OPINION

on a competition for the academic position of "Associate Professor" in the field of higher education 5. Technical Sciences, professional field 5.2. Electrical Engineering, Electronics and Automation, scientific specialty "Elements and Devices of Automation and Computing Technology" for the needs of Section Control of Robots and Mechatronic Systems of the Institute of Robotics of the Bulgarian Academy of Sciences, announced in the State Gazette No. 39 of 13.05.2025.

The opinion was prepared by Prof. Dr. Maya Ivanova Dimitrova, Institute of Robotics at the Bulgarian Academy of Sciences, in my capacity as a member of the scientific jury for the competition in accordance with Order No. 79 / 17.07.2025 of the Director of the Institute of Robotics at the Bulgarian Academy of Sciences, Prof. Dr. August Ivanov.

Only one candidate has submitted documents to participate in the announced competition: Assistant Professor Dr. Vanya Dimitrova Markova from the Institute of Robotics - BAS.

1. General Description of the Presented Materials

The documents, submitted by the candidate in the competition, comply with the requirements of the Law for Development of the Academic Staff in the Republic of Bulgaria, the Regulations of Application of the Law for Development of the Academic Staff in the Republic of Bulgaria and the Regulations on the terms and conditions for acquiring scientific degrees and occupying academic positions of the Institute Robotics of the Bulgarian Academy of Sciences.

Dr. Vanya Markova participates in the competition with 10 titles indexed in Scopus and WoS, equivalent to a monograph, 4 titles in publications, referenced and indexed in world-renowned databases of scientific information and 17 publications in non-referenced publications. A list of 25 citations in Scopus and WoS is presented.

2. Candidate Details

Dr. Vanya Markova graduated with a degree in "Mathematics", qualification "Mathematician with specialization in Informatics" from Plovdiv University "Paisiy Hilendarski" in 1987.

She was appointed as a Researcher at the Institute of Control and Systems Research, Bulgarian Academy of Sciences in 2001, and since 2008 she has been an Assistant. Since 2013 she has been an Assistant Professor at ISER, transformed in 2017 into the Institute of Robotics - Bulgarian Academy of Sciences. In 2013 she obtained the scientific degree of PhD with a dissertation on the topic: "Methods and algorithms for describing the behavior of an autonomous mobile sensor agent". Dr. Vanya Markova has participated in two projects, one of which is a Center of Competence, within which a laboratory in "Collective Robotics" has been established, where she is a leading scientist.

3. General Characteristics of the Candidate's Scientific Works and Achievements

The table presents the number of points obtained by indicators for Area 5. Technical Sciences of the candidate Dr. Vanya Markova after consulting the world-famous scientific information database Scopus:

Indicator Group	Indicator (I)	Minimal Requirements	Number of Points of the Candidate
A	Thesis for the award of the PhD degree	50	**50**
B	4. Habilitation thesis – scientific publications (no less than 10), which are referenced and indexed in world-renowned databases of scientific information (Scopus) – 10	60/n >100	**330**
Г.	7. Scientific publications in publications that are referenced and indexed in world-renowned databases of scientific information – 4	40/n	40
	8. Scientific publications in non-refereed journals with scientific review or in edited collective volumes - 17	20/n >200	200 240
Д	12. Citations (or reviews) in scientific publications, referenced and indexed in world-renowned databases of scientific information or in monographs and collective volumes - 25 citations in Scopus	10 >50	250
	Total	>400	870

As can be seen from the table, the points of the candidate Dr. Vanya Markova cover and significantly exceed the minimum national requirements (under Art. 2b, para. 2 and 3 of the Law for Development of the Academic Staff in the Republic of Bulgaria for

the position of "Associate Professor" in the scientific field and professional direction of the competition.

The scientific papers submitted by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position; There is no plagiarism proven in accordance with the statutory procedure in the scientific papers submitted for the competition.

4. A Substantive Analysis of the Candidate's Scientific and Applied Scientific Achievements Contained in the Materials for Participation in the Competition

The candidate's contributions are in the areas of autonomous agent design, development of deep learning methods, reinforcement learning, deep recurrent neural networks, and development of the theory of collective robotics, the methods for achieving consensus and controlling formations of mobile robots. I accept the proposed division of contributions, in which the following contributions are of *scientific nature* :

1. An innovative neural architecture based on models with long short-term memory and attention mechanism, used to predict the behavior of autonomous agents in a discrete two-dimensional dynamic environment;

2. A new method for initializing clusters of agents in geometric graphs for accelerated convergence of the graph partitioning algorithm;

3. A novel approach to knowledge transfer in reinforcement learning in the neural network in a simulated two-dimensional environment with traps and obstacles, in which trained agents transfer knowledge to new agents in real time;

4. A new, leader-independent, consensus decision-making mechanism in multi-agent systems with an introduced "maximum dislocation" metric and its role in predicting the time to reach a future consensus state.

Scientific applied nature have a number of the presented contributions, such as:

- Adaptation of optimization algorithms for multi-robot systems;

- Adaptive neural approaches for creating and maintaining formations of autonomous mobile robots;

- Adaptation of methods for identification of dynamic systems through recurrent neural networks;

- Developed experimental protocol for knowledge transfer between agents, etc.

5. Personal Impressions of the Candidate

I have known the candidate for many years on a collegial basis. My personal impressions are of a deep researcher and a warm-hearted person.

CONCLUSION

The works submitted by the candidate for the competition fully comply with the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, the Regulations of the Bulgarian Academy of Sciences and the Regulations of the Institute of Robotics at the Bulgarian Academy of Sciences. Based on the above, I would like to recommend to the Scientific Jury to propose to the Scientific Council of the Institute of Robotics - BAS to elect Dr. Vanya Dimitrova Markova for the academic position of "Associate Professor" in the field of higher education 5. 5. Technical Sciences, professional field 5.2. Electrical Engineering, Electronics and Automation, scientific specialty "Elements and Devices of Automation and Computing Technology".

Prepared by:

Prof. Dr. Maya Dimitrova

12.08.2025