

## OPINION

by associate professor engineer Hristiyan Chavdarov Kanchev, PhD, department of Power Electronics, Faculty of Electronic Engineering and Technologies, Technical University of Sofia.

regarding the documents, presented for the competition for academic position of “associate professor” in higher education area: 5. Technical Sciences,  
professional field: 5.2. Electrical Engineering, electronics and automatics,  
specialty – “Industrial electronics” (construction and technology of electronic equipment, reliability of electronic systems, construction of communication equipment)

In the competition for the position of “associate professor” declared in the state official journal issue 68/31.07.2020 and on the website of Technical University – Gabrovo for the needs of the department “Electronics” in the faculty of “Electrical Engineering and Electronics” **the applicant is assistant professor engineer Prodan Ivanov Prodanov, PhD.**

### **1. Overview of the content and the results in the presented works.**

The works, presented by the applicant completely cover and exceed the national requirements and those of the Technical university of Gabrovo for the academic position of “associate professor”. The applicant has presented a total of 38 scientific publications, 6 of them are individual. The presented publications have 14 citations by other authors. The applicant has authored and co-authored 4 educational books. In 2018 he has been awarded the prize of best paper in the international scientific conference “UNITECH 2018”, section “Electronics and sensors”, entitled “PSPICE modelling of switch-mode power supplies with integrated circuit VIPER100A”.

The applicant’s research activity is mainly in the fields of: reliability analysis of electronic systems; modelling and investigation of circuits and processes in power converters; Modelling, construction and research on positioning drives.

### **2. General characteristic of the applicant activity**

#### **2.1. Educational and pedagogical activity**

Assistant professor engineer Prodan Prodanov, PhD has 10 years of experience in teaching. From 2010 on he has given lectures and conducted laboratory exercises in 4 disciplines from the “bachelor” educational plans of “Electronics”, “Communication techniques and technologies”, “Mechatronics”, “Techniques and technologies for environment protection” and “Industrial and automobile electronics”. He has been giving lectures and conducting laboratory exercises in 2 disciplines of the “master” degree programs in “Electronics”.

The total number of lectures and laboratory exercises conducted by the applicant largely exceed the minimum required for the academic position of “associate professor”. He is currently titular of the following disciplines: “Construction and technology of electronic devices”, “Construction of communication equipment”, “Electric drives” and “Educational practice” for “bachelor” degree and “Reliability of electronic systems” and “Industrial electronic devices and systems – II” for “master” degree.

The applicant has participated in the establishment of new educational laboratories in the fields of “Construction and technology of electronic devices”, “Electric drive systems” and “Educational practice”.

To this moment, a total of 53 students have graduated under the tutorship of assistant professor Prodan Prodanov PhD.

## 2.2. Scientific and applied-science activity.

The applicant's scientific activity started in 2006 with his PhD thesis in the "Electronics" department in the Technical University of Gabrovo. He has completed and defended his PhD thesis in 2010 on the subject of "Theoretical and experimental investigation of power supplies and induction-technology devices reliability" and the scientific field of "Industrial Electronics".

The applicant was head of the scientific research project № 2005E / 2020, „Power electronic converters based on new semiconductor devices". He has as well participated in a total of 3 projects funded by the EU operational programs, 1 project funded by the Bulgarian National Scientific Research Fund and 6 projects for scientific research funded by the Technical University of Gabrovo.

## 2.3. Implementation activity.

Assistant professor engineer Prodan Prodanov PhD has participated in 4 industrial implementations: two times in the "MADARA" company in the city of Shumen, in "Ingeborg Demirova - Petar Karabadjakov" in Gabrovo and "IMG Union" company in Gabrovo.

His implementation activity in "MADARA" is related to commissioning and implementation of machines for induction heating, forging and pressing machines fed by thyristor converters, as well as design and development of printed circuit boards and technical documentation of: startup transient control blocks of rectifier and inverter modules, protection and feedback circuits, frequency and thyristor restoration time synchronization circuits. His developments have contributed for improvement of the reliability and efficiency of the thyristor converters supplying power to the machines in the "MADARA" facility.

The implementation activity of assoc prof. Prodan Prodanov in "IMG Union" is related to the design and construction of precise positioning electric drive system, as part of a machine for winding of brushless DC motors. As a result an improvement of the parameters of the automated manufacturing has been achieved.

In the "Ingeborg Demirova – Petar Karabadjikov" company, the applicant has participated in the design and implementation of a system for positioning electric drive with stepper motors for 3D printers. He has as well performed supplementary tuning and optimization of the parameters of the electric drive systems, which resulted in productivity and efficiency improvement of the 3D printers.

**3. Contributions** (scientific, applied-scientific and applied). Practical importance of the contributions.

The contributions presented by the applicant **definitely have** practical importance, which is also confirmed by the results of his implementation activity in several companies

Among his scientific contributions are: proposed new method for reliability parameters of power MOSFET transistors based on a model that takes into account the thermal resistance of the heatsink (publication Г7.4.); proposed and implemented method for reliability analysis of supercapacitors based on models that take into account their ageing. This method allows for the estimation of operating temperature and voltage limits and their equivalent series resistance (paper B4.8.); Mathematical expression and a proposed 3D model for estimation of the reliable operation of power electronic converters as a function of the operating conditions (publications B.4.4. и Г.8.1.)

**The applied-scientific** contributions of assistant professor Prodan Prodanov include: presentation of a novel approach for definition of the temperature limits for a whole class of power semiconductor devices – power transistors, diodes and thyristors (publications B4.7, B4.10, Г8.22, Г8.23); synthesis of probabilistic models taking into account the time of preventive maintenance and the reliability functional correlations of power electronic converters (including also converters with rated power  $\geq 50$  kW), including the protections,

planned maintenance and repairs (publications B.4.6. and B.4.11.); proposed simulation models and simulation studies in PSPICE environment of the operation modes of a broad class of power electronic converters. As a result are obtained parameters that are difficult to be measured experimentally (publications Г.8.7., Г.8.16., Г.8.19.);

**The applied contributions** of assistant professor Prodan Prodanov include: reliability study of a broad range of electronic systems according to their operating conditions and modes. As a result are determined reliability characteristics and guaranteed operational life, as well as recommendations for reliability improvement are proposed (publications B.4.1., Г.8.6., Г.8.9, Г.8.15. and Г.8.16.); synthesized and simulated probabilistic models for determining the efficiency of the implemented protection circuits in the power stages of a series of thyristor converters for induction heating of steel parts (publications B.4.2. and Г.8.3.); proposed simulational equivalent model of a specialized integrated circuit, verified in PSPICE environment as well as by laboratory experimentations (publication Г.21.); proposed and studied modified model of digital PID regulator and DC servomotor in MATLAB environment. Based on this a digital PID regulator is developed and programmed (publications Г.8.8., Г.8.10., Г.8.13.).

#### **4. Assessment of the applicant personal contribution.**

Based on the documents presented by the applicant, my conclusion is that apart from his considerable amount of collective work the applicant has 6 individual scientific publications, he has been the head of one scientific research project and is titular of 6 educational disciplines which points out his important personal contributions.

#### **5. Critical notes and recommendations**

I have no critical notes regarding the applicant's activities and the documents provided. My personal recommendation for the applicant is to continue working with the same intensity in his teaching, scientific and implementation activities which guarantee him a brilliant future development.

#### **6. Personal impression**

My personal impression, based on the documents and works provided by the applicant is excellent.

#### **Conclusion:**

**Given the abovementioned, I propose the choice of assistant professor Prodan Ivanov Prodanov PhD for associate professor in higher education area 5. Technical sciences, professional field 5.2. "Electrical Engineering, Electronics and Automatics", specialty: "Industrial Electronics" (construction and technology of electronic equipment, reliability of electronic systems, construction of communication equipment)**

20.12.2020

Scientific jury member: /signature/

/assoc. prof. Hristiyan Kanchev, PhD/