R E V I E W

by Corr.- Member Prof. Dr. Eng. Georgi Todorov,

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of the Materials on a concourse for the academic position of "Associate Professor" in the field of higher education - 5. Technical Sciences, professional field - 5.1. Mechanical Engineering, specialty - Electronic (analog and digital) measuring transducers and devices,

with candidate Senior Assit. Dr. Eng. Borislav Atanasov Georgiev

1. Information about the concourse

The concourse for the academic position of "Associate Professor" was announced in the "State Gazette", issue 48 of 13.06.25 and on the website of Technical University of Gabrovo for the needs of the "Department of Mechanical and Precision Engineering", Faculty of "Department of Mechanical and Precision Engineering".

2. Information about the candidate

One candidate participated in the announced competition - Senior Asst. Assoc. Prof. Dr. Eng. Borislav Atanasov Georgiev, full-time lecturer in the Department of Mechanical and Precision Engineering. The candidate fully meets the normative quantitative and qualitative requirements of the "Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRoB)" and the regulations for its implementation in the part "Conditions and Procedure for Holding the Academic Position of Associate Professor".

Chief Assoc. Prof. Dr. Eng. B. Georgiev is a Master of Sciences with a specialty of Mechanical and Precision Engineering and a Doctor with a scientific area of "Hydraulic and Pneumatic Drive Systems" based on a defended dissertation on the topic "Research and Optimization of the Dynamics of an Electro-Hydraulic Drive Tracking System".

Dr. Georgiev began his scientific and teaching career in 2018 at TU-Gabrovo. At the beginning of his work, he worked as a ship repair corporal at the Odessa Shipyard EOOD - Varna. in "Mercury Production and Packaging" AD - Gabrovo, marketing expert in "Alfrida Peev" EOOD - Gabrovo, responsible for the "TV, audio and electronics" sector in "Technomarket Europe", as well as in the "Panda-Sofia" cooperative - Gabrovo. He is fluent in English and Russian. In the concourse, Dr. Georgiev participates with scientific materials that do not repeat the publications submitted for the acquisition of the "Doctor" and for occupying the academic position "Senior Assistant".

3. Overview of the content and results of the submitted works

The candidate's submitted scientific works can be grouped into the following three generalized groups: habilitation work (monograph), scientific publications - articles in journals and conference reports, textbook. The review of the materials submitted by Dr. Georgiev indicates that they meet and exceed in quantitative terms the relevant minimum national requirements according to the "Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRoB)", the regulations for its implementation and the regulations of TU-Gabrovo.

The habilitation thesis presents a comprehensive study on the application of adaptive methods for controlling the dynamics of electro-hydraulic systems. The monograph, entitled "Adaptive Methods for Controlling the Dynamics of Electro-Hydraulic Systems", begins with a comprehensive review of the development, structure and application areas of electro-hydraulic drives, highlighting their advantages, limitations and trends in the direction of energy efficiency and intelligent control. The main external impacts and structural features affecting the stability and accuracy of the systems are analyzed, and approaches for their compensation through adaptive and intelligent algorithms are proposed.

Particular attention is paid to the principles and algorithms for adaptive control, including recursive identification, Kalman filters and hybrid models that allow dynamic adjustment of parameters in real time. The monograph considers the possibilities for integrating these methods into frequency-controlled electro-hydraulic systems and evaluates their effect on stability, accuracy and energy efficiency. Examples are presented, demonstrating the practical applicability of the proposed solutions in industrial, robotic and measurement systems.

The candidate presents 21 papers, which indicates active research activity. His publications have been published both in Bulgaria and abroad, with 11 of them indexed in databases such as Scopus and/or WoS. It is noteworthy that three of the articles have IF and/or SJR. This is evidence of the high quality and scientific value of the research. Dr. Georgiev's publications are aimed at researching and improving control and measurement methods in electrohydraulic and mechatronic systems. The main point is the development of mathematical models of dynamic processes, the analysis of factors affecting accuracy, and the application of modern algorithms and the least squares method for adaptive parameter estimation. A number of works consider systems for measuring the angular orientation of moving objects, analyzing errors in determining tilt and rotation and proposing approaches for their compensation. A significant part of the research is devoted to the optimization and adaptive control of electro-hydraulic drives in order to increase stability, energy efficiency and accuracy. The full research cycle is covered - from modeling and simulation to experimental validation of the results.

The candidate actively participates in research projects and collective publications, making a significant contribution to their implementation. In a significant part of the works, he is a second or third author, which testifies to meaningful participation in the experimental work, data analysis and the implementation of applied tasks. Along with this, Dr. Georgiev also has an established leading participation - in ten publications he is the first author, which emphasizes his ability to formulate scientific ideas and guide their practical application.

The textbook "Manual for Laboratory Exercises in Elements of Automation" is intended for students of the specialty "Mechatronics" and covers both the theoretical foundations and practical aspects of the discipline. It has developed laboratory exercises that support the mastery of the principles of operation, structure and classification of programmable logic controllers (PLC). The manual provides the basic theoretical statements and the practical implementation of control and automation tasks, creating a connection between training and real engineering applications. The content is structured with good methodological consistency and high didactic value for student training.

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

From the reference provided by the candidate, it is clear that Dr. Georgiev's publications are reflected by the global scientific community, which is evidenced by a total of 19 citations of his publications, 11 of which are registered in the internationally recognized databases WoS and Scopus, which is a good response to his scientific results.

5. General characteristics of the candidate's activities

5.1. Teaching and pedagogical activity

Senior asst. B. Georgiev is a well-established university lecturer. He began his teaching activity in 2018 and has consistently gone through all stages of his career development, which logically and fully deservedly should continue by awarding the academic position of "Associate Professor". In support of this statement of mine, I can point out that the Department of "MEI" of TU-Gabrovo has highly appreciated his teaching and pedagogical skills and has assigned him to lead lecture courses in 6 disciplines in the Bachelor's and Master's degree programs. It is beyond doubt for me that the demonstrated depth, innovation and competence in the presented works are reflected in his teaching activity.

5.2. Scientific and applied research activities

Dr. Eng. Borislav Georgiev has demonstrated significant scientific and applied research achievements in the field of measuring transducers and devices, mechatronic systems and electro-hydraulic drives. His research is aimed at developing and implementing adaptive methods for control and parameter estimation in dynamic measuring systems using Kalman filter algorithms and the least squares method. The results obtained have direct application in the analysis of the accuracy and stability of electro-hydraulic systems and in the improvement of measuring instruments for determining angular orientation and dynamic characteristics of objects.

His scientific and applied research activities include participation in 7 international, national and university projects related to the development of intelligent measuring systems and adaptive control algorithms. Within the framework of these projects, Dr. Georgiev has contributed to the modeling, simulation analysis and experimental verification of the proposed methods and technical solutions. Part of the results have been realized in collaboration with leading scientific teams and presented in international conferences and refereed publications.

The candidate's scientific and applied research activities are distinguished by a clearly expressed focus on increasing the accuracy and reliability of measurement systems, in full accordance with the subject matter of the specialty "Electronic Measuring Transducers and Devices".

5.3. Implementation activity

Although no specific evidence of implementation activity has been presented, a number of Dr. Georgiev's scientific developments have a direct applied focus and potential for implementation in industrial and laboratory control and measurement systems.

6. Contributions. Significance of contributions for science and practice

The contributions presented in the author's reference are well formulated, but in my opinion they have been restructured in good accordance with the generally accepted categories. I have grouped the contributions presented in two main groups - Scientific and applied contributions and applied ones.

A) Scientific and applied contributions

1. Formulation or justification of new models and approaches

1.1-NP. A model of the dynamic error in measuring the angular orientation of moving objects has been formulated, based on the deviation of the physical pendulum from the vertical, which is implemented in a Kalman filter for correction of this error in real time.

1.2-NP. Mathematical models have been developed to describe the dynamics of electrohydraulic systems that take into account nonlinearities, external influences and varying load regimes.

1.3-NP. An adaptive method for real-time estimation of the covariance matrix of measurement errors R in a system for measuring the angular orientation of moving objects has been developed, which uses two independent measurement channels and allows the filter to take into account the current characteristics of the noise.

2. Proving with new means significant new aspects of already existing scientific solutions

2.1-NP. An algorithm for adaptive estimation of the covariance matrix of the model Q in a system for measuring the angular orientation of moving objects has been developed, which performs real-time estimation based on the differences between the predicted and measured states and increases the accuracy in dynamic and nonlinear regimes.

2.2-NP. Algorithms for estimating parameters and states in electrohydraulic systems based on recursive methods, Kalman and Wiener filters, as well as modifications of the least squares method have been formulated.

2.3-NP. Within the framework of the Kalman filter structure, an algebraic approach to calculating the acceleration of the hydraulic motor has been introduced, which replaces the classical numerical differentiation.

2.4-NP. An adaptive procedure for updating the model covariance matrix based on the derivatives of the parameters has been developed, which provides a more accurate description of the dynamics of electrohydraulic systems in variable modes.

2.5-NP. A hybrid algorithm for determining the dispersions of the measuring channels of electrohydraulic systems has been created, which combines exponential smoothing and local regression.

2.6-NP. A methodological framework has been developed that integrates regression dependencies, derivatives and smoothing procedures into a single architecture for adaptive assessment of states in electrohydraulic systems.

3. Creation of new classifications, methods, designs, technologies

3.1-NP. An integrated method for measuring the angular orientation of moving objects has been developed, which combines a simplified mechanical structure to reduce the instrumental error with a hardware-software platform for adaptive compensation of dynamic errors.

3.2-NP. A methodology for metrological assessment of the accuracy of a system for measuring the angular orientation of moving objects in dynamic mode has been developed, which combines the theory of errors and the theory of uncertainty.

3.3-NP. Identification coefficients have been introduced that summarize the influence of internal hydrodynamic processes and adapt the model to real operating conditions.

B) Applied contributions

1.1-P. An experimental verification of a system for measuring the angular orientation of moving objects was carried out, and a comparative analysis with a standard AHRS system was carried out using a calibrated stand simulator with traceability to international standards.

1.2-P. Simulation verification of the developed models and algorithms of electrohydraulic systems was implemented in the MATLAB/Simulink environment.

1.3-P. A procedure for dynamic calibration of a system for measuring the angular orientation of moving objects was developed, through which it is possible to determine the components of the combined uncertainty and ensure traceability to international standards.

1.4-P. A mechanism for adaptive compensation of systematic errors in a system for measuring the angular orientation of moving objects was implemented, in which the stable vertical position of the pendulum is used as an internal reference for automatic correction of drifts and temperature effects in real time.

1.5-P. An experimental setup and methodology have been created to study the accuracy of systems for measuring the angular orientation of moving objects, based on a hexapod-type simulator stand calibrated in static and dynamic mode, which allow for comparative analyses and metrological verification.

The scientific and applied contributions reflect the development of new models, algorithms and methodologies for adaptive assessment and control of dynamic processes in electrohydraulic and measurement systems.

The applied contributions have an engineering focus and are related to experimental implementations, metrological verification and calibration methodologies for angular orientation measurement systems.

They are justified and argued and are important both for the development of scientific research in the field and for practical applications in modern measurement technologies.

7. Assessment of the candidate's personal contribution

The personal contribution of the candidate Dr. Georgiev to the results obtained from the scientific, scientific and applied and educational and pedagogical activities is visible and significant. The presence of a large number of co-authors is evidence of the comprehensiveness of the researched issues and the ability to work in a team. It should be emphasized that the scientific results obtained and citations are largely due to the personal efforts and organizational qualities of the candidate.

8. Critical notes and recommendations

The candidate's accumulated general life experience, as well as scientific and teaching experience in recent years, creates a very good foundation for a good academic career. I recommend activating research jointly with business to support the industry with high-tech solutions. I also recommend developing teaching aids and materials. It is recommended that Dr. Georgiev continue to participate in national and international projects for the development of the experimental base.

I recommend that in his future work, Dr. Georgiev continue to intensify his scientific work, focusing on publications in international journals. This would contribute to highlighting his scientific profile.

9. Personal impressions

I do not know Dr. Georgiev personally, but I have good reviews from his colleagues about his professional and personal qualities such as honesty and willingness to cooperate.

10. Conclusion

Based on my familiarization with the materials submitted for the competition, the relevance and significance of the scientific-applied and applied contributions contained in the research and the pedagogical activity carried out, I find it completely justified to propose to the esteemed Scientific Jury to award the Senior Asst. Dr. Eng. Borislav Georgiev the academic position of "Associate Professor" in the field of higher education - 5. Technical Sciences, professional field - 5.1. Mechanical Engineering, specialty - Electronic (analog and digital) measuring converters and devices

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