**REVIEW**

**in a competition for the academic position "Professor",**

**professional field 5.2. “Electrical engineering, electronics and automation”,**

**educational discipline "Management of technological processes",**

**announced in State Gazette, issue 14 from February 16, 2024**

**with candidate: Nikola Nikolaev Nikolov, PhD, Associated Professor**

**Reviewer: Bohos Rupen Aprahamian, PhD, Professor**

**1. General provisions and biographical data.**

Nikola Nikolaev Nikolov graduated from the "Production Automation" specialty in 1989 at TU-Varna and obtained the qualification "Master of Engineering in Electronics and Automation". In 2009, he defended his thesis "Research of Algorithms for the Synthesis of Modal Adaptive State Regulators" and obtained the doctoral degree. Since 1990, he has been successively an assistant, senior assistant and chief assistant in the "Production Automation" department of TU-Varna. In 2013, he qualified as an associate professor in professional direction 5.2. "Electrical Engineering, Electronics and Automation", specialization "Production Automation". From 2013 until now, he has been an associate professor at the "Production Automation" department of TU-Varna. He is not registered as an associate professor in the register of the academic staff of National Centre for Information and Documentation (NACID).

Assoc. Prof. PhD Nikola Nikolaev Nikolov participates in a competition for the academic position of "Professor" in professional field 5.2 "Electrical Engineering, Electronics and Automation", educational discipline "Management of Technological Processes", announced in the State Gazette, no. 14 of 16.02.2024. The competition is announced on the TU-Varna website in the "Personnel Development" section, "Competitions" subdivision.

**2. General description of submitted materials.**

In order to participate in the competition, Prof. Dr. Eng. Nikola Nikolaev Nikolov submitted a copy of the competition announcement in the State Gazette, a curriculum vitae, a copy of the diploma for the acquired educational and scientific degree "doctor", medical certificate, criminal record certificate, employment certificate internship in the specialty, diploma for the academic position of "associate professor", a reference certifying the fulfillment of the minimum national requirements for the occupation of the academic position of "professor" from the Regulations for the Application of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the minimum requirements from the Regulations for the terms and conditions for the occupation of academic positions in the Technical university - Varna, a reference to the original scientific contributions, summaries of the scientific works participating in the competition in Bulgarian, summaries of the scientific works participating in the competition in English, scientific publications submitted for participation in the competition in full text, declaration of reliability of the provided information, declaration of originality, declaration of absence of plagiarism, reference of the teaching occupation, reference of supervision of doctoral students, reference of membership in scientific organizations and scientific forums, reference of participation in scientific juries. In addition, a reference on

participation in national scientific research projects and a reference on funds spent to build a "Marine Robotics" laboratory were presented.

To participate in the competition, Associate Professor Nikola Nikolaev Nikolov submitted a total of 29 works, of which 8 scientific articles, 20 papers at scientific conferences and 1 book. Of the scientific articles and papers submitted for participation in the competition, 27 are in English and 2 in Bulgarian. In 12 of the submitted publications the candidate is the first author, in 7 he is the second and in 10 he is the third or subsequent author. Referred and indexed in Scopus and Web of Science are 20 publications. 9 publications in Bulgarian and English are in editions included in the National Reference List of contemporary Bulgarian scientific publications with peer review.

The candidate has a total of 23 papers registered in Scopus, 16 independent citations in Scopus and a Hirsch index of 2.

The works presented are directly related to the current competition for the academic position of "professor" and are in the professional field 5.2. "Electrical engineering, electronics and automation".

When comparing the presented materials with the minimum required points by groups of indicators for occupying the academic position "professor" according to the Regulations for the terms and conditions for occupying academic positions in TU-Varna, the following results are obtained:

| ***Group of indicators*** | ***Content*** | ***Indicator*** | ***Number of points required to hold the academic position of "Professor"*** | ***Number of points of the candidate*** | |
|---|---|---|---|---|---|
| A | Indicator 1 | 1. Thesis for conferment of the educational and scientific degree "Doctor" | 50 | 50 | |
| B | Indicator 4 | 4. Habilitation thesis - scientific publications (not less than 10) in issues that are referenced and indexed in world-famous databases with scientific information | 100 | 183 | |
| C | Sum of indicators 7 and 8 | 7. Scientific publication in issues that are referenced and indexed in world-famous databases of scientific information | 200 | 147.9 | 234.7 |
| | | 8. Scientific publication in unreferred journals with scientific review or in edited collective scientific works | | 86.8 | |
| D | Indicator 12 | 12. Citations or reviews in scientific journals, referenced and indexed in world-famous databases of scientific information or in monographs and collective volumes | 100 | 180 | |
| E | Sum of indicators 17, 18 and 22 | 17. Supervision of a successfully defended doctoral student | 150 | 40 | 199 |
| | | 18. Participation in a national scientific or educational project | | 20 | |

| | | | | | |
|---|---|---|---|---|---|
| | | 22. Raised funds for projects managed by the applicant | | 139 | |
| F | Sum of indicator 29 | 29. Horarium of lectures held at TU-Varna for the last three years (1 point for each lecture hour held) | 120 | 600 | |

**3. General characteristics of the research and scientific applied activity of the candidate.**

The scientific-research and scientific-applied activity of Associate Professor PhD Nikola Nikolaev Nikolov, which is reflected in the publications and in the projects in which he participated, is directed in the field of production automation and is entirely in the field of the competition.

I accept the main directions of scientific research formulated by the candidate, which are summarized as:

1. Research related to control and management of technological processes and devices. [B.4.1., B.4.2., B.4.3., B.4.4., B.4.5., B.4.6., B.4.7., B.4.8., B.4.9., B.4.10.]

A modal control (SMC) algorithm of one-dimensional (SISO) linear steady-state discrete systems is developed, which calculates the elements of the feedback vector for a SISO system with a modal discrete-state controller such that the poles of the closed-loop system simultaneously satisfy the degree of stability, degree of fluctuation of the transient processes in the discrete system and not to be multiples. Two adaptive control system structures with a modal state regulator have been developed, which during adaptive monitoring are controlled by the purpose-built relay-pulse regulator. A control system structure is developed based on a modal state controller with an integrating component and a direct connection to an inverse model. A methodology is proposed for measuring the attenuation and phase shift of the electromagnetic wave when measuring moisture and thickness of bulk materials from the agro-industrial complex. A technological scheme and management algorithm of a combined local system for co-purification of drinking water from iron and arsenic with limitation of the level of harmful substances in the washing water have been developed. Resource tests on a roller mill and vertical washing machines were performed, the experimental data were processed and measures for technical monitoring and diagnostics of the equipment were proposed. A variant for controlling the thrusters of a remotely operated underwater vehicle ROV (remotely operated vehicle) using a discrete modal state controller is proposed.

2. Research related to adaptive surveillance algorithms. [C.7.3., C.7.4., C.7.7., C.7.10., C.7.11.]

An algorithm with reduced computational complexity for the initial parameter estimation of SISO linear stationary discrete systems - based on the method of least squares - has been developed. Two non-recursive algorithms for estimating the initial and current state vectors of SISO linear stationary discrete systems based on the least squares method and the instrumental variables method are developed. A recursive algorithm for adaptive monitoring of SISO linear stationary discrete systems is developed based on the recursive extended least squares method, and a recursive evaluation library is created.

3. Research related to automatic control systems. [C.7.8., C.8.2., C.8.7., C.8.8., C.8.9.]

A schematic solution of a two-position disturbance-adaptive SISO object control system has been developed. Multi-model modal control of nonlinear SISO system based on Takagi-Sugeno fuzzy controller is synthesized. A variant of the Smith-predictor system has been developed to control

long-delay objects via a state controller. Variants of control systems with PLC-based state regulators are proposed.

4. Research related to communication networks in control systems. [C.7.9.]

A lightweight underwater network architecture (LUNA) has been developed for remote control communication of a tethered underwater remotely operated vehicle (ROV).

5. Research related to engineering practices in marine resource management. [C.7.1., C.7.2., C.7.5., C.7.6., C.8.3., C.8.4., C.8.5., C.8.6.]

A two-step procedure was developed using the method of least squares and introducing an instrumental variable to simultaneously determine the three unknown parameters of biological objects in the von Bertalanffy equation. Three types of models for describing the length-weight relationship of biological objects were analyzed in detail: linear, polynomial, and nonlinear, and their properties were investigated. The normal frequency distribution of experimentally taken growth frequency samples of two types of biological objects from the Bulgarian part of the Black Sea has been proven, by combining a direct statistical method (Pearson's Chi-square test) and indirect methods for testing statistical hypotheses for a normal distribution of random variable. Extensive research has been done and recommendations have been developed for determining the number of sampling intervals for testing the hypothesis of normal distribution of data in representative samples for data numbers n>200, and the impact of errors in determining the distribution law has been established. Based on the application of the cybernetic approach, a block diagram of the system for managing the stock of biological objects in the conditions of uncertainty using a precautionary approach is proposed. A MATLAB-based independent application was developed specifically for the purpose of the fish stock assessment procedure.

The research activity of Assoc. Prof. PhD Nikola Nikolaev Nikolov defines him as a scientist with high theoretical and practical knowledge in order to successfully cope with research tasks in parallel with the teaching activity.

**4. Assessment of the pedagogical preparation and activity of the candidate.**

Assoc. Prof. PhD Nikola Nikolaev Nikolov is an approved lecturer in the "Production Automation" department of TU-Varna. He lectures on disciplines such as "Management of technological processes", "Automated electric drives", "Logical control systems", "Description of logical control systems", "Technical means of automation", "Design of automation systems", "Sensors in automation and robotics", "Mobile robots", etc. of the students from the "Bachelor's" and "Master's" degrees at the Technical University of Varna.

Associate Professor PhD Nikola Nikolaev Nikolov is the supervisor of a doctoral student, trained in the "Production Automation" doctoral program.

I consider that his teaching work meets the requirements for the academic position of "Professor".

**5. Main scientific and applied scientific contributions.**

I accept the candidate's reference for the main contributions in the works presented, which are of a scientific, scientific-applied and applied nature and can be summarized in the following fields:

1. Contributions in the presented 10 scientific publications, equivalent to habilitation work and united under the common theme "Control and management of technological processes and devices".

2. Contributions in the presented 19 scientific publications, beyond those equivalent to habilitation work and summarized in 4 main thematic areas:

2.1. Adaptive surveillance algorithms

2.2. Automatic control systems

2.3. Communication networks in management systems

2.4. Engineering practices in marine resource management

**Scientific contributions:**

1. A new modal control (SMC) algorithm of one-dimensional (SISO) linear steady-state discrete systems is developed, which calculates the elements of the feedback vector for a SISO system with a modal discrete-state controller such that the poles of the closed-loop system simultaneously satisfy the degree requirements of stability, degree of fluctuation of the transient processes in the discrete system and not to be multiples. [B.4.1.]

2. A new algorithm with reduced computational complexity is developed for the initial parameter estimation of SISO linear stationary discrete systems. [C.7.7.]

**Scientific applied contributions:**

1. Two new adaptive structures of state modal controller control systems have been developed, which during adaptive monitoring are controlled by the purpose-built relay-pulse controller. [B.4.2., B.4.3.]

2. A structure of a new control system based on a modal state controller with an integrating component and a direct connection with an inverse model is developed. [B.4.4.]

3. A new methodology is proposed for measuring the attenuation and phase shift of the electromagnetic wave when measuring moisture and thickness of bulk materials from the agro-industrial complex. [B.4.6., B.4.7., B.4.8.]

4. Two new non-recursive algorithms for estimating the initial and current state vector of SISO linear stationary discrete systems based on the method of least squares and the method of instrumental variables are developed. [C.7.3., C.7.10.]

5. A new recursive algorithm for adaptive monitoring of SISO linear stationary discrete systems is developed based on the recursive extended least squares method and a recursive evaluation library is created. [C.7.4., C.7.11.]

6. Multi-model modal control of nonlinear SISO system based on Takagi-Sugeno fuzzy controller is synthesized. [C.8.2.]

7. An improved version of the Smith-predictor system has been developed to control long-delay objects through a state controller. [C.8.8.]

8. A lightweight underwater network architecture (LUNA) has been developed for remote control communication of a tethered underwater remote operated vehicle (ROV). [C.7.9.]

9. A two-step procedure was developed using the method of least squares and introducing an instrumental variable to simultaneously determine the three unknown parameters of biological objects in the von Bertalanffy equation. [C.7.5.]

10. Confirmatory data were obtained when a detailed analysis was carried out of 3 types of models for describing the length-weight relationship of biological objects: linear, polynomial and non-linear, and their qualities were investigated. [C.7.6.]

11. Confirmatory data have been obtained and the normal distribution of frequencies has been proven in experimentally taken growth frequency samples of two types of biological objects from the Bulgarian part of the Black Sea, by combining a direct statistical method (Pearson's Chi-square test) and indirect methods for checking statistical hypotheses for the normal distribution of a random variable. [C.8.3.]

12. Confirmatory data were obtained and recommendations were developed for determining the number of intervals when splitting the sample to test the hypothesis of a normal distribution of data in representative samples for a number of data n>200, and the influence of errors in determining the distribution law was established. [C.8.4.]

**Applied contributions:**

1. A new technological scheme and a new algorithm have been developed for the management of a combined local system for the co-purification of drinking water from iron and arsenic with the limitation of the level of harmful substances in the washing water. [B.4.5.]

2. Confirmatory data were obtained during resource tests on a roller mill and vertical washing machines, the experimental data were processed and measures for technical monitoring and diagnostics of the equipment were proposed. [B.4.9.]

3. An improved variant for controlling the thrusters of a remotely operated underwater vehicle ROV using a discrete modal state controller is proposed. [B.4.10.]

4. An improved schematic solution of a two-position disturbance-adaptive SISO object control system is developed. [C.7.8.]

5. Improved versions of control systems with PLC-based state regulators are proposed. [C.8.7., C.8.9.]

6. Based on the application of the cybernetic approach, an improved block diagram of the system for managing the stock of biological objects in the conditions of uncertainty using a precautionary approach is proposed. [C.8.5., C.7.1., C.7.2.]

7. A new MATLAB-based application has been developed specifically for the purpose of the fish stock assessment procedure. [C.8.6.]

The publications are sufficient in terms of volume, scientific level, national and international promotion and fully represent the candidate's research activity.

**6. Significance of contributions to science and practice.**

The relevance of research in the field of automation makes the teaching and research work, as well as the works of Assoc. Prof. PhD Nikola Nikolaev Nikolov, significant for science and education.

The significance of the scientific contributions of Assoc. Prof. PhD Nikola Nikolaev Nikolov for science and practice is indisputable. It can be judged by the publications in national and international journals and his participation in international scientific conferences. He is well known to the scientific community at home and abroad and is undoubtedly a leading specialist in the field of automation.

The quantitative indicators of the criteria for occupying the academic position "professor" have been met, and in some groups of indicators the candidate exceeds the minimum requirements.

**7. Critical remarks and recommendations.**

I have some recommendations and technical remarks regarding the submitted materials and the candidate for participation in the competition:

1. I would recommend the candidate to focus on publishing in scientific journals with impact factor and impact rank, which will increase the prestige of scientific publications.

2. I would recommend expanding the work under the supervision of doctoral students, as well as working with doctoral students and young lecturers on research projects. I would recommend the creation of a scientific group of teachers or a scientific school of automation under the leadership of the candidate for the academic position of "professor".

3. In the candidate's materials, there are no presented documents about the results of scientific research applied in practice. It would also be good to consider patent protection for an invention or utility model.

4. No textbooks and handbooks written by the applicant have been submitted. It would be good to activate the publication of educational literature.

5. The candidate is not registered as an associate professor and as a doctor in the Register of academic staff of the National Centre for Information and Documentation (NACID), which significantly facilitates the fulfillment of the minimum national requirements for occupying the academic position "professor".

6. There are some inaccuracies in the completion of the reference certifying the compliance with the minimum national requirements that were indicated to the applicant. However, these inaccuracies do not call into question the fulfillment of the minimum national requirements for holding the academic position of "professor".

**8. Personal impressions and opinion of the reviewer.**

My personal impressions from my more than 10-year acquaintance in the professional sphere with Assoc. Prof. PhD Nikola Nikolaev Nikolov are very good. As a responsible researcher, he strives for comprehensiveness and accuracy of research, its design and publication.

The impression created by the materials presented for the competition is also good.

For me, as a reviewer, there is no doubt that the main scientific and scientific-applied contributions in the works presented for the competition are the personal work of the candidate and with his direct participation.

Undoubtedly, Assoc. Prof. PhD Nikola Nikolaev Nikolov has established himself as a good specialist in the field of automation with a marked interest in modern achievements in this scientific field and great potential for future development.

**CONCLUSION**

The submitted materials in the competition for the academic position of "professor" allow to evaluate the teaching and research activities and qualities of the candidate Associate Professor Nikola Nikolaev Nikolov and to define him as a highly qualified and established scientist in the field of automation of production with national and international authority.

The minimum requirements for occupying the academic position "professor" in professional field 5.2 "Electrical engineering, electronics and automation", determined by the Regulations for the terms and conditions for occupying academic positions of the Technical University - Varna, which also cover the minimum national requirements according to the Application Regulations of the Law on the Development of the Academic Staff in the Republic of Bulgaria have been fulfilled.

Based on the acquaintance with the presented scientific works, their importance, the scientific, scientific-applied and applied contributions contained in them and despite the critical remarks, I find it reasonable to propose Assoc. Prof. PhD Nikola Nikolaev Nikolov to occupy the academic position "professor" in professional field 5.2 "Electrical engineering, electronics and automation", educational discipline "Management of technological processes" for the needs of the "Production automation" department of the Technical University - Varna.

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