

R E V I E W

by **Prof. Nikolay Ivanov Yankov, DSc**

on the competition for acquiring the academic position „**professor**”
in professional field: 4. Natural sciences, mathematics and informatics,
professional area: **4.6. Informatics and computer science** (Informatics)
published in State Gazette No 100 from 01.12.2023
for Faculty of Mathematics and Informatics, Konstantin Preslavski University of
Shumen (SHU), department „Computer informatics”,
with only candidate **Assoc. Prof. Dr. Krasimir Mitkov Kordov**

1. Applicant information

The applicant has a bachelor’s degree in computer informatics at the SHU and a master’s degree in „computer systems and technologies” at the Vasil Levski National Military University. In 2015, he defended his dissertation on the topic „Research of cryptographic algorithms for the protection of raster graphic files” and received the educational and scientific degree „doctor” in the scientific specialty of informatics. He has been working at the SHU since 2012 and has held various academic positions: assistant, chief assistant. He has been an associate professor since 2017, again in the professional field of informatics. I know Assoc. Prof. Kordov as a colleague at FMI.

2. General presentation of the received materials in accordance to art. 60–61(1) of RALDASRB

By order RD-16-013/30.01.2024 from the Shumen University Konstantin Preslavski’s Rector, I’m appointed as a member of the scientific jury and at its first meeting on 06.02.2024 I was selected to write this review.

In accordance to art. 61, para. 1 of RALDASRB (Rules on the application of the Law for the development of the academic staff in the Republic of Bulgaria), the assessment of the applicant for the academic position ”professor” is done by art. 61 and the results from the reference in accordance to art. 60, para. 3 from RALDSRB. In connection with the implementation of art. 61, on the basis of the documents submitted, it was established:

- a copy of diploma No D-083 issued on 28.10.2015 for the educational and scientific doctoral degree „PhD” (satisfying art. 60, para. 1, item 1);

- a copy of a certificate No FD-02-09 from 28.03.2017 for the academic position of „associate professor”, moreover a register entry in the Bulgarian registry of academic staff in the National centre for information and documentation (NACID) shows that the candidate has been hired as an „associate professor” with Rector’s order RD-12-093/01.04.2017 thus has at least two academic years of experience in an university (satisfying art. 60, para. 1, item 2);
- 3 scientific papers, 1 of which is indexed in Web of Science (WoS) and 2 in Scopus, totaling 105 pts. (the required minimum is 100 pts.);
- a reference list for meeting the minimal national requirement in accordance art. 2b, para. 2 and 3 of LDASRB as well as a reference for the original scientific contributions that are backed by evidence (satisfying art. 60, para. 3);
- a reference list for the additional indicators applicable to the respective area (satisfying art. 61, para. 3);
- a declaration of authorship on the scientific works for this competition (satisfying art. 60, para. 3, item 6).

3. General characteristics of the applicant’s scientific activity and contributions

For participation in this competition assoc. prof. Krasimir Kordov has listed a total of 9 published works not used for the doctoral thesis or for the associate professorship – 6 of the papers are published in scientific journals the 3 others are in the Proceedings of the third international conference Control Systems, Mathematical Modeling, Automation and Energy Efficiency (SUMMA).

Of the scientific articles, all are referenced and indexed in world-renowned scientific information databases, with 9 available in Scopus, of which only 2 are in Web of Science (WoS) and have an overall IF of 3.80 (1 each in quartiles Q2 and Q3). Of the publications included in Scopus, the overall impact-rank is 1.67. A good impression is made by the fact that all the articles are in journals and collections entered in WOS/Scopus in the category „informatics”, which shows the exact correspondence of the scientific activity of the candidate with the scientific specialty of the competition.

The candidate’s scientific papers submitted to this procedure can be grouped as follows:

- Cryptography ([7.2], [7.5]);

- Steganography ([4.1], [7.1], and [7.4]);
- Hash algorithms ([4.2] and [4.3]);
- Information systems and processes ([7.3], [7.6]).

Assoc. Prof. Kordov's science results on cryptography included in [7.2] consist of a new model for symmetric encryption of digital video. More specifically, it's a pseudo-random number generator (PRNG) that is induced by the composition of two maps: the 3-dimensional Hitzl-Zele and the Tinkerbell. A complete statistical analysis for the distribution using DIEHARD and NIST Statistical Test Suite shows positive results, and the cardinality of the keyspace is shown as 2^{313} . Applying this new PRNG a new cryptographic scheme for frame-by-frame enciphering is presented. In [7.5] a new algorithm for encrypting digital images is shown based on the composition of the Zaslavsky and Gingerbreadman maps. The cryptographic analysis performed – statistical randomness tests, key space analysis, and other tests – shows this algorithm's applicability.

The candidate's steganographic results are unconditionally at a high level. Here in [4.1], he introduces a new algorithm implemented by the chaotic three-dimensional Hitzl-Zele dynamic map. It is shown that this algorithm can be used for a least significant bit (LSB) -based steganographic system. The performed stego- as well as visual, histogram analyses and peak signal-to-noise ratio analyses show that the proposed steganographic scheme meets all standards. The article [7.1] is devoted to LSB steganography in images by random selection of the pixels, as a result of which an encrypted text message can be hidden. The proposed algorithm combines the chaotic maps induced by the Duffing and Circle dynamic systems. The reliability and efficiency of this new steganographic system are demonstrated. In the paper [7.4], the performance of steganographic algorithms using the method of replacing symbols in text containers is studied. Tests were conducted with Cyrillic texts in Bulgarian and Russian, as well as in English and German. As a result, it is shown that among these languages, the most suitable for the given steganography is Bulgarian.

Assoc. Prof. K. Kordov also works in the field of hash algorithms. In the study [4.2], a new SHAH algorithm is proposed, which is based on the Tinkerbell image depending on four parameters and represents a quadratic recurrence. By combining two images, a new scheme was investigated that irregularly decimates the outputs of two Tinkerbell functions by using the shrinking rule. The proposed pseudorandom number algorithm successfully passes the NIST, DIEHARD, and ENT statistical tests. Based on it, a hash algorithm

with 5 digest lengths is proposed: 128, 160, 256, 512, and 1024 bits. The robustness of SHAH to collisions has been demonstrated, and the distribution, diffusion, confusion, and hashed information-dependent sensitivity analyses show that this scheme meets all required criteria. Similar is the work [4.2], in which the BentSign hash algorithm based on a binary bent function and two signature attractor chaotic images is presented. Tests of the same characteristics of the hash functions as in the previous work were successfully passed.

The works [7.3] and [7.6] are applied-scientific; the first presents the web-based system for dictionaries of word associations in the Bulgarian language LABLASS, and the second provides an assessment of the reliability of information processes in communication systems by studying the influence of the disturbing effects and tracking the change of the reliability coefficients when the disturbance values change.

The database textbook [19.1] and MS Access manual [20.1] submitted for this procedure are standard and cover the topics studied in the corresponding curricula at FMI. However, by writing these works, assoc. prof. K. Kordov tried to pass on his academic experience to the next generation.

Unfortunately, evaluating the individual contribution of the candidate, it is noticed that only the textbook [19.1] was written independently, and the other works have a total of 2 to 6 authors, as follows: 4 are with 2, 2 with 4, 3 with 5, and 1 with 6 authors. I consider the applicant's participation in all collaborations to be equal, and the declaration of authorship states the same.

4. Fulfillment of minimum national requirements

I accept the candidate's list of points to the minimal national requirements:

- Group B: 3 scientific papers totaling 105 pts. (the required minimum is 100 pts.);
- Group G: 210 points from 6 scientific articles (the required minimum is 200 pts.);
- Group D: 13 citations in WOS and Scopus totaling 104 pts. (the required minimum is 100 pts.);
- Group E: participation in 6 national scientific or educational projects; one Databases textbook and one MS Access manual – a total of 110 pts (100 pts. being the minimum).

The candidate meets also the additional FMI criteria.

5. Teaching, projects and citations

From the candidate's CV, as well as from the additional reference for his educational and teaching work, it is clear that for the last more than 12 years, Assoc. Prof. Kordov has led lectures and the corresponding exercises in 15 different disciplines for Bachelors and Masters degrees. These disciplines are mainly related to programming, design of computer systems, as well as cryptography. In this way, his main scientific activity related to cryptography and steganography is passed on to the students through the various disciplines that he teaches. Related to the teaching work are the two textbooks submitted for participation in this competition, published by the University Publishing House of SHU. The textbook on databases includes the standard course in the discipline, on the positive side, I can note that after each question there is a self-assessment test.

Unfortunately, K. Kordov does not report supervision of doctoral student that is successfully defended a PhD. Nevertheless he was the supervisor of Georgi Dimitrov, who studied as a PhD student and in 2021 he was discharged with the right of thesis defense. A document attached to the competition states the candidate has a scientific advisor to the theses of 14 students from the bachelor's and master's programs at the FMI. Confirmation of Assoc. Prof. Kordov's recognition as an expert among the scientific community working in the field of informatics and computer sciences is his participation in 7 scientific juries for scientific degrees and academic positions: 5 for PhD defences, and 2 for chief assistant.

For his entire career, the candidate has had 160 independent citations on Scopus. The average citation index for the entire work is 14.5, which is a great score for the field of informatics. This shows the recognition of Assoc. Prof. Kordov among specialists in his field, and in particular cryptography, steganography, and information systems. As for the citations selected for participation here, their number is 13, all of which are based on data from WoS and Scopus. It is surprising to me that with so many citations (a total of 56 on Scopus for the 9 articles in this competition), the applicant has chosen only 13 that nominally cover the minimum national requirements. The applicant's h-index shows a value of 8 in WoS and in Scopus, with only the latter allowing self-citations to be removed. I acknowledge all formulated original scientific and applied-scientific contributions indicated in the attached reference. I am not aware of plagiarism in the works presented.

K. Kordov is also active in the dissemination of the results of his scientific activity; participation in 16 scientific forums, of which 4 were held abroad, is indicated. The project activity is also positive, in which participation in a total of 10 national projects is stated, among which the project for centers of excellence UNITE („Universities of Science, Informatics and Technologies in the E-society”) stands out. He also actively worked on research projects internal to the SHU, managing four of them out of a total of 14 project participations.

6. Critical notes and recommendations

I recommend to assoc. prof. Kordov to increase his work with doctoral students and in the future to achieve a successful doctoral thesis defence of one of them. It would also be good to focus his efforts on more participation in prestigious conferences abroad, thereby increasing the visibility of his research, increasing the citations count.

7. Conclusion

All mentioned above, and the fact that the candidate satisfies all requirements of LDASRB, RALDASRB and Konstantin Preslavski University's rules, forms the basis for me to propose Assoc. Prof. Krasimir Mitkov Kordov to be awarded the academic position „**Professor**” in area: **4.6. Informatics and computer science**, scientific speciality „Informatics”.

Shumen, 29.02.2024

Scientific jury member:

/Prof. Nikolay Yankov, DSc/