

REVIEW

by Prof. Dimitar Ivanov Diakov, PhD, Technical University - Sofia
on the competition for the occupation of the academic position of
"Associate Professor"
in the field of higher education 5. Technical sciences,
Professional field 5.1. Mechanical Engineering,
Specialty "Methods, Transducers and Devices for Measurement
and Control of Physical-Mechanical and Geometric Quantities"
with candidate Ch. Assist. Prof. Tsanko Vladimirov Karadzhov, PhD

1. Information about the competition

The competition for the academic position of "Associate Professor" at the Technical University of Gabrovo was announced in the State Gazette, issue 50/15.06.2021 and on the website of the Technical University - Gabrovo for the needs of the Department of Mechanical Engineering and Measuring Devices at the Faculty of Mechanical Engineering and Measuring Devices.

2. Information about the candidate

Only one candidate participates in the announced competition - Ch. Assist. Prof. Tsanko Vladimirov Karadzhov, PhD, full-time lecturer in the Department of Mechanical Engineering and Measuring Devices. The candidate fully covers the normative quantitative and qualitative requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) in the part "Conditions and procedure for holding the academic position of associate professor" and the requirements for occupation the academic position "associate professor" according to the Acquisition Regulations of scientific degrees and occupying academic positions at the Technical University - Gabrovo.

Tsanko Karadjov graduated master's degree in Electronic Engineering and Technology from the Technical University of Gabrovo, Faculty of Electrical Engineering and Electronics, Department of Electronics in 2001. He obtained the educational and scientific degree "PhD" in 2007 in the scientific specialty "Quantum and Optoelectronics", defending a dissertation on "Research, modeling and circuitry of multi-element photodetectors". He started his teaching and research work at the Technical University - Gabrovo as an assistant in the Department of Physics at the Technical University - Gabrovo in 2006. Since 2008 he has been a senior assistant in the Department of Physics, and since 2009 in the Department of Mechanical Engineering and Measuring Devices at the Faculty of Mechanical Engineering and Measuring Devices.

3. General description of the presented materials

The scientific works of the candidate presented at the competition include:

- abstract of a dissertation for awarding an educational and scientific degree "Doctor" on the topic: "Research, modeling and circuitry of multi-element photodetectors" (index A);
- monograph "Methods and means for measuring physic-mechanical quantities" (index B);
- 12 scientific publications in publications, referenced and indexed in world-famous databases with scientific information, including 1 article with IF and 11 publication with SJR (index $\Gamma 7$);
- 21 scientific publications in non-refereed editions with scientific review or in edited collective volumes (index $\Gamma 8$);
- 1 textbook "Computer-aided design in mechatronics" and 1 handbook for laboratory exercises "Devices for measuring physical and mechanical quantities" (index E).

The analysis of the materials received from Karadzhev, PhD shows that they cover and exceed in quantitative terms the relevant minimum national requirements within the meaning of LDASRB and the rules for its implementation - according to Indicator Γ the candidate has 436 points out of 200 required. The Regalement of TU-Gabrovo for acquiring scientific degrees and holding academic positions the candidate has submitted 33 within 20 required publications, of which 5 independent according to a requirement for 4. The presented publications include 1 article with impact factor (WoS) and 1 publication with SJR (Scopus).

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

From the reference, at the moment of the present review, it is evident that the publications of Karadzhev, PhD have been noticed by the world scientific community. As a confirmation of this I will note that in the world-famous databases (Web of Science and/or Scopus) 12 citations of the candidate's publications and 3 citations in unrefereed journals with scientific review have been found. Quantitatively, this is expressed in 126 points under Indicator Δ , with a required 50.

5. Overview of the content and results in the presented works

The publications of Ch. Assist. Prof. Tsanko Karadjov, PhD, reflecting his research activities, cover the following thematic areas:

- Measurement of noise, vibrations and dynamic measurements ($\Gamma.8.16$, $\Gamma.8.13$, $\Gamma.8.3$, $\Gamma.8.1$, $\Gamma.8.2$, $\Gamma.7.2$, $\Gamma.8.8$) - a method for diagnostics of a gearbox by vibroacoustic measurements is presented; a methodology, a method and a measuring system for experimental determination of the oscillation frequency of different systems are proposed; the dependence of the absorption of sound waves on the frequency has been

- studied; mathematical models and analysis of new methods for measuring dynamic parameters of moving objects are proposed;
- Temperature measurement methods (Г.8.4, Г.8.10, Г.8.21, Г.7.1, Г.7.3, Г.7.6) - a microprocessor system for signal processing from linear temperature sensors and a microprocessor control system for multi-channel are presented electronic device, method for non-contact temperature measurement with two photodetectors with different spectral sensitivity, a multi-channel microprocessor system for determining the temperature regimes of electrical machines was studied and the error of nonlinearity of the static characteristic was analyzed;
 - Measurement of illuminance, time pressure and angular velocity (Г.8.6, Г.8.7, Г.8.14, Г.8.14, Г.8.15, Г.8.19) - a multifunctional converter of illuminance-frequency and ratio between two illuminances in number of pulses has been developed, a system for determining the diurnal error of a mechanical watch with a Swiss running mechanism, the methods and devices for measuring pressure are analyzed, the main parameters and characteristics of the centrifugal tachometers and the methodology for determining the static characteristic of a centrifugal tachometer are considered;
 - Laser technologies (Г.7.10, Г.8.17, Г.8.20, Г.8.5, Г.7.5, Г.8.9, Г.7.4) - the influence of parameters such as power density, frequency, marking speed of different laser technological systems on the process of laser marking in different types of materials, developed methods and devices for measuring the power of laser radiation, algorithms of the control programs of the measuring devices, the main physical methods for measuring the power and energy of laser radiation are systematized;
 - Low-modulus gears (Г.7.8, Г.7.9, Г.7.7, Г.7.12) - the main methods for synthesis of gears with asymmetric tooth profile in low-modulus gears, used in the devices for measuring physic-mechanical quantities, are considered.

5. General characteristics of the candidate's activity

5.1. Educational and pedagogical activity

Ch. Assist. Prof. Dr. Tsanko Karadjov began his teaching career in 2006. Initially he entered as an assistant in the Department of Physics at the Technical University - Gabrovo. Since 2008 he has been a senior assistant in the Department of Physics, and since 2009 in the Department of Mechanical Engineering and Instrumentation at the Faculty of Mechanical Engineering and Instrumentation. Conducts lectures in 3 disciplines and exercises in 5 disciplines, related to devices for measuring physical and mechanical quantities, intelligent positioning systems, signal processing, industrial control systems, vibroanalysis and noise protection, all within the scope of the announced competition for the academic position of "Associate Professor". The participation in projects under the Leonardo da Vinci program, 2008-1-BG-LEO03-00367 "Improving the qualification of the teaching staff in engineering pedagogy" in 2008 and 2009 and LLP - LTVPLM -07_BG 166226 " Laser Technology Training " at LIM, Germany in 2008 also contributes to the educational and pedagogical qualification of the candidate..

5.2. Scientific, scientific-applied and implementation activity

The candidate Ch. Assist. Prof. Dr. Eng. Tsanko Karadzhov has an active research activity at the Technical University of Gabrovo. He is the head of a contract between the University Center for Research and Technology and Blazer Group Gabrovo for the study of geometric parameters of details. Participates in a number of projects from the internal competitions for scientific research at the Technical University - Gabrovo. He is a member of the research team of the Center for Competence "Intelligent mechatronic, eco- and energy saving systems and technologies", laboratory complex "Intelligent mechatronic systems for measurement and control", laboratory "Intelligent mechatronic systems for measuring static and dynamic quantities".

6. Contributions. Significance of contributions to science and practice

I accept in essence and with approval the contributions claimed in the author's reference from the research, publication and applied activity of the candidate, proposed in the respective thematic directions:

6.1 Scientific and applied contributions

"Methods and means for measuring physicomachanical quantities"

- The main characteristics of the measuring instruments are analyzed, on the basis of which a classification of the measurement methods and the types of errors is made [B.3.1].
- A classification of the means for measuring physicomachanical quantities has been developed, as well as the methods for increasing the accuracy of the measuring devices [B.3.1].
- A generalized mathematical model of the dynamic characteristics and methods for optimization of measuring systems and transducers has been developed [B.3.1].

"Measuring transducers"

- A comparative analysis between the different types of measuring transducers is made, on the basis of which classifications of the measuring transducers of physicomachanical quantities according to different criteria are developed [B.3.1].
- The methods for reducing the errors in the measuring transducers are analyzed, on the basis of which models, circuit solutions and methods for elimination are proposed [B.3.1].

"Methods for measuring noise and vibration"

- Methods have been developed for diagnostics of a reducer by means of vibroacoustic measurements and for determination of the frequencies of gearing of the gears of the reducer, which is used in the vibroacoustic diagnostics of rotary and piston machines [B.3.1, Г.8.16].
- A computer measuring system for determining the natural frequencies of mechanical systems with distributed parameters has been developed [B.3.1, Г.8.3].
- An analytical method for calculating the second natural frequency of transverse oscillations of a beam with a length-varying cross-section has been developed and is used in military equipment [B.3.1].

- A methodology for studying the absorption of sound waves in various sound-insulating materials by frequency has been developed [Г.8.1].
- New methods for measuring dynamic parameters of moving objects have been synthesized and analyzed [Г.7.2, Г.8.2].
- The dependence of the absorption of sound waves on the frequency of materials used for sound insulation and protection against noise and vibration has been studied [B.3.1]

"Methods for contact and non-contact temperature measurement"

- Microprocessor systems for signal processing from temperature sensors and automated temperature measuring devices with improved parameters and characteristics have been developed. Optimal algorithms for real-time measurement signal processing have been developed. [Г.8.3, Г.8.4, Г.8.10, Г.7.1, Г.7.3].
- A method for non-contact temperature measurement with two photodetectors with different spectral sensitivity has been developed, which allows to expand the temperature range of measurement [B.3.1, Г.7.1].
- A digital temperature measurement channel has been developed and studied for integration in larger measuring systems with a primary thermistor converter [B.3.1]
- Basic models for non-linearity error analysis of the static characteristic of measuring instruments have been developed [Г.8.21].

"Measurement of illuminance, time and angular velocity"

- A scheme for converting illuminance into frequency and ratio between two illuminances in number of pulses has been developed, which has improved linearity of the static characteristic and higher accuracy in comparison with the existing transducers illuminance - voltage [B. 3.1, Г.8.6, Г.8.7].
- A system for determining the round-the-clock error of a mechanical watch with a Swiss running mechanism has been created by measuring the vibrations on the case [Г.8.19].
- The methods for measuring angular velocity and revolutions are analyzed, on the basis of which a methodology for experimental determination of the static transmission characteristic of a centrifugal tachometer has been developed [Г.8.15].

6.2 Applied contributions

Laser technology

- The influence of parameters such as power density, frequency, speed of marking of different laser technological systems on the process of laser marking of parts of different types of materials, which have wide application in industry and specific solutions for improving the quality of this process [Г.7.10, Г.8.17, Г.8.20].
- The methods for measuring the radiation power of laser sources with different wavelengths and different powers are analyzed, on the basis of which their classification [B.3.1, Г.7.4, Г.7.5, Г.8.9] has been developed.

7. Assessment of the personal contribution of the candidate

I accept that the contributions are the personal work of Ch. Assistant Professor Tsanko Karadzhov PhD, the results of which are given by the results of the research, scientific-applied and

applied work of the candidate, which has been published in prestigious scientific journals and reported at international and national scientific forums.

8. Critical remarks and recommendations

The above-mentioned merits of the materials presented by the candidate definitely dominate in my entirely positive assessment. I have no critical remarks or recommendations.

9. Personal impressions

I know the candidate Ch. Assistant Professor Tsanko Karadzhov, PhD for several years from the joint work of R&DL "CMME" at TU-Sofia and the laboratory "Intelligent mechatronic systems for measuring static and dynamic quantities", as well as from our meetings at a number of scientific forums. I highly appreciate and admire his responsibility, intelligence, professionalism and dedication to work.

10. Conclusion

In view of the above, I **propose to the esteemed Scientific Jury to award Ch. Assist. Prof. Eng. Tsanko Vladimirov Karadzhov, PhD Academic position "Associate Professor"** in: field of higher education - 5. Technical sciences, professional field - 5.1. Mechanical Engineering, specialty - "Methods, transducers and devices for measurement and control of physical-mechanical and geometric quantities"

10/27/2021

Reviewer: /signature/