O P I N I O N

by Assoc. Prof. Plamen Tsenkov Tsankov, PhD, Technical University - Gabrovo

on the materials submitted for participation in 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, specialty - "Automated Information Processing and Control Systems" (Technical means for automation, Design of control systems).
In the competition for associate professor, announced in the State Gazette, No. 48/13.06.2025 and on the website of the Technical University of Gabrovo for the needs of the Department of Automation, Information and Control Engineering at the Faculty of Electrical Engineering and Electronics, Senior Assistant Professor Dr. Eng. Georgi Ivanov Mihalev is participating as a candidate.

1. Overview of the content and results of the presented works

Candidate Senior Assistant Professor Georgi Mihalev, PhD, presents the following main materials for the competition:

- 11 publications referenced in Scopus for Group B.4. Habilitation thesis - scientific publications (no less than 10) in publications that are referenced and indexed in world-renowned scientific information databases. One of the publications [B.4.1] is in a publication with SJR=0.203;
- 33 publications for Group G.8. Scientific publication in non-indexed peer-reviewed journals or in edited collective volumes;
- 1 textbook and 1 teaching aid;
- 5 citations of publications in Scopus and Web of Science, 2 citations abroad, excluding those with impact factor (Web of Science) and impact rank (Scopus), and 7 citations in the country.

The abstracts of the works are divided into 4 thematic areas:

- *Modeling and control of electrohydraulic systems* – the publications present modeling and investigation of electrohydraulic systems with: identification and parametric optimization of the system under consideration [B.4.1, B.4.2], development of a nonlinear model and linearized model in state space, development and testing of various controllers, such as conventional PI and PID [B.4.1, B.4.2], fuzzy controllers [B.4.3], robust controllers [B.4.5, G.8.14], adaptive and multi-parameter controllers [B.4.8, D.8.31], model predictive controller [B.4.9], switching multiregulator control [B.4.7], etc. The influence of the working fluid temperature on the operation of the electrohydraulic servo system in dynamic mode has been investigated [B.4.6];
- *Artificial intelligence and machine learning in automation* - [B.4.10] explores and proposes key approaches for implementing AI in PC-based industrial process control systems. An example of AI implementation in a PC-based solar power plant control application is presented in [B.4.11]. In [G.8.28], the main approaches for creating business analysis algorithms are discussed and examples of their application in real business scenarios are presented. The use of deep learning platforms [G.8.17] is examined with the aim of creating applications running on superclusters built from single-board computers [G.8.15]. The possibility of using conventional artificial neural networks (ANN) in the management of ecological systems, in particular beehives, is investigated, and a system for real-time monitoring of beehives is developed [G.8.20, G.8.21]. In order to automate and optimize the care of the beehive, ANNs are used to predict the weight of the hive, with three types of ANNs being investigated - NARX, NAR, and NIO [G.8.19]. In [G.8.29], the issue of approximating impulse (transient) characteristics of systems using Laguerre orthonormal functions is discussed.;
- *Automation and Robotics* - A robotic system has been developed with a study of the inverse kinematic model in its control loop [B.4.4]. In [G.8.25], a mathematical description of the DM-S2006MD servo drive is presented, and a Simulink model based on it has been created. The combination of the Fanuc LRMate 200iD 4S industrial robot and the CMZ for camera calibration has been investigated with a view to implementing a subsequent process of 3D scene reconstruction, as well as the camera calibration process using the Zhang method [G.8.9, G.8.10]. A modification has been proposed and implemented, achieving better results for the density of the 3D model in relation to the number of generated points [G.8.23];
- *Intelligent systems for process monitoring and control* - a system for orienting details in a vibrating hopper has been developed [G.8.1], which is also used to monitor print flow as part of a

general automated line [G.8.2]. The system has been expanded by developing a controller for the vibrating hopper [G.8.4], with a virtual tool for monitoring and detecting the resonance frequency [G.8.5]. The control of the object was investigated using a model predictive controller [G.8.12], as well as various techniques for preventing integral saturation when using a PID controller [G.8.11, G.8.16, G.8.27]. A system for quality assessment of food and food products based on metal oxide gas sensors was developed [G.8.3, G.8.13]. An integrated hardware and software system has been designed and built to monitor production capacity utilization in real time [G.8.6, G.8.7]. The structure of an intelligent system for solid waste management in urban and extra-urban environments has been presented, which helps to optimize waste collection schedules and reduce overall costs [G.8.22].

The quantitative assessment of the candidate's publication activity shows that the minimum national requirements by groups and indicators, as well as the minimum scientometric requirements of TU-Gabrovo for the academic position of "associate professor" have been met.

2. General characteristics of the candidate's activities

2.1. Teaching and pedagogical activity (work with students and doctoral students)

The candidate, Dr. Eng. Georgi Mihalev, began teaching in 2017 at the Department of AIUT as an honorary lecturer and then as an assistant. In 2019, he became a senior assistant in the same department, a position he still holds today.

In recent years, the candidate has lectured on the subjects "Technical Means for Automation," "Higher Mathematics I," "Higher Mathematics II," and "Informatics," and has conducted laboratory exercises on "Programming and Use of Computers," "Applied Programming," "Control System Design," "Real-Time Control Systems," "Informatics," "Higher Mathematics I," "Higher Mathematics II," and "Training Practice." He has supervised course projects in "Technical Means for Automation" and "Control System Design."

From 2017 to present Senior Assistant Professor Georgi Ivanov Mihalev has supervised 33 graduate students and reviewed 44 theses. He has also participated in thesis defense committees.

2.2. Scientific and applied scientific activity

Senior Assistant Professor Dr. Georgi Mihalev has participated in 7 internal research projects at TU-Gabrovo: Contract No. D1629E: "Development and research of a system for the protection of classified information in automated information systems and networks," at the Center for Scientific and Technical Information at the Technical University of Gabrovo, 2016-2017; Contract No. 1710E: "Development of a smart medicine dispenser with architecture ensuring the protection of personal information," at the Center for Scientific Research and Innovation at the Technical University of Gabrovo, 2017-2018; Contract No. 1917E: Development and research of systems for the protection of classified information in automated information systems and networks" at the Center for Scientific and Technical Information at the Technical University of Gabrovo, 2019-2020; Contract No. 2010E:

"Research on methods and solutions for the security of cyber-physical systems in Industry 4.0" at the Center for Scientific and Technical Information at the Technical University of Gabrovo, 2020-2022; Contract No. 2219U: "Electronic voting at the Technical University of Gabrovo" at the Technical University of Gabrovo, 2022-2023; Contract No. 2217M: "Research and optimization of an automated electrohydraulic system with intelligent control" at the Center for Scientific and Technical Information at the Technical University of Gabrovo, 2023-2024; Contract No. NIP2025-1: "Methodology for the use of generative artificial intelligence in the preparation of scientific publications" at the UCNIT of TU-Gabrovo, 2024-2025.

2.3. Implementation activity

The candidate has not provided documents proving implementation. From the available information presented in the CV and the prototypes presented in publications G.8.1, G.8.2, G.8.4, G.8.6, G.8.7, G.8.15, G.8.20, and G.8.22, it can be concluded that there are practical developments of controllers for management and intelligent automated systems.

3. Contributions (scientific, scientific-applied, applied)**. Significance of contributions to science and practice**

The author's report on the contributions in the candidate's scientific works presents 18 contributions, of which I would classify the following as scientific-applied:

- Development and verification of a nonlinear mathematical model of an electrohydraulic system, taking into account the influence of temperature and changes in the viscosity of the hydraulic fluid on the dynamics of the processes in the system;

- The development of methodologies for: approximation of linear systems with parametric uncertainty, in which artificial neural networks (ANN) are used to automatically generate the coefficients of decomposition by Laguerre orthogonals, and automated calibration of an industrial camera using an industrial robot, with a developed hardware-software system;

- A robotic anthropomorphic finger has been developed and implemented as part of a robotic arm. A kinematic model of the system has been derived using a hybrid approach and the corresponding basic functional dependencies for the forward and inverse kinematic models. An analysis of the system's behavior has been performed using differential kinematics and the manipulator's working space.

- The implementation of a control system for an electrohydraulic servo system and the investigated fuzzy control systems, robust control, an adaptive PID controller has been synthesized, which uses feedback from sensors to measure the parameters of the working fluid, as well as a system with a classic PID controller on the setpoint channel and a fuzzy controller on the disturbance channel to adapt the parameters of the PID controller.

I believe that the scientific-applied and applied contributions are significant for science and useful for practice and scientific research work in the candidate's research areas.

4. Assessment of the candidate's personal contribution

Of the publications submitted for the competition, 4 (9%) are independent, in 14 (32%) the candidate is the first author, and in 14 (32%) he is the second author. This gives reason to believe that the personal contribution of Assoc. Prof. Dr. Eng. Georgi Mihalev to the publications is significant.

5. Critical comments and recommendations

There are no significant critical comments. I would recommend that Senior Assistant Professor Dr. Georgi Mihalev expand his international mobility and publishing activities, as well as develop his implementation projects for the protection of intellectual property.

6. Personal impressions

My personal impressions of Senior Assistant Professor Dr. Eng. Georgi Mihalev are of a friendly and qualified young lecturer who performs his educational and research tasks at the Technical University of Gabrovo to a high standard o.

7. Conclusion:

In view of the above, I propose that Senior Assistant Professor Georgi Ivanov Mihalev, PhD, be elected as an associate professor in the field of higher education - 5. Technical Sciences, professional field - 5.2. Electrical Engineering, Electronics and Automation, specialty - "Automated Information Processing and Control Systems" (Technical Means for Automation, Control Systems Design).

31.10.2025 Member of the jury:

/ Assoc. Prof. Plamen Tsankov /