REVIEW

for a competition for the academic position of " **Associated Professor** " in the field of higher education 5. Technical Sciences; Professional field 5.1. "Mechanical Engineering", Scientific specialty "Robots and Manipulators" (Applications of service robotics and control systems with elements of artificial intelligence), announced in "State Gazette", issue 61/ 29.07.2025, for the needs of the "RiMIS" section with candidate **Dr. George Tsvetanov Angelov**

Reviewer: Academician Chavdar Rumenin, member of the scientific jury, according to Order No. 81/ 30.09.2025 of the Director of the Institute of Robotics at Bulgarian Academy of Sciences

1. Antechamber

In the competition, only one candidate, Dr. George Angelov, submitted regular documents within the legal deadline. From 2017 to the present, he has been an employee of the Institute of Robotics-BAS as an assistant and chief assistant . In 2018, G. Angelov defended his dissertation on the topic " Research, modeling and implementation of software systems for control and communication of service mobile robots in the TCP / IP network environment " for the PhD degree. Since 2019, he has been the head of the National Laboratory of Robotics and Artificial Intelligence at the Institute of Robotics. His competencies are in the scope of robotics, mechatronics and engineering physics. He participates in a total of 14 projects, of which 3 international, 3 national at the Bulgarian National Science Foundation, etc. For me, his participation in two National Centers of competence. The other projects are with companies. In 2008, he received a gold medal from the International Technical Fair in Plovdiv for the development of "Megapixel IP cameras for video surveillance" .

2. General phenomenology of materials

Dr. G. Angelov, in addition to the submitted mandatory documents for the competition such as an application for participation, CV, PhD diploma, lists of scientific works, a list of citations of his publications, a reference for his scientific and applied scientific contributions; a reference for participation in scientific and

educational projects, etc., for me his monographic work in English " Modern Applied Service Robotics", which I will discuss in more detail. He has also presented 10 publications on the topic of the competition in publications that are referenced in world-renowned databases, as well as 14 works published in non-refereed journals. According to the candidate's statement of compliance of the materials with the minimum national requirements for the academic position "Associated Professor", it is clearly seen that Dr. Angelov meets the required number of points for the relevant indicators.

About the monography

The monograph "Modern Applied Service Robotics" is a thorough and consistent work on the theoretical and applied aspects of modern service robotics, with an emphasis on its educational applications. The author competently examines The main concepts related to service robotics are clearly and thoroughly described, as are the necessary hardware and software components for building modern service robots. Particular attention is paid to the key building blocks such as micro-sensors and multi-sensors, integrated circuits, mini-actuators, actuators, microcontrollers and computing hardware, which makes the monograph a useful resource for specialists, engineers and researchers working on the implementation of such systems. It is presented detailed analysis of the use of Linux in robotics, with an emphasis on historical development, open source and the most popular distributions suitable for robotic applications. Particularly useful are the chapters that examine the Linux system architecture, the main approaches and the ideology of work. The ROS robot operating system and its latest version ROS 2 are presented with a clear distinction and detailed analysis of key concepts such as nodes, topics, services and command -line visualization tools. Included are many of the solutions used such as FreeRTOS , VxWorks and RTLinux, which are essential for robotics, requiring high accuracy and speed of response. The monograph also thoroughly presents the importance of various programming languages, including C and C ++, Python and web-based languages (JavaScript , HTML , CSS and PHP), emphasizing their applicability and advantages in the development of service robotic systems and platforms. The candidate also examines the main types of databases - relational, vector, etc., which contribute significantly to the intelligence and adaptability of robots. Descriptions of basic software libraries and tools such as

OpenCV , Point Cloud Library (PCL), MoveIt as well as advanced configurations for machine learning and AI.

A special attention has been paid to communication technologies – serial interfaces, TCP / IP networks, IoT communication standards and cloud services, highlighting their critical role in building reliable robotic systems. A significant contribution is the development and detailed presentation of the educational robots ANRi2, MaxiBot and BeBot, integrated into the OPERA platform (Open Platform for Education in Robotics and AI). These robots were designed, prototyped and implemented at the National Laboratory of Robotics and Artificial Intelligence at the Institute of Robotics at the Bulgarian Academy of Sciences, with G. Angelov being the initiator and actively participating in the entire implementation process. The monograph describes in detail the mechanical structures, electronic subsystems and software architecture of each of the robotic platforms. Particularly valuable are the demonstrated practical applications such as programming lessons in robotics for beginners and advanced users, robot-assisted games and educational scenarios for children with specific educational needs. All this shows the real potential of robotics for improving the quality and efficiency of education. Also, in the context of the rapidly developing technological ecosystem, the author successfully identifies and describes the key trends and future directions in service robotics. In addition to all of the above, the book is a highly professional guide in the field of robotics. The presented monograph "Modern Applied Service Robotics" is the first in the field of didactic robotics. For me, of particular importance is the fact that this work is based on original results obtained by Dr. G. Angelov. The work is characterized by a significant contribution to the field of educational service robotics, providing knowledge and practical guidance for the academic community. I highly appreciate the results contained in the monograph, which in its unity is on the topic of the announced competition "Applications of service robotics and control systems with elements of artificial intelligence".

3. Some characteristic results of the candidate's innovation activity

Dr. George Angelov has presented in the competition, in addition to the monograph already analyzed by me, 24 more scientific works outside the publications on the dissertation . The ten publications referenced in world databases are entirely on the topic of the competition. The results of the main part of these

works are on robotic systems in biology and medicine. With the created educational service robots Bebot and Maxibot are in the field of STEM education and social pedagogy, and the automated computer-controlled electrochemical spectrometer is applicable in the study of bilayer phospholipid membranes. The created robots have a modular architecture and open access, which makes them convenient for upgrading and subsequent adaptation. A significant minimization of control errors is achieved and the quality of the data necessary for the functioning of the robots is increased. Dr. G. Angelov successfully implemented service robots for security and maintenance of security in the work environment, and for the reliability of service robots for medical applications. In the management of the energy systems of mobile service robots, algorithms have been developed to achieve efficiency, reliability and duration of operation. Iimpressive development in which Dr. Angelov actively participated is the creation of the transport robot "Spartakus". Its main mission is to optimize systems for reliable movement of goods. This innovation was presented at the fifth edition of the National Forum "Science for Business" and made an exceptional impression on the visitors. The candidate has developed collaborative service robots for training purposes, supporting people with specific needs, together with colleagues from the Institute of Robotics-BAS. The procedure presented 7 citations of his publications by scientists from home and abroad.

4. Main scientific and applied scientific contributions

I will present my reading of the contributions and results contained in the works of Dr. G. Angelov. In a certain aspect they differ from his interpretation. I accept the contributions and results formulated by the candidate in the publications submitted in the competition.

4.1. Scientific contributions

1. A model and practical programming system for controlling service robots for training has been formulated and tested. It has been created and are algorithms for managing service robots for the purposes of the educational process. A programming framework is proposed in which students can directly train without additional software.

2. A model and user interface for controlling service robots for training with an integrated web-based programming editor has been implemented, which is compliant with the specific requirements of the training process.

4.2. Scientific - applied contributions

3. Implemented are cyber-physical systems for educational purposes, containing software components for service robots , for teachers and students in a networked environment, which is of particular importance for online learning. I rate these results very highly, as they essentially introduce innovative model of teaching information – remotely, interactively and based on real robots.
4. An interactive model of a charging system for the production and storage of green hydrogen has been created and ecological energy - sustainable systems in robotics have been developed. These ideas are the basis of a competitive project in the field of robotics won with the participation of the candidate. A prerequisite is created for the robots to be ecological, autonomous and to function for a long time without frequent recharging.
5. Interfaces for service robots with elements of artificial intelligence and a methodology for a voice-controlled user interface have been designed and verified . A demonstration interface has been successfully implemented , using the created innovation methodology.
6. A new educational specialty in robotics has been created in secondary schools with the active participation of Dr. G. Angelov. He is among the initiators and implementers of a state program educational standard (DSE), curriculum, syllabus and examination program for the first specialty in our country "Robot Programmer". Only some schools in the USA and Japan have such programs.

5. Significance of contributions

The significance of the created models, devices and robotic systems is categorical, since these are completed technical solutions, some of which have been implemented through the implementation of projects and contracts. In general, I define the candidate's contributions as the formulation and substantiation

of new scientific concepts, the proof with new means of significantly new aspects in an existing scientific field - robotics, and the creation of original methods and constructions for the purposes of real and virtual education, there are numerous confirming facts.

6. Reviewer's final assessment

Dr. G. Angelov has a deep knowledge of the complex interdisciplinary field of service robotics. I repeat, for me the key role is his monographic work. Only it would be sufficient for the desired academic position of "Associated Professor". I declare that I have no joint publications with the candidate, nor any financial relationships. I am not aware of any incorrect attitude towards intellectual property in his works.

I recommend that G. Angelov formulate and submit some of the innovative solutions as patent applications for inventions to the National Patent Office.

7. FINAL CONCLUSION

Based on the above, the contributions and results achieved, I take the liberty to propose to the esteemed Scientific Jury to make a positive decision on the election of Dr. George Tsvetanov Angelov as "Associated Professor", and to propose to the Scientific Council of the Institute of Robotics that he be elected to occupy the academic position of "Associated Professor" in the professional field 5.1. Mechanical Engineering (Applications of Service Robotics and Control Systems with Elements of Artificial Intelligence) in the "RiMIS" section, NLRAI laboratory of the Institute of Robotics at the Bulgarian Academy of Sciences .

Sofia
10/28/2025

Reviewer :
Chavdar Rumenin