

# OPINION

**of Prof. Nikolay Filev Djagarov, D.Sc.**

Full Professor at Nikola Vaptsarov Naval Academy, Varna

of 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 Technology of Electronic Equipment, Design of Communication Equipment) in the competition for Associate Professor, published in the Official Gazette, issue 68/31.07.2020 from Technical University of Gabrovo.

## 1. Short background data

Prodan Ivanov Prodanov was born in 1981 in the town of Gabrovo. In 2000 he graduated from the Technical School of Mechanical and Electrical Engineering in Gabrovo with a secondary education degree in Electrical Equipment of Industrial Enterprises. He graduated from the Technical University of Gabrovo as a Bachelor of Electronics in 2004 and as a Master of Electronics in 2005.

In the period 2006 – 2009 he was a full-time PhD student at the Technical University of Gabrovo, where he defended a 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*”.

Prodan Prodanov has been working since 2010 at the Technical University, Gabrovo as an Assist. Prof. and Senior Assist. Prof.

## 2. General overview of the submitted materials

The candidate Prodan Prodanov is participating in the competition with: **1 Textbooks**, **3 study guides** (Manuals for laboratory exercises) and **38 scientific publications**. The Publications can be classified as follows:

**11 scientific publications** in editions refereed and indexed in world-renowned scientific information databases (SCOPUS), equivalent to a monographic work, **4 scientific publications** in editions refereed and indexed in world-renowned scientific information databases, **23 scientific publications** in peer-reviewed scientific editions that are not refereed in world-renowned scientific information databases.

## 3. Reflection of the Candidate’s scientific publications in the scientific community (known citations)

According to the scientific database SCOPUS, the Candidate, Prodan Prodanov, has 11 indexed scientific publications, which have been cited 19 times in 14 scientific publications and he has a **h-index = 3**.

## 4. Correspondence of the submitted materials to the minimum national requirements

The materials submitted by P. Prodanov has the following summarized indicators:

<b>A</b> Indicator	1	50
<b>B</b> Indicators	3 ÷ 4	285
<b>C</b> Indicators	5 ÷ 11	280
<b>D</b> Indicators	12 ÷ 15	140

The above summarized indicators shows, that the Candidate has higher scientometric indicators than the minimum requirements stipulated in the Act on Development of the Academic Staff in the Republic of Bulgaria.

## **5. General characteristics of the Candidate's performance**

### **5.1. Teaching practice**

Prodan Prodanov delivers lectures and laboratory exercises to students following Bachelor degree and Master degree courses in: *Electronics, Communication Equipment and Technologies, Mechatronics, Environment Protection Equipment and Technologies, Industrial and Automotive Electronics*. The Candidate is a lead lecturer of the following academic courses: *Design and Development of Electronic Equipment, Design of Communication Equipment, Electrical Drives, Training Practice, Reliability of Electronic Systems, Industrial Electronic Devices and Systems*.

In the period 2010 – 2020, under the supervision of Prodan Ivanov Prodanov, 34 students have successfully defended their Bachelor Degree and 19 their Master Degree.

Prodan Prodanov is an author of the study programs of the following academic courses: *Educational Practice, Industrial Practice, Electronic Regulators and Control Systems, Design and Development of Electronic Equipment, Power Supply Devices, Design of Communication Equipment and Electric Drive*.

Prodan Prodanov has participated in the establishment of the following university laboratories: Design and Development of electronic equipment, Training practice and Electric drive systems.

Prodan Prodanov is an author of the following university textbooks and study guides:

Simeonov M. V., **P. I. Prodanov**, "Design and Development of electronic equipment - study guide for laboratory exercise". "Eks-Press Gabrovo" Publishing, 2010, ISBN 978-954-490-170-7, 100 pages

**Prodanov I. P.**, D. Dankov, "Power supply devices - study guide for laboratory exercise". "Vassil Aprilov University Publishing", 2016, ISBN 978-954-683-547-5, 96 pages.

**Prodanov I. P.**, "Reliability of electronic systems", "Eks-Press Gabrovo" Publishing, 2020, ISBN 978-954-490-685-6, 239 pages.

**Prodanov I. P.**, "Electric Drive - study guide for laboratory exercise". "Vassil Aprilov University Publishing", 2020, ISBN: 978-954-683-626-7, 97 pages.

### **5.2. Implementation activities**

P. Prodanov has submitted official documents for the following implementation activities: 1. MADARA AD: implementation of machines for mass heating of steel pieces for press-forging technologies; 2. Ingeborg Demirova - Petar Karabadjakov ET: Design and implementation of a positional electric drive system of a 3D printer; 3. IMG Union OOD: Design and realization of a positional electric drive system for winding of brushless dc motors (BLDC motors).

### **5.3. Participation in scientific and research projects**

P. Prodanov has participate and is still participating in the following scientific projects:

National scientific research projects: 1. "Student Practice – Phase 1; 2. "Development and Implementation of Virtual Technologies for Sustainable Development of Distance Learning at TU-Gabrovo"; 3. "Smart Mechatronic, Eco- and Energy-saving Systems and Technologies"; 4. "Optimal Design and Control of Electric Energy Storage Systems".

University scientific research projects: 1. „Design, modelling and research of efficient and reliable digital control circuits for electronic technologies”; 2. „Development and study of

reliable electronic converters with microprocessor control systems“; 3. „Design, study and reliability of three-phase servo drive in an induction heating machine“; 4. „Sensor devices and actuators in mechatronic and microelectromechanical systems“; 5. „Sensor devices and actuators in mechatronic and microelectromechanical systems“; 6. „Sensor devices and actuators in mechatronic and systems“; 7. „Electronic energy converters based on new semiconductor elements“ – as a team leader.

#### **5.4. Contributions**

I agree with the classification of the author’s contributions, which are divided in the following four thematic areas: 1. Analysis of reliability of electronic elements; 2. Analysis and modelling of reliability of electronic systems; 3. Modeling and studying schemes and processes in converters of electric energy; 4. Modelling, construction and study of position electrical drives.

##### **First thematic area**

A classification of the methods for analyzing the failure rates of electronic elements has been done and an analysis of their applicability has been made in relation to power semiconductor elements. The limit values of the thermal modes of a whole class of power semiconductor elements have been defined. The reliability indicators of power MOSFET transistors have been analyzed, based on a model considering the thermal resistance of the cooling system. A method for analyzing supercapacitor reliability has been proposed and implemented. Using this method, the admissible temperature values, the operating voltage and the equivalent series resistance of the supercapacitors can be determined when setting the supercapacitors reliability boundary level.

##### **Second thematic area**

Probability models considering preventive maintenance time and functional reliability connections for powerful electronic converters of energy have been synthesized. 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. Probability models of electric energy storage systems and energy converters have been synthesized. A 3D model for obtaining the area of reliable performance of electronic converters of energy has been developed. The reliability of a wide group of electronic systems have been studied.

##### **Third thematic area**

A method for analyzing the electromagnetic processes of the inductor-piece system with differentiated domains of the magnetic field has been proposed and inductor electromagnetic parameters have been calculated. A model for analyzing the electromagnetic processes of a quasi-resonant inverter has been synthesized. Simulation models of a wide group of electronic circuits of electric energy converters have been done in P-SPICE environment. Simulation models and studies of the operating modes of electronic circuits have been done, where parameters which are hard to be experimentally measured have been obtained. A simulation model of a specific integrated circuit verified in P-SPICE environment and by means of real measurements has been proposed. Devices with improved functional possibilities, elements and ways of controlling have been developed, studied and implemented.

##### **Fourth thematic area**

A model of a digital PID controller for DC servomotor has been developed and studied, which later has been implemented. A model of a stepper motor has been developed and its mechanical characteristics under different input parameters have been obtained. A prototype of a stepper motor driver with increased functionality and active regulation of the motor current has been created and implemented.

## **6. Assessment of the Candidate's personal contribution**

Analyzing the performance of Prodan Prodanov in the educational, scientific and implementation fields, it can be concluded that his interests and activities are diverse. The presented results and documents prove that in each field where he has worked, he has personal contributions.

## **7. Critical remarks**

I haven't any critical remarks to the Candidate.

## **8. Conclusion**

The works and materials submitted for the competition for the academic position of Associate Professor have passed through approbation, have been published and presented at important scientific forums. The scientific research methods are adequate and the obtained scientific results are authentic. The Candidate has sufficient scientific and applied contributions and teaching experience. The submitted materials meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Regulations for the implementation of the Act on Development of the Academic Staff in the Republic of Bulgaria, and the Higher Education Act, wherefore **I recommend** to the scientific jury Senior Assist. Prof. PhD Prodan Ivanov Prodanov to be selected as an 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 equipment, “Design and Development of electronic equipment”, “Design of communication equipment”).

10.12.2020 г.

Member of the scientific jury:

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(Prof. Nikolay Djagarov, D.Sc.)