R E V I E W

by Prof. Dr. Eng. Kosta Petrov Boshnakov, retired (formerly professor at the University of Chemical Technology and Metallurgy, Sofia)

**of the materials submitted for participation in a competition
for the academic position "Associate Professor" in
the field of higher education - 5. Technical Sciences
in the professional field - 5.2. Electrical Engineering, Electronics and Automation
specialty - "Automated Systems for Information Processing and Control" (Technical instrumentations for control, Design of control systems)**

In the competition for "Associate Professor", announced in the State Gazette, issue 48 of June 13, 2025 and on the website of TU-Gabrovo for the needs of the Department of Automation, Information and Control Technique at the Faculty of Electrical Engineering and Electronics, the candidate is Chief Assistant Dr. Eng. Georgi Ivanov Mihalev

1.Brief biographical data

Chief Assist. Georgi Mihalev graduated from the Technical University of Gabrovo with a bachelor's degree in 2012 and a master's degree in 2013. He obtained the professional qualification of Master of Automation Engineer. In the period 2013 - 2016 he was a PhD student at the Technical University of Gabrovo at the Department of Automation, Information and Control Technique in the doctoral program "Automated Systems for Information Processing and Control". In September 2017 he defended his dissertation on the topic "Intelligent Control of a Class of Discrete Technological Processes" and was awarded the educational and scientific degree "Doctor" in "Automated Systems for Information Processing and Control".

In parallel with his studies for the acquisition of a master's and doctoral degrees, Ch. Assist. G. Mihalev works as orientation specialist and fitter at TEMP-01 EOOD, Gabrovo.

In the period 2017 – 2019, Dr. G. Mihalev is an assistant at TU-Gabrovo, Faculty of Electrical Engineering and Electronics, Department of AIUT, and since 2019 he is currently a chief assistant at the department. Since 2017 and currently he works in parallel as an engineer, production organizer at TEMP-01 EOOD, Gabrovo

The presented CV shows that Dr. Mihalev has specialized computer training for working with software packages such as Microsoft Office, graphic processing packages, knowledge and experience in working with a large number of programming languages, system programming, PLC programming, microcontroller programming, software for automation of technological processes.

2. General description of the submitted materials

The following materials are submitted for participation in the competition: (1) Application to the Rector for admission to the competition; (2) Copy of the state gazette with the announcement of the competition; (3) Diploma of completed higher education; (4) Diploma for the educational and scientific degree "doctor"; (5) Curriculum Vitae (CV European template);

(6) List of publications for participation in the competition; (7) List of publications submitted for the acquisition of the educational and scientific degree "doctor"; (8) Copies of each publication; (9) List of citations; (10) Certificate of impact factor of a journal in which an article has been published; (11) Author's reference for contributions in scientific works; (12) Summaries of works after defense of a doctoral dissertation in thematic areas; (13) Certificate of fulfillment of the minimum national requirements and the minimum requirements of TU - Gabrovo for holding the academic position of "Associate Professor"; (14) Summaries of the peer-reviewed publications, in Bulgarian and English; (15) Declaration of authenticity of the information provided; (16) List of other scientific achievements; (17) Copies of all specified documents in pdf format; (18) Employment record book of Ch. Assist. Prof. G. Mihalev.

3.Impact of the candidate's scientific publications in the scientific community

According to the submitted list of citations, the following publications have been cited:

1.In scientific papers with SJR and IF: B4.1 and B4.6 are cited in Journal of Physics: Conference Series, 2024 (SJR 0.187); B4.4 is cited in Journal of Vibration and Control, 2025 (IF 2.3, Q1), Journal of Mechanisms and Robotics, 2025 (IF 2.2 Q1) and 22nd LACCEI International Multi-Conference for Engineering, Education and Technology 2024 (SJR 0.114); B3 is cited in Actuators 2023 (IF 2.2 Q2).

2.In scientific works published abroad without SJR and IF: B4.3 is cited in Izvestiya vysshih uchebnyh zavedenii. Severo-Kavkazskiy region. Tekhnicheskiye nauki, 2023; B4.2 is cited in Journal EECCIS 2023

3. In scientific works published in the country without SJR and IF: B4.1, B4.2, B4.3, B4.4, B4.5, B4.6 and 1 publication that is not in the attached lists are cited in the VIII National Scientific Conference with International Participation TechCo-2024.

I believe that the scientific works in which Ch. Assist. G. Mihalev is author or co-author are known and are of interest to colleagues working in the same subject area from the country and abroad.

4. Overview of the content and results of the submitted papers

The scientific papers submitted for participation in the competition are classified by the candidate into four thematic areas: (1) Modeling and control of electrohydraulic systems; (2) Artificial intelligence and machine learning in automation; (3) Automation and robotics and (4) Intelligent systems for monitoring and control of processes.

The thematic area "Modeling and Control of Electrohydraulic Systems" includes scientific works in which nonlinear and linearized models of the studied electrohydraulic system and of a water turbine with a short and long pressure pipeline have been developed.

For the electrohydraulic servo system, the following more important control approaches have been studied: classical control with PI and PID controllers, classical PI controller and standard fuzzy control, robust control, a control system with the inclusion of the working fluid parameters has been synthesized, control with three parallel-connected and switched depending on the setpoint value PID1, PI2, PI3 controllers, control consisting of a conventional PID controller operating in the deviation control channel and a fuzzy PID controller operating in the disturbance channel, continuous in the time domain model predictive control.

A state-space mathematical model has been developed for the water turbine with a short and long head pipe and a control system with an H∞ robust controller has been synthesized.

Benchtop and simulation studies have been conducted and comparisons have been made between the results of the proposed control approaches.

In the thematic area "Artificial Intelligence and Machine Learning in Automation", approaches for implementing generative pre-trained transformers (GPT) in PC-based industrial process control systems have been studied, an artificial intelligence system has been designed to improve control efficiency by adapting the parameters of the controller for controlling a photovoltaic system, a comparison has been made between the characteristics of the most popular deep learning platforms Keras, PyTorch and TensorFlow, a real-time beehive monitoring system has been developed, the possibilities and results of the development and implementation of artificial intelligence algorithms for business analytics are considered, and the possibility of using artificial neural networks to generate decomposition coefficients and orthonormal Lager functions in system approximation is presented.

Theoretical and applied developments and implementations are included in this direction.

In the thematic area "Automation and Robotics", control of a robotic finger has been developed, a combination of an industrial robot, a microprocessor system and a machine vision system for camera calibration has been developed, a practical implementation of 3D reconstruction of real scenes from images has been presented, and a system for remote monitoring of the health of pregnant women has been developed.

In the thematic area "Intelligent Process Monitoring and Control Systems", a system for video surveillance and control of a vibrohopper is presented, a machine vision system has been developed providing monitoring and control of the "floating" of the seal in an automatic tube production line, a study has been conducted proving the capabilities of a computer-based system for food product analysis, using a gas sensor module, fresh raw meat has been examined using a multi-sensor "electronic nose" system to register changes in its condition, a virtual tool for monitoring the resonant state of vibration hoppers has been developed, a controller for controlling vibrohoppers has been developed, a continuous time-domain model predictive regulator for a vibration power supply module has been synthesized, automated tests have been developed and implemented in the Cadence environment, which provide fast and accurate correspondence between the logical circuit and the physical topology of the chip, a microcontroller has been developed in which an auto-tuning algorithm has been implemented, anti-saturation strategies for a PID controller and a linear vibrating conveyor with an electromagnetic drive have been studied, the use of multi-agent system technology in the process of traffic regulation in an urban environment has been presented, automated tests have been developed to verify electrical connectivity when designing sensors based on integrated circuits, a technical solution has been proposed for remote control and monitoring of the production process in a textile company, etc.

5. General characteristics of the candidate's activities

During his teaching work, Ch. Assist. G. Mihalev has lectured on the subjects "Technical instrumentations for control", "Higher mathematics I", "Higher mathematics II" and

"Informatics" and has led laboratory exercises on "Programming and use of computers", "Applied programming", "Design of control systems", "Real-time control systems", "Informatics", "Higher mathematics I", "Higher mathematics II" and "Teaching practice". He has supervised course projects on the subjects "Technical instrumentations for control" and "Design of control systems". He has been the supervisor of 33 graduate students and has reviewed 44 diploma theses, and has also participated in committees for the defense of diploma theses.

The documents for participation in the competition include 1 textbook (Lecture Notes) and 1 teaching aid (Laboratory Exercise Guide):

1. Yordanov St., G. Mihalev, "Programming and Using Computers. Lecture Notes", 2025, ISBN 978-619-258-064-3

2. G. Mihalev, "Design of Control Systems. Laboratory Exercise Guide", 2025, ISBN 978-619-258-063-6

5.1. Educational and pedagogical activity (work with students and doctoral students)

Ch. Assist. G. Mihalev is supervisor of a team of 5 students, specialty "Automation, Robotics and Computer Control Systems", who took part in a hackathon in March 2025 on the topic "Artificial Intelligence and Smart Cities", held at the Technical University - Gabrovo - 12.03.2025 in the city of Gabrovo. The team he led won first place with the project "Guide Stop". Under the scientific leadership of Ch. Assist. G. Mihalev, students participated in 6 student scientific sessions, and with his co-authorship, two students took part in 2 international conferences.

5.2. Scientific and applied scientific activity

In the competition, Ch. Assist. G. Mihalev participated with 44 scientific papers, which he classified into 4 thematic areas. In point 4 of the review, the problems that were developed and researched and supplemented by the contributions that I believe are contained in them are presented in detail, point 6 of the review gives a complete idea of the scientific and applied scientific activity of Ch. Assist. G. Mihalev.

The candidate has participated in 7 projects funded by TU-Gabrovo.

Almost all scientific papers are related to specific objects and applications related to their control. The candidate has an interest in research and control of real objects and processes.

5.3. Implementation activity

The candidate has not provided documents proving implementations. However, from the available information presented in the CV, it can be concluded that the candidate is also associated with the industry and in my opinion, some of the developments have the potential to be implemented in practice, such as 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.

6.The scientific works of Ch. Assist. G. Mihalev contain the following scientific (S), scientific-applied (SA) and applied (A) contributions:

1.A mathematical model of an electrohydraulic servo system with characteristic nonlinearities (B4.1, B4.2) and a mathematical model in state space (B4.9) have been developed and studied (SA).

2.To implement a control system for an electrohydraulic servo system, fuzzy control systems (B4.3), robust control (B4.5) have been developed and studied, an adaptive PID controller has been synthesized that uses feedback from sensors to measure parameters of the working fluid (B4.6), as well as a system with a classic PID controller along the setpoint channel and a fuzzy controller along the disturbance channel for adapting the parameters of the PID controller (B4.8) (SA).

3.A switching control with three conventional regulators (PID1, PI2, PI3) for an electrohydraulic servo system (B4.7) is proposed and studied, using the system setpoint as the variable controlling the switching (SA).

4.A continuous time-domain model predictive control is proposed and studied, with the control signal being approximated using orthonormal Lager functions. (B4.9) (S)

5. A water turbine control system with a short and long pressure pipeline with an H∞ robust regulator (G8.14) has been synthesized (SA).

6. Key approaches for implementing generative pre-trained transformers (GPT) in PC-based industrial process control systems are investigated and proposed (B4.10). An artificial intelligence system is designed to improve the control efficiency of a photovoltaic system by adapting the controller parameters (B4.11) (SA).

7. A system for monitoring beehives in real time has been developed, measuring hive weight, external and internal temperature and humidity. An analysis and comparison of the results of the application of different types of artificial neural networks for predicting honey yield has been made (G8.19, G8.20, G8.21) (A).

8. A direct and inverse kinematic model of a robotic finger has been derived. A kinematic analysis has been performed based on a study of the workspace and differential kinematics. A microcontroller-based control has been developed, allowing remote control of the finger joints (B4.4) (SA).

9. The process of camera calibration using a robotic system is studied. A forward and inverse kinematic model is developed and verified with a real robot (G8.9). The developed combination of an industrial robot, a microprocessor system and a machine vision system provides the opportunity to implement multiple flexible camera calibration techniques (G8.10) (SA).

10. A practical implementation of 3D reconstruction of real scenes from images is presented. In order to achieve a denser 3D model, image segmentation algorithms based on the first and second derivatives of the image intensity function for edge and boundary detection (G8.23) (A).

11. A system for remote monitoring of the health of pregnant women has been developed. Temperature is measured in real time, environmental factors such as humidity, pressure and gas resistance, pulse and blood oxygen levels are monitored (G8.24) (A).

12. Systems for video surveillance and control of a vibrohopper (G8.1) and for machine vision providing monitoring and control of the "floating" of the seal in an automatic tube production line (G8.2) have been developed. A controller for controlling vibrohoppers (G8.4) and a virtual tool for monitoring the resonance state of vibration hoppers (G8.5) have been developed (A).

13. Studies have been conducted on the analysis of food products using a gas sensor module, in which a trained artificial neural network recognizes different types of meat, as well as the length of time they have been stored (G8.3). Similar studies have been conducted on fresh raw meat using a multi-sensor system "electronic nose" to register changes in its condition (G8.13) (SA)

15. A multi-agent system for traffic control in an urban environment is presented, which increases the flexibility of traffic management (G8.18) (A).

16. Automated tests have been developed, implemented in the Cadence environment, which ensure fast and accurate correspondence between the logical scheme and the physical topology of the chip (G8.31) (A).

7. Assessment of the candidate's personal contribution.

In the scientific papers submitted for participation in the competition, Ch. Assist. G. Mihalev is in first place among co-authors in 31.8% of the papers, in second place – in 31.8%, in third and subsequent places – in 27.3% and is an independent author – in 9.1% (4 publications). The above gives me confidence that the candidate has made a significant contribution to the developments made.

8. Critical notes and recommendations

My only remark is that the thematic area "Intelligent Systems for Monitoring and Controlling Processes" includes modern research and developments, but in my opinion, not all of them belong to the class of intelligent systems.

9. Personal impressions

I participated in the scientific jury of Ch. Assist. G. Mihalev in 2019 for Chief Assistant Professor and I have observations related to his participation in the IEEE International Conference Automatics and Informatics and the International Symposium Control of Energy, Industrial and Environmental Systems. I have very good impressions of his overall work.

10.Conclusion:

The minimum national required points by groups of indicators for the academic position "Associate Professor" in the professional field 5.2. Electrical Engineering, Electronics and Automation and the achievements of the candidate are presented in Table 1.

Table 1

Groups of indicators	A	B	G	D	Sum
Points according to the minimum national requirements for an Associate Professor at 5.2	50	100	200	50	400
Achieved by the candidate	50	271	266.71	85	672.71

Table 1 shows that the minimum national requirements have been met, with indicators B, G and D being exceeded.
Regarding the Minimum Requirements of TU-Gabrovo for Scientific and Teaching Activities for Holding the Academic Position of Associate Professor with a Minimum of 15 Scientific Publications Required, Chief Assistant G. Mihalev has submitted 44, of which 4 are independent publications, 11 are indexed in Scopus, of which 1 is with SJR. A certificate for 1 publication with IF is attached, but I did not find the publication in the list of scientific papers for participation in the competition. 1 textbook (Lecture Notes) and 1 teaching aid (Laboratory Exercise Guide) have been published.

Considering the above, I propose that Chief Assistant Dr. Eng. Georgi Ivanov Mihalev be elected as "Associate Professor" in

field of higher education - 5. Technical Sciences,

professional field - 5.2. Electrical engineering, electronics and automation,

specialty - "Automated Systems for Information Processing and Control" (Technical instrumentations for control, Design of control systems)

October 27, 2025 Reviewer:

/Prof. Kosta Boshnakov/