Review

for the competition for the occupation of the academic position „Associate Professor“
in the professional field 5.2 Electrical Engineering, Electronics, and Automatics,
for the needs of the
Institute of Information and Communication Technologies (IICT) -
Bulgarian Academy of Sciences (BAS),
Department of Information Technology for Security,
announced in the State Gazette, № 81/11.10.2022

by Prof. Dr. Kalinka Kaloyanova
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I am presenting this review as a member of the Scientific jury in the above-mentioned competition, on the basis of the order № 355/09.12.2022 of the Director of IICT-BAS, which is based on the decision of the Scientific Council of IICT (Protocol №13/ 30.11.2022).

The only candidate for the competition is Dr. George Ivanov Sharkov - Chief Assistant Professor at Paisii Hilendarski University of Plovdiv.

As a member of the jury, I received the following documents and papers from the candidate:

1. CV;
2. Copy of diploma for educational and scientific degree “Doctor”;
3. Medical certificate;
4. Criminal record certificate;
5. Certificate of the length of services (*Paisii Hilendarski* University of Plovdiv);
6. List of publications for participation in the competition;
7. List of citations;
8. List of annotations (in Bulgarian & in English) of the publications presented at the competition;
9. Copies of the publications presented at the competition;

10. Reference for the fulfillment of the minimum national requirements and the requirements of IICT for the professional field 5.2 Electrical Engineering, Electronics, and Automatics;
11. Reference for original scientific contributions;
12. Candidate's declaration of absence of plagiarism in scientific works;
13. Reference of the fulfillment of the requirements for NACID registration;
14. Reference for participation in international research or educational projects.

A short CV

Georgi Sharkov graduated from the Faculty of Mathematics and Informatics (FMI) at the University of St. Kliment Ohridski" with a bachelor's degree in Mathematics in 1986. He acquired a Ph.D. degree on the topic "Presentation and interpretation of knowledge from the field of membrane biophysics" in 1993. He specialized (as a postdoc) in genetics and thermography at the Laboratory of Genetics, Ghent University, Belgium.

His professional biography is impressive.

He has worked both in scientific organizations and in leading positions in a number of prestigious software organizations. The most important among them are - the manager (managing partner) of Soft Innovations EOOD, the manager of the European Software Institute - Center Eastern Europe (ESI CEE) since 2004, Head of the Cybersecurity Laboratory, Sofia Tech Park since 2016. In the period 2017-2019, he was an advisor to the Minister of Defense, a national coordinator for cyber security, and an advisor in the political cabinet of the Prime Minister.

He participated as an expert in the High Level Expert Group on Artificial Intelligence (AI) at the European Commission from 2018 to 2021.

He also held a number of academic positions. In the period 1986-1993 he worked as a researcher and research assistant at the Bulgarian Academy of Sciences (BAS), in 2013 he started working as an assistant, and since 2014 he has been a half-time Chief Assistant at *Paisii Hilendarski* University of Plovdiv - Faculty of Mathematics and Informatics.

General presentation of the submitted materials. Compliance with the minimum requirements

It is clear from the presented documents that Chief Assistant Professor George Sharkov meets the requirements for the occupation of the academic position of "Assoc. Professor", which are specified in the Act on Development of the Academic Personnel in the Republic of Bulgaria and the Rules of the Implementation of the Act on Development of the Academic Personnel in the Republic of Bulgaria and the Regulations for the Special Conditions for Acquisition of Academic Degrees and for Applying for Academic Positions at IICT - BAS :

- The candidate has obtained the scientific degree "doctor" - topic "Presentation and interpretation of knowledge from the field of membrane biophysics", diploma No 28911/ 05.05.1994, Higher Attestation Council.
- He has submitted 10 publications covering the group "В" requirements. All of them are visible in Scopus, and four of them are also indexed by WoS - a total of 269.5 points out of the required 100 points. The publications were made in the period 1995-2022.
- He has presented 26 publications and two book chapters to meet the group "Г" requirements - a total of 238.8 points out of the required 220 points. The publications were made in the period 1989-2022.
- The presented publications were not used in previous procedures.
- A list of 21 citations is provided, all visible in Scopus – 210 points, which far exceeds the requirements of "Д" group of 60 points.
- Dr. Sharkov held academic positions at the *Paisii Hilendarski* University of Plovdiv for more than 3 years.
- Georgi Sharkov has provided a document for participation in 2 projects under the Erasmus+ program, as well as in two H2020 projects, with which he achieves 80 points in "E" group, where only 20 points are required in this group.
- There is no identification of plagiarism in his scientific work.

General characteristics of the applicant's scientific and applied activities and his contributions in the submitted for the review publications

Dr. Sharkov has submitted thirty-six publications for the competition and two chapters of a collective monograph. Eleven publications are indexed by Scopus, and six publications are visible in WoS.

The majority of publications were presented at scientific conferences, eight of them are journal articles. Dr. Sharkov is the single author of four of the publications, as well as the two book chapters, the remaining publications are collective. Considering the presented results, the consistency and coherence in the research, as well as the fact that he is the first co-author in a significant part of the publications, I believe that his contribution to all research is significant.

The presented results focus on actual topics.

The main group of the obtained results is related to the establishment of a complex approach for researching the security and resilience of complex interconnected systems and the risks associated with them. The complex modern systems and applications are considered new types of composite systems with emergent behavior - "System of Systems" (SoS).

Specifics of the interdependencies of complex interconnected systems in cyberspace have been studied and analyzed at different levels and at different layers.

A new theoretical approach and model for achieving cyber resilience of SoS are proposed, suitable for threat detection, combined risk management and a "layered" view on different types of SoS - industrial systems, supply chain management systems, monitoring systems, and management of critical infrastructures and components of national security and defense,

An original and flexible architecture model is developed for a specialized research "cyber-physical" environment for simulating the behavior of complex systems, which enables automated analysis and tracking of vulnerabilities and cyber attacks in a closed environment and/or Internet environment. The pilot implementation and testing demonstrate promising results.

The SoS approach was implemented in the National Cybersecurity Strategy "Cyber resilient Bulgaria 2020".

A conceptual model for structuring knowledge and object models in cyberspace has also been proposed, and ontologies have been developed, including various hierarchical concepts, classes and elements for the purpose of modeling and studying the behavior of complex cyber-bio-socio systems.

Different types of connections have been identified and defined by mapping the used in practice and standardized taxonomies for interoperability at different levels of interaction - weaknesses and vulnerabilities of software and communication systems, cyber attack logic models, sector structuring and damage (harm) assessment, and others, in accordance with the ENISA (European Cybersecurity Agency) recommendations.

The developed models for the cyber terrain formalized description and the interaction of different types of actors/agents are applied for defining theoretical frameworks and practical architectures of computing environments for the simulation of different real eco-systems, segments, and digitized sectors, also for the development of a new generation of simulation cyber-environments (Cyber Range) of a hybrid type and realization of complex scenarios for realistic cyber-exercises ("Cyber Shockwave" type).

Several publications present methodologies that enable the adaptation of standards and competency models (CMMI, TMMi, CERT Resilience Management Model (CERT-RMM)) for small and medium-sized business organizations and for training IT and cybersecurity professionals at the university level.

Following the publications, it should be noted the holistic process applied - from the conceptual approach, through the theoretical models and architecture decisions - to the implementation, even looking for inclusionelements and concepts in educational programs.

Citations

The list of citations submitted by Dr. Sharkov for the competition presents 21 citations, all visible in Scopus, which together with the invitations for him to participate in conferences focused on security topics declares a good visibility of his results in this emerging field.

Teaching activities

The submitted documents do not present information on specific academic disciplines taught by Dr. Sharkov, but taking into account his position as Chief Assistant at the *Paisii Hilendarski* University of Plovdiv and the fact that he traditionally teaches several courses at FMI - SU "St. Kliment Ohridski" every year, it can be concluded that his teaching activity is also significant.

Personal impressions

I have known George Sharkov for more than 10 years in connection with joint activities of ESI CEE and Carnegie Mellon University, as well as from his teaching activities at the Faculty of Mathematics and Informatics - SU "Kliment Ohridski" both in the bachelor's programs and in the Master's program "IT services and projects". I am impressed by his active and diverse activities in a number of directions. I highly appreciate his tireless efforts to spread knowledge to students and other community groups. Both as a specialist and researcher, as well as a lecturer, Georgi Sharkov demonstrates a high level of professionalism.

Comments and recommendations

Taking into account the promising topics of Dr. Sharkov's research, I would like to recommend him to actively work with doctoral students as well.

Conclusion

In conclusion, the documents and materials presented by Chief Assistant Professor George Ivanov Sharkov declare significant results that completely meet all requirements for the academic position of "Associate Professor" according to the Act of the Development of the Academic Personnel of the Republic of Bulgaria, the Rules for its implementation, as well as of the Regulations for the Specific Conditions for Acquisition of Academic Degrees and for Applying for Academic Positions at IICT-BAS in 5.2 Electrical engineering, electronics, automation and even exceed some of these requirements. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been found in the scientific works submitted for the competition.

I give a **positive assessment** of the application of Chief Assistant Prof. Dr. George Ivanov Sharkov.

GENERAL CONCLUSION

Based on the above, I **strongly recommend** to the Honorable Scientific Jury to vote on a proposal to the Scientific Council of IICT-BAS to select Dr. George Sharkov for the academic position of Associate Professor at IICT-BAS in the professional field 5.2 Electrical Engineering, Electronics, and Automatics.

31.01.2023
Sofia

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