algorithm works in practice. The commutativity theorems of Jacobson and Herstein are revisited in the light of this algorithm and some general results are obtained. Moreover, the homogeneous multilinear identities that imply the commutativity of a given ring, as well as the homogeneous multilinear polynomial identities with the property that when a given ring satisfies this identity it is necessarily commutative, are fully characterized. A rough classification of finite noncommutative rings is given for which every proper homomorphic image and every proper subring is commutative.

The papers [6] and [13] give some new essential and non-trivial characterizations of the well-known periodic rings. In [6], a necessary and sufficient condition was found when a ring is periodic in terms of invertible elements combined with π-regular elements. Some results for the full matrix ring are also proved. The obtained results are applied to the so-called $*$-periodic rings. In the paper [13], the structure of weakly invo-clean rings, which possess weak involution, is fully described up to isomorphism. These studies strengthen earlier results obtained by Associate Professor DSc Peter Danchev, which concern weakly invo-clean rings, which are equipped with only simple involution.

The publication [8] addresses the question of elucidating the structure of some broad classes of clean rings, such as those of the almost n-torsion clean. A number of results are obtained concerning the full matrix ring as well as its triangular matrix subring on a finite field with two elements, and in particular, criteria are obtained when these two rings are n-torsion clean and

almost *n*-torsion clean. Some results from number theory are also used in the calculations and proofs.

The scientific work [10] investigates the problem of generalized commutators and Lie ideals for arbitrary associative rings. In particular, here it is achieved a significant extension of Hirstein's theorem [Portugal. Math. 13 (1954), 137–139] for classical commutators. The obtained results are for an arbitrary length of the commutator index. Questions related to *n*-generalized commutators and their relation to some classes of non-commutative polynomials are also discussed.

In conclusion, I will note that the candidate is very well acquainted with the main problems in the field of non-commutative rings and algebras and with the literature on the topics under consideration. Some of the papers submitted for the competition continue the applicant's previous research, but most of them address questions previously posed by other mathematicians and generalize results obtained by other authors. Various methods were used to prove the results obtained. The credibility of the arguments in the proofs is beyond doubt. The obtained results are interesting and contain new facts about important objects of ring theory. The description of the achievements of the applicant, although too short, correctly reflects the main contributions of the papers submitted for participation in the competition.

7. Other activities.

Associate Professor DSc Peter Danchev is a participant in three national and three international research projects. One of the national projects was financed by the Bulgarian National Science Fund, one by the European Commission and one by the Shumen University. The international projects are in cooperation with Hungary, Spain and Turkiye. The project with Hungary is within the framework of inter-academic contracts and agreements (EBR).

In the competition documentation, there is no information about lectures and exercises led by the candidate in Bulgarian or foreign universities, about published textbooks or study aids, as well as about scientific supervision of PhD students. I believe that these are important activities that a candidate for a professorship should be engaged in.

8. Critical remarks and recommendations.

I have no significant critical remarks on the candidate's publications. I shell just note that many of the papers are very short and address similar issues, which begs the question "Why are not these results combined into normal sized articles?". The presence of a large number of such articles raises suspicions that the applicant is aiming for quantitative results.

The documentation for the competition is prepared extremely carelessly with a number of incorrect data, as well as missing or very scarce information on some issues. For example, there is incorrect reporting of the year of publication of some of the articles, as well as the quartiles of some of the journals. Sufficient information on the applicant's biography and citations is missing. A complete list of the observed citations of the candidate's publications is not given, but only a reference to the number of citations in the various databases, which also includes self-citations. The summaries of the scientific works presented for the competition do not provide complete information about the scientific results and contributions obtained in the respective article. In addition, some of them are identical and give the impression that the different articles deal with the same issue, which in practice is not true.

As a recommendation to Associate Professor DSc Peter Danchev, I would like to add that it will be very useful for young researchers in Bulgaria if he imparts his knowledge and experience, gained from his impressive scientific activity, through scientific supervision of PhD students in Algebra and Number Theory

CONCLUSION

In the presented scientific works, Associate Professor DSc Peter Vassilev Danchev has obtained interesting results in topical areas and has made significant contributions to the theory of non-commutative rings and algebras. The results have been published in authoritative journals with an impact factor and have been cited by other authors, which is an indicator of their importance in the relevant field. Based on the arguments presented in the review, I find it reasonable to recommend to the respected Scientific Jury of the announced competition to propose to the Scientific Council of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences to elect Associate Professor DSc Peter Vassilev Danchev to the academic position of "Professor" in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.5. Mathematics, science specialty Algebra and Number Theory (Non-commutative Rings and Algebras).

17.11.2023

Signature:
/Assoc. Prof. Ilinka Dimitrova/