OPINION

on the competition for the academic position of "Associate Professor" in the field of higher education: 5. Technical Sciences, in the professional field 5.2. Electrical Engineering, Electronics and Automation, scientific specialty "Elements and Devices of Automation and Computing Equipment," for the needs of the "Control of Robots and Mechatronic Systems" (CRMS) Department at the Institute of Robotics – Bulgarian Academy of Sciences (IR–BAS), announced in State Gazette No. 39 of 13 May 2025.

Member of the Scientific Jury: Prof. Dr. Maya Ignatova – IR–BAS

1. General information and biographical data

The sole applicant in the competition is Chief Assistant Professor Dr. Vanya Dimitrova Markova. She graduated from Plovdiv University "Paisii Hilendarski" in 1987. Since 1988, she has worked as a programmer, first at the Central Laboratory of Automation and Scientific Instrumentation – Plovdiv branch, and later at the Institute of Robotic Systems. In 1992, she worked as a part-time lecturer in programming and computing systems at the EEP Department of the Higher Institute of Food and Flavor Industries – Plovdiv (now University of Food Technologies – Plovdiv). From 2001 to 2013, Dr. Markova worked at the Institute of Systems Research and Robotics – BAS (now IR–BAS) as an assistant professor. In 2013, she obtained her PhD at the same institute. Since 2013, she has held the position of Chief Assistant Professor in the CRMS Department at IR–BAS.

2. General description of submitted materials

The applicant, Chief Assistant Professor Dr. Vanya Markova, is participating in the competition for "Associate Professor" with a list of 31 scientific publications. Fourteen of them are published in journals referenced and indexed in world-renowned scientific databases.Ten publications are grouped in Category B – Habilitation work – scientific publications (minimum 10) in journals referenced and indexed in world-renowned databases; 4 publications are in Category G7. Seventeen publications are in Category G8 – Scientific publications in non-referenced journals with peer review or in edited collective volumes. There are no publications in journals with an impact factor. Only 2 publications submitted for the competition have an impact rank and are in quartile Q4. There are 25 citations of 6 articles. For the third there is one self-citation; therefore, I accept 24 citations..

Table

Group of indicators	Minimum national requirements	BAS requirements	Declared points by the applicant
A	50	50	50
B	–	–	–
C	100	100	330
G	200	200	250
D	50	60	240
E	–	–	–

The analysis of the table shows that in all groups of indicators, Dr. Markova exceeds the minimum national requirements according to the ZRASRB, PPZRAS.

The submitted works are in topical scientific and practical fields. A closer look shows that the applicant applies modern methods and tools to solve scientific problems and achieve the stated goals.

3. Scientific and applied-scientific contributions

The applicant, Dr. Markova, has formulated 4 scientific and 7 applied-scientific contributions.
The scientific contributions demonstrate significant progress in the field of autonomous multi-agent systems, robotics, and the application of modern machine learning methods.
The work is interdisciplinary, combining classical mathematical approaches – graph theory, optimization algorithms, and kinematic models – with modern techniques such as deep recurrent neural networks (LSTM, GRU), Sequence-to-Sequence architectures with attention, and reinforcement learning (RL, DRL).
Among the most significant results are:

- Development of decentralized consensus protocols for leaderless swarm control, robust to noise and uncertainty;
- Formalization of knowledge transfer between RL agents through Markov processes, introducing a new task similarity metric, leading to accelerated learning;

- Integration of Sequence-to-Sequence models for modeling agent behavior in dynamic environments – an approach that offers an alternative to classical RL methods;
- Development of decentralized versions of the Kuhn–Munkres algorithm and hybrid methods (APF+RPF) for controlling large swarms of robots.

4. Significance of contributions for science and practice

I believe that the contributions listed in point 3 are relevant and significant for enriching and developing research in the thematic field in which she works. They highlight the link between theoretical developments and their experimental application – through simulations and realistic scenarios with mobile robots and drone systems – demonstrating the high practical value of the results.

The submitted materials represent a current, original, and well-structured body of work, presenting Dr. Markova as a specialist contributing to the development of adaptive and intelligent methods for the control of autonomous systems.
The results have potential applications in robotics, industrial automation, autonomous transport, and intelligent infrastructures.

Dr. Markova's active participation in international scientific forums convincingly shows that her work has achieved the necessary recognition in both national and international scientific communities.

5. Final notes and recommendations

Based on the submitted scientific production for participation in the present competition, I consider that Dr. Markova is a highly qualified and erudite scholar with broad general knowledge and well-deserved authority among specialists in Bulgaria and abroad.

I would like to make the following remark regarding the preparation of the submitted materials:
The presentation of contributions is rather lengthy. Usually, clear and concise descriptions without unnecessary detail are preferable. The publication list in the "Reference for meeting the minimum requirements of the ZRASRB" table is not prepared correctly – incorrect or missing page numbers. The first cited article cannot be traced, and the third has one self-citation. I recommend that Dr. Markova direct

her publication activity toward scientific journals with an impact factor and impact rank, which is a primary requirement for specialists with long-standing research experience.

CONCLUSION

Based on my review of the competition materials, the relevance and significance of the contributions achieved, and my positive assessment of the applicant's overall research activity, I propose to the Scientific Council of IR–BAS to elect **Chief Assistant Professor Dr. Vanya Dimitrova Markova to the academic position of "Associate Professor"** in the field of higher education: 5. Technical Sciences, in the professional field 5.2. Electrical Engineering, Electronics and Automation, scientific specialty "Elements and Devices of Automation and Computing Equipment," for the needs of the CRMS Department at the Institute of Robotics – BAS.

02.09. 2025 **Member of the Scientific Jury:**

Sofia