O P I N I O N

of Prof. Anatoliy Trifonov Aleksandrov, PhD,
Technical University of Gabrovo,
regarding the materials submitted for participation in a competition
for the academic position of Associate Professor in
the Field of Higher Education - 5. Technical sciences, Professional Trend - 5.2. Electrical engineering, Electronics and Automation, scientific subject – "Industrial Electronics" (Reliability of Electronic Systems, Design and Development of electronic equipment, Design of communication equipment)

Senior Assist. Prof. PhD Prodan Ivanov Prodanov is participating in the competition for associated professor, published in the Official Gazette, issue 68/31.07.2020 and on the website of TU-Gabrovo, for the needs of the Department of Electronics at the Faculty of Electrical Engineering and Electronics, Technical University of Gabrovo.

1. An overview of the content and results of the submitted works

In the competition for the academic position of Associate Professor Senior Assistant Professor PhD Prodan Ivanov Prodanov participates with a total of 38 scientific works, of which a monography - 11 scientific publications (C4.1 – C4.11) in editions refereed and indexed in world-renowned scientific information databases (SCOPUS), equivalent to a monographic work, 4 scientific publications (D7.1 – D7.4) in editions refereed and indexed in world-renowned scientific information databases (SCOPUS) and 23 scientific publications in peer-reviewed scientific editions that are not refereed in world-renowned scientific information databases.

The Publications can be classified as follows:

- articles in editions of national scientific conferences with international participation – 5 [C4.8, C4.9, C4.11, D7.4, D8.7].
- articles in editions of international scientific conferences and symposiums in Bulgaria – 27 [C4.1, C4.3, C4.5-C4.7, C4.10, D7.2, D7.3, D8.1-D8.4, D8.6, D8.8, D8.9, D8.11-D8.21, D8.23].
- articles in editions of international scientific conferences and symposiums abroad – 3 [C4.2, C4.4, D7.1].
- articles in journals and annuals of universities – 3 [C8.5, D8.10, D8.22].

The independent publications of the Candidate are 6 [C4.7, C4.11, D7.4, D8.5, D8.10, D8.23], 19 publications have one co-author [C4.2-C4.4, C4.6, C4.8-C4.10, D7.2, D7.3, D8.1, D8.3, D8.4, D8.8, D8.11-D8.13, D8.16, D8.21, D8.22], and 13 publications have two or more co-authors [C4.1, C4.5, D7.1, D8.2, D8.6, D8.7, D8.9, D8.14, D8.15, D8.17-D8.20]. Sixteen of the Candidate's publications are written in English language [C4.1-C4.11, D7.1-D7.4, D8.6].

The Candidate covers and, in certain indicators exceeds, the minimum national requirements. He defended his PhD Thesis in the scientific subject 02.20.09 - *Industrial Electronics* on the topic: *Theoretical and experimental research on the reliability of power supplies for induction technologies*. (indicator A - 50 points) in 2010. He has submitted a habilitation work – 11 scientific publications in journals refereed and indexed in world-famous databases with scientific information (indicator C - 370 points), 4 scientific publications in journals, refereed and indexed in world-famous databases with scientific information (Scopus) (indicator D7 - 93.33 points) and 23 scientific publications in non-refereed peer-reviewed journals or in edited collective volumes (indicator D8 - 225.03 points) and 14 citations (indicator E - 140 points). He has participated in 1 national scientific project and in 3 educational projects. In addition, he is the author of 1 university textbook and 3 university study guides (indicator F - 80 points).

Senior Assist. Prof. PhD Prodan Prodanov covers and, according to certain indicators exceeds, the scientometric data according to the minimum requirements of TU-Gabrovo. With the required 20 publications, of which 4 are required to be independent, the Candidate has submited 38 publications, 6 of which are independent. With the required 5 citations, the Candidate has submitted 14, and with the required 2 textbooks and study guides, the Candidate has submitted 4 - 1 textbooks and 3 study giedes. He also has lead one scientific project.

2. General characteristics of the Candidate's performance

2.1. Teaching practice

Senior Assist. Prof. PhD Prodan Prodanov is an established lecturer at the Technical University of Gabrovo. He has 10 years and 10 months of experience as a lecturer at the University.

According to the presented reference of the workload at TU-Gabrovo, over the last 3 years the Candidate has delivered 1809 academic hours to full-time and part-time students. He is a lead lecturer of the courses: *Design and Development of electronic equipment*, *Design of communication equipment*, *Electrical drives* and *Training practice* included in Bachelor degree courses. He is also a lead lecturer of the following courses included in Master degree courses: *Reliability of Electronic Systems* and *Industrial Electronic Devices and Systems – 2nd part*.

The Candidate is an independent author of one university textbook (*Reliability of Electronic Systems*) and three university study guides (*Design and Development of Electronic Equipment*, *Power Supply Devices* and *Electrical Drive*).

The Candidate is an author of the study programs of the following academic courses: *Educational Practice*, *Industrial Practice I*, *Electronic regulators and control systems*, *Industrial Practice*, *Design and Development of electronic equipment*, *Power supply devices*, *Pre-graduation practice*, *Design of communication equipment* and *Electric Drive*.

Senior Assist. Prof. PhD Prodan Prodanov has participated in the establishment of 3 university laboratories - *Design and Development of electronic equipment*, *Training practice* and *Electric drive systems* of Schneider Electric Bulgaria. He supervised 53 students who successfully defended their Bachelor and Master Degree Thesis.

The above data give me the reason to evaluate the teaching practice of the Candidate as very good.

2.2. Scientific and scientific-applied activity

The scientific work of the Candidate can be categorized in four main areas: Analysis of reliability of electronic elements (C4.3, C4.5, C4.7, C4.8, C4.10, D7.4, D8.5, D8.11, D8.22, D8.23); Analysis and modelling of reliability of electronic systems (C4.1, C4.2, C4.4, C4.6, C4.11, D8.1, D8.3, D8.6, D8.9, D8.15, D8.16); Modeling and study of circuits and processes in converters of electric energy (D7.1-D7.3, D8.2, D8.7, D8.16-D8.21); Modelling, construction and study of position electrical drives (D8.4, D8.8, D8.10, D8.12, D8.13).

According to the presented reference of scientific and research activities, Senior Assist. Prof. PhD Prodan Prodanov has participate in 7 scientific projects at University Centre for Research and Technology at TU-Gabrovo. He has lead one of these projects (№2005E/2020 „Electronic energy converters based on new semiconductor elements"), and has participated in 6 of them as a member of scientific staff (№ E1205/2012, „Design, modelling and research of efficient and reliable digital control circuits for electronic technologies", № E1503/2015 „Development and study of reliable electronic converters with microprocessor control systems", № D1628E/2016 „Design, study and reliability of three-phase servo drive in an induction heating machine", №1707E/2017 „Sensor devices and actuators in mechatronic and microelectromechanical systems", №1807E/2018 „Sensor devices and actuators in mechatronic and microelectromechanical systems", № 1912E/2010 „Sensor devices and actuators in mechatronic and microelectromechanical systems").

Senior Assist. Prof. Prodanov has participated in three projects under Operational Programmes (project BG05M20P001-2.002-0001-Student Practice – Phase 1, project BG05M2OP001-1.002-0023 - Smart Mechatronic, Eco- and Energy-saving Systems and

Technologies under Operational Programme Science and Education for Smart Growth and Project BG051PO001-4.3.04-0051 – Development and Implementation of Virtual Technologies for Sustainable Development of Distance Learning at TU-Gabrovo under Operational Programme Development of Human Resources), and and in a national scientific research project (№КП-06-Н37/25 - Optimal Design and Control Of Electric Energy Stirage Systems under the Scientific Research Fund.

2.3. Implementation activities

The Candidate, PhD Prodan Ivanov Prodanov, has submitted 4 official documents regarding his implementation activities issued by the following companies: MADARA AD, IMG Union OOD and Ingeborg Demirova - Petar Karabadzhakov ET.

3. Contributions

I accept the formulated contributions in the presented scientific works. They are of scientific, scientific-applied and applied nature and they are related to proving new aspects of existing scientific problems by means of new tools and to obtaining confirmatory facts in the field of industrial electronics.

3.1. Contributions in publications, equivalent to a monographic work

Scientific contributions

- A method for analyzing supercapacitors on the basis of models considering the aging processes, which provides possibilities for defining the admissible temperature values, the operating voltage and the equivalent series resistance of the supercapacitors, has been proposed and implemented. (C4.8).
- A mathematical model has been developed and a 3D model for obtaining the area of reliable performance of electronic converters of energy as a function of the operating conditions has been proposed (C.4.4).

Scientific-applied contributions

- Classification of the methods for analyzing the failure rates of electronic elements has been presented and a new approach to defining the limit values of the thermal modes of power semiconductor elements – power transistors, diodes and thyristors has been presented (C4.3, C4.5, C4.7, C4.10).
- Probability models of electric energy storage systems and energy converters have been synthesized (C4.6, C4.9, C4.11).
- Probability models for defining the efficiency of the protection circuits in the power circuits of a series of thyristor converters for induction heating of steel pieces have been synthesized and simulated (C4.1, C4.2).

3.2. Contributions in publications outside those equivalent to a monographic work

Scientific contributions

- A new approach to analyzing the reliability indicators of power MOSFET transistors, based on a model considering the thermal resistance of the cooling system has been proposed (D7.1, D7.4).

Scientific-applied contributions

- A model for analyzing electromagnetic processes of a quasi-resonant inverter combining the adjustment method and harmonic analysis has been synthesized (D7.2).
- Simulation models have been proposed and simulation studies of the operating modes of a wide group of electronic circuits of electric energy converters have been done in P-SPICE environment, where parameters, which are hard to be experimentally measured, have been obtained (D8.7, D8.16, D8.19, D8.21).
- A simulation model has been synthesized on the basis of a mathematical analysis of stepper motors so as to obtain a family of mechanical characteristics under different input parameters of the drive-stepper motor system (D8.4, D8.12).

- A modified model of a digital PID controller and a DC servomotor has been proposed and studied in MATLAB environment, on the basis of which a digital PID controller has been implemented (D8.8, D8.10, D8.13).

Applied contributions

- The reliability of electronic systems have been studied according to operating conditions and modes. In relation to the analysis done, the reliability characteristics and the service life have been identified (D8.3, D8.6, D8.9, D8.15, D8.16).
- Devices with improved functional possibilities, elements and ways of controlling have been developed, studied and implemented (D7.3, D8.2, D8.17, D8.18, D8.20).

4. Assessment of the Candidate's personal contribution

The assessment of the significance of the contributions is related to the citations stated in the competition documents. A list of 14 citations in scientific journals refereed and indexed in world-famous databases of scientific information has been psubmitted. On that basis I can conclude that the Candidate is a well-known author and has published in important scientific forums in the field of the competition. The quantitative indicators according to the minimum requirements of TU-Gabrovo and the minimum national requirements for holding the academic position of Associate Professor have been met.

The Candidate has an award granted by the Union of Electronics, Electrical Engineering and Telecommunications – UEET for successful participation in International Scientific Conference UNITECH 2018 and the holds three certificates for completed courses.

5. Critical notes and recommendations

I did not find any significant deficiencies in the works of the Candidate. I recommend summarizing the publications and publishing a monography, as well as preparing IF publications.

6. Personal impressions

I know Senior Assist. Prof. PhD Prodan Prodanov as an esteemed colleague. I don't have any collaborative publications with him. We are not related parties as defined in paragraph 1 (5) of the Supplementary Provisions of the Act on Development of the Academic Staff in the Republic of Bulgaria. I highly evaluate the Candidate's contributions and results.

7. Conclusion:

Taking into account the above mentioned, I propose Senior Assist. Prof. Prodan Prodanov PhD to be awarded the academic position of Associate Professor in the field of higher education – 5. Technical Sciences, professional trend – 5.2. Electrical engineering, Electronics and Automation, scientific subject – "Industrial Electronics" (Reliability of Electronic Systems, Design and Development of electronic equipment, Design of communication equipment).

18.12.2020 Member of the scientific jury: /signature/

/Prof. A. Aleksandrov, PhD/