OPINION

for procedure for occupation of the academic position **"Associate Professor"**

Professional Field: 5.2. Electrical Engineering, Electronics and Automation,
Scientific Specialty: Elements and devices of automation and computing technology,
Published in SG : No. 39 from 13.05.2025

Candidate: **Assist. Prof. Vanya Markova, PhD**

Member of the Scientific Jury: Prof. Michail Petrov, PhD
Technical University of Sofia, Plovdiv branch

1. General characteristics of the candidate's scientific research and applied scientific activities

The candidate participates in the announced competition with a list of 10 scientific works: including 1 scientific article and 9 conference papers, which are referenced and indexed in the world scientific data bases SCOPUS and Web of Science. Of the scientific articles and reports submitted for participation in the competition, all are in English. The candidate has 1 individual publication, in 7 publications the candidate is the first author and in 2 publications is the second author.

The total number of citations of the candidate's scientific works in the competition, visible in SCOPUS, is 40. The attached list of citations by the candidate includes 25 citations.

It is evident a reference list certifying the fulfillment of the minimum national requirements by the Regulations of the Law for the Development of the Academic Staff in Bulgaria and also the minimum requirements by the Regulations on the Conditions and Procedures for Acquiring Scientific Degrees and Holding Academic Positions of the Bulgarian Academy of Sciences for occupying the academic position "Associate Professor". The reference list shows that the requirements for individual groups of indicators have been filled: group A - 50 points; group B - 330 points; group Г - 240 points; group Д - 260 points; (Total 880 points, with 860 required).

The analysis of the presented materials shows that the requirements are covered according to the Law for the Development of the Academic Staff in Bulgaria, as well as the Regulations on the Conditions and Procedures for Acquiring Scientific Degrees and Holding Academic Positions of the Bulgarian Academy of Sciences.

2. General scientific and applied scientific contributions

In the scientific works of the candidate, there are sufficient in terms of importance and number of scientific, scientific-applied and applied contributions. They correspond to the scientific specialty of the competition and include three interconnected areas in the field of autonomous multi-agent systems and robotics: Formation and control of collectives of autonomous agents and robots; Joint training and strategy of agents through support training and knowledge transfer; Building and prediction of behavior of autonomous agents using deep machine learning methods.

I accept the candidate's pretentions for contributions to the scientific works as follows:

Scientific contributions:

- It has been developed and implemented an innovative neural architecture of the encoder-decoder type and sequence-to-sequence models for agent behavior in game and dynamic environments [2];
- It has been developed and investigated a new method for cluster initialization, appropriate for the tasks of forming collectives of autonomous robots, based on unsupervised machine learning methods in geometric graphs [8];
- It has been made a definition and formalization of knowledge transfer through Markov Decision Processes (MDP). A general formulation of the transfer problem in Reinforcement Learning as a sequential decision-making process has been derived, with a precise mathematical description of the transition and reward functions and their role in the learning process [3].

Scientific-applied and applied contributions:

- They have been developed improved consensus algorithms in multi-agent systems [6];
- Advanced optimization algorithms of the Hungarian assignment type have been applied for the distribution of roles and positions in robot formations [7];
- It has been proposed an original Deep Reinforcement Learning (DRL) approach for creating and maintaining formations of autonomous mobile robots [5];
- It has been proposed a framework with a conceptually and technically new solution for building agents with autonomous behavior with built-in meta-learning [1];
- The use of recurrent neural networks for identification and prediction of behavior of chaotic dynamic systems has been applied [4];
- It has been proposed a hybrid approach for controlling a formation of mobile robots through the joint use of Artificial Potential Fields and a Refined Particle Filter [10];
- It has been developed and implemented a system for off-line knowledge transfer between agents [3];
- They have been developed kinematic and dynamic models of non-holonomic mobile robots in a collective formation [6].

4. Significance of the contributions to science and practice.

The presented publications of the candidate are aimed at developing intelligent algorithms and approaches for decentralized control and coordination in a dynamic and uncertain environment of collectives of autonomous agents and robots. The main part of the research covers key directions in the field of Reinforcement Learning, Deep Machine Learning, consensus protocols and control of collectives of autonomous agents and robots. The research is aimed at developing intelligent algorithms and approaches for decentralized management and coordination in a dynamic and uncertain environment.

Assist. Prof. Markova has presented a certain number of lecture courses in the field of the professional field, related to the topic of her scientific research.

It should be noted that the quantitative and qualitative indicators of the criteria for occupying the academic position of "associate professor" are met by the candidate. In general, with his scientific production and contributions, the candidate is known among scientific community at home and abroad.

5. Critical notes and recommendations

I have no significant critical comments on the scientific works submitted by the candidate.

The proposed reference list for the contributions in the works of Assist. Prof. Markova has been expanded to a certain extent. A shorter systematization and summarization is possible on the basis of the attached substantive abstracts of the publications. In this case, this is a natural result, considering the topic of the candidate's scientific publications and the teamwork of the developments. This note is essentially of a recommendatory nature and do not affect the results achieved by the candidate in his scientific and scientific-applied activities.

CONCLUSION

I would like to give a positive assessment to the materials submitted by the candidate. I believe that they satisfy the requirements of the the Law for the Development of the Academic Staff, the Regulations for its implementation, the Regulations of the Bulgarian Academy of Sciences for the terms and conditions for occupying the academic position of associate professor. I evaluate the scientific and scientific-applied contributions in the candidate's scientific works as significant for the scientific-research practice and the educational process. Therefore, I find it reasonable to propose Assist. Prof. Vanya Markova, PhD for the academic position of "Associate Professor" in the professional field 5.2. Electrical Engineering, Electronics and Automation (specialty Elements and Devices of Automation and Computing Technology).

Date,
10.09.2025

SCIENTIFIC JURY MEMBER:

/Prof. Dr. Michail Petrov/