

REPORT

**on a competition for occupation of the academic position “Associate Professor”
in professional field 5.2. Electro technique, electronics and automation,
announced in State Gazette No. 81 of October 11, 2022
by the Institute of Information and Communication Technologies – BAS,
Department of Information Technologies for Security**

This review is prepared by Prof. Dr. Maria Nisheva-Pavlova from Sofia University St. Kliment Ohridski as a member of the scientific jury for the competition according to Order No. 355/09.12.2022 of the Director of the Institute of Information and Communication Technologies (IICT) – BAS.

One applicant has submitted documents for participation in the announced competition: Dr. Georgi Ivanov Sharkov, Chief Assistant Professor at Paisii Hilendarski University of Plovdiv.

1. General description of the materials presented

The documents of the applicant comply with the requirements of the Act of the Development of the Academic Personnel of the Republic of Bulgaria (ADAPRB), the Rules for the Implementation of the Act of the Development of the Academic Personnel of the Republic of Bulgaria (RIADAPRB), the Rules for the conditions and the order for acquiring scientific degrees and for occupying academic positions in BAS and the Rules for the specific conditions for acquiring scientific degrees and for occupying academic positions in the Institute of Information and Communication Technologies.

The applicant has submitted for the competition:

- European CV,
- Copy of diploma for educational and scientific degree “Doctor”,
- Medical certificate,
- Criminal record certificate,
- Copy of contract for occupation of the academic position “Chief Assistant Professor” in Paisii Hilendarski University of Plovdiv,
- List and copies of scientific publications presented at the competition,
- List of citations,
- Abstracts of the publications presented at the competition (in Bulgarian and in English),
- Reference for original scientific and applied scientific contributions,

- Reference for the fulfillment of the minimum national requirements and the requirements of IICT – BAS for the professional field 5.2. Electro technique, electronics and automation,
- Declaration that there is no proven plagiarism in the scientific works of Dr. Georgi Sharkov.

The documents of the applicant have been prepared in full compliance with the requirements of the Rules for the specific conditions for acquiring scientific degrees and for occupying academic positions at IICT – BAS.

2. Details of the applicant

The applicant Dr. Georgi Sharkov has a higher education in Mathematics, completed in 1986 at Sofia University St. Kliment Ohridski, Faculty of Mathematics and Informatics. In 1993, after a successful defense of a dissertation on the topic “Representation and interpretation of knowledge in the field of membrane biophysics”, he was awarded a doctoral degree. In the period 1986-1993, he worked as a research associate at the Bulgarian Academy of Sciences and a researcher at the University of Ghent, Belgium. He has worked as an IT specialist, head of software development and IT director in international financial institutions. From 2002 to 2014, he was a managing partner in Soft Innovations Ltd. Since 2013, he has been working as a chief assistant professor (part-time) in Paisii Hilendarski University of Plovdiv.

Since 2004, he has been a manager and member of the Board of Directors of the European Software Institute - Center Eastern Europe (ESI CEE) Foundation. Since 2016, he is the head of the Cybersecurity Laboratory, Sofia Tech Park. During the period 2014 - 2021, he was an advisor to the Minister of Defense, and during part of this period, he was also a national coordinator for cybersecurity and an advisor in the political cabinet of the Prime Minister.

From 2018 to 2021, he was an expert in the High Level Expert Group on Artificial Intelligence of the European Commission.

3. General characteristics of the applicant's scientific work and achievements

The research activities of Dr. Georgi Sharkov and the topics of his scientific works are entirely in the field of competition. The publications with which he participates in the competition do not repeat those of the previous procedure for the acquisition of his doctoral degree.

Six of the scientific papers submitted for participation in the competition are single-authored and the remaining 32 are co-authored. I have no doubt about the applicant's significant personal contribution to the collective publications.

There is no proven plagiarism in the scientific works of Dr. Georgi Sharkov.

In accordance with the requirements of the Rules for the specific conditions for acquiring scientific degrees and for occupying academic positions at IICT – BAS, the candidates for an academic position of associate professor in professional field 5.2. Electro technique, electronics and automation must have: 50 points in group of indicators “A”, at least 100 points in group of indicators “B”, at least 220 points in group of indicators “Г”, at least 60 points in group of indicators “Д”, at least 20 points in group of indicators “E”.

Each of these conditions is stronger than the corresponding requirement under Art. 1a, para. 1 of the RIADAPRB.

According to the submitted documents the applicant covers:

- 50 points in group of indicators “A”,
- 269.5 points in group of indicators “B”,
- 238.8 points in group of indicators “Г”,
- 210 points in group of indicators “Д”,
- 80 points in group of indicators “E”.

Therefore, the minimum national requirements and the additional requirements under Art. 1a, para. 2 and para. 3 of the RIADAPRB for occupation of the academic position of “Associate Professor” in the professional field 5.2. Electro technique, electronics and automation have been completely covered and exceeded by Dr. Georgi Sharkov.

4. Substantive analysis of the scientific and applied scientific achievements of the applicant, presented in the materials for participation in the competition

The scientific papers, presented by Dr. Georgi Sharkov for participation in the competition, contain original research results, which can be grouped and summarized as follows:

- *Theoretical models to study the security, resilience and risks of complex interconnected systems.* A concept and models have been developed to study the security, resilience and risks of complex interconnected systems, based on the approach known as “System of Systems” (SoS). Methods for identifying and assessing dependencies, weaknesses, threats and risks in different types of SoS are proposed. The specifics of the dependencies of complex interconnected systems at different levels of the cyberspace have been studied. SoS interaction models are proposed that build an extended view of the “terrain” for attacks or malicious actions with great effect and can serve for objective situational awareness of complex systems, as well as be used for coordinated attack and crisis response. An original flexible architecture of an experimental cyber-physical environment has been developed to simulate the behavior

of complex systems with the possibility of automated analysis and tracking of weaknesses and cyber attacks in a closed and/or Internet environment.

- *Conceptual model for structuring knowledge and object models in the so-called cyber terrain.* A conceptual model for structuring knowledge and object models in the so-called “cyber terrain” is proposed. In particular, ontologies have been developed, unifying hierarchies of heterogeneous concepts, for the purposes of modeling and studying the behavior of complex cyber-bio-socio systems. Different types of connections between the main objects and actors in the cyber environment have been identified and formally defined, and a map has been made of the used in practice and already standardized taxonomies for interoperability at different levels of interaction – weaknesses and vulnerabilities of software and communication systems, cyber-attack models, etc. Variants of a methodology for determining the levels of cyber risks and the threat level in complex interconnected systems are proposed.

In my opinion, the aforementioned results characterize the candidate Dr. Georgi Sharkov as a scientist with significant achievements, which give reason to claim that he completely covers the concept of an established researcher in the field of information technologies.

The significance of the applicant’s research results is evidenced by their reflection in the works of other authors. Dr. Georgi Sharkov submitted data for a total of 21 citations of publications with which he participates in the competition, in articles of other authors that were referenced and indexed in Web of Science or Scopus.

5. Critical notes and recommendations

I have no significant critical comments on the materials in the competition and in particular on the scientific works of Dr. Georgi Sharkov. I am aware of the fact that serious research in the scientific field in which he works is generally a collective matter, but I recommend him to aspire in his future work to a larger number of single-authored publications, presenting results for which he has a key contribution. I also recommend that the candidate focuses on working actively with postgraduate and doctoral students, and in particular on supervision of doctoral students, so that he contributes to the preparation of the next generation of information technology researchers.

6. Personal impressions of the applicant

I have excellent personal impressions of the applicant’s work during his doctoral studies at BAS, as a part-time lecturer at the Faculty of Mathematics and Informatics of Sofia University St. Kliment Ohridski, as well as in connection with some educational initiatives of ESI CEE. I highly appreciate

Dr. Georgi Sharkov's professionalism, initiative, thoroughness and efficiency in his work, his ability to work, communication and cooperativeness.

7. Conclusion on the application

Having become acquainted with the materials and scientific works presented in the competition and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I **confirm** that the scientific achievements of the candidate Dr. Georgi Sharkov meet the requirements of the ADAPRB, the Regulations for its implementation and the corresponding BAS Regulations and IICT Rules for the occupation of the academic position of "Associate Professor" in the professional field "Electro technique, electronics and automation". In particular, the applicant meets the minimum national requirements in the professional field and no plagiarism has been detected in his scientific papers submitted at the competition.

I give a **positive assessment** of the application of Dr. Georgi Sharkov.

GENERAL CONCLUSION

Based on the above, I **recommend the scientific jury to vote on a proposal to the Scientific Council of the Institute of Information and Communication Technologies of the Bulgarian Academy of Sciences to select Dr. Georgi Sharkov for the academic position of "Associate Professor" in the professional field 5.2. Electro technique, electronics and automation.**

January 27, 2023

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