

REVIEW

authored by Prof. Iliya Slavov Zhelezarov, Ph.D.

concerning materials submitted for participation in competition for awarding academic position of “Associate Professor” in Higher education area 5. Technical sciences, Professional field 5.1. Mechanical engineering, Scientific major “Methods, Converters and Devices for Measurement and Control of Physical, Mechanical and Geometric Quantities”

There is one applicant, Chief Assistant Professor Tsanko Vladimirov Karadzhov, Ph.D., for participation in the competition for awarding the position of Associate Professor announced in the State Gazette, issue 50/15.06.2021 and on the website of Technical University of Gabrovo for the needs of department “Mechanical and Precision Engineering” which is a constituent unit of the faculty of Mechanical and Precision Engineering

1. Brief background data

In 2001 Tsanko Karadzhov graduated as a master engineer in “Electronic equipment and technologies” from the Technical University of Gabrovo, faculty of “Electrical engineering and electronics”, department “Electronics”. He defended a dissertation for awarding of educational and scientific degree “Doctor” in 2007 in the scientific major “Quantum and optoelectronics” titled “Investigation, modelling and circuit engineering of multicomponent photo detectors” In 2006 he started his teaching and research career as assistant professor in department “Physics” at the Technical University of Gabrovo. In 2008 he took the position of chief assistant professor in department “Physics” and in 2009 in department “Mechanical and precision engineering” in the faculty of “Mechanical and precision engineering”

2. General overview of the submitted materials

Chief assistant professor Tsanko Karadzhov, Ph.D has submitted all the required documents in compliance with the Act for Academic Staff Development in Republic of Bulgaria

(ASDRB), the Rule for Implementation of ASDRB and the Rule for Acquisition of Academic Titles and Positions of TU – Gabrovo, for participation in the competition for awarding the academic position of “Associate Professor”. The submitted works include annotation of dissertation work for awarding academic degree of “Doctor” titled “Investigation, modelling and circuit engineering of multicomponent photodetectors”, monograph “ Methods and means for measurement of physical and mechanical quantities” published by University Publishing House “Vasil Aprilov” – Gabrovo in 2021, 12 scientific publications in referenced editions indexed in world renowned data bases of scientific information, including 1 article with IF (WoS) and 11 publications with SJR (Scopus), 21 scientific publications in non-referenced journals with scientific reviewing or in edited volumes of collections, 1 course book “ Computer design in mechatronics”, 1 study guide for laboratory classes “ Devices for measurement of physical and mechanical quantities”. Some of the publications submitted for participation in this competition are the result or present the results of implemented projects and contracts.

The quantitative indicators of the criteria for awarding the academic position of “ Associate Professor” have been complied with and correspond to the stipulations of the Act for Academic Staff Development in Republic of Bulgaria, and the Rule for Acquisition of Academic Titles and Positions of TU – Gabrovo.

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

The 12 citations of publications in scientific editions referenced and indexed in world renowned data bases as well as the 3 citations in non-referenced journals with scientific reviewing testify to the high quality of the candidate’s scientific and applied research activity.

4. Overview of content and results in the submitted works

Scientific and applied research activity conducted by Chief assistant professor Tsanko Karadzhov, Ph.D. and presented in his publications is focused in the field of:

- Development and analysis of methods for measuring noise, vibrations and dynamic measurements including: methods for measuring vibroacoustic diagnostics, study of sound wave absorption, study of resonant phenomena, determining the frequency of free transverse and

longitudinal oscillations of beam anchored at one end, absorption of sound waves by various materials;

- Development and analysis of methods for measuring temperature including: Processing of signals from linear temperature sensors, contactless measuring of temperature with two photo receivers with different spectral sensitivity and signal processing algorithm from the two receivers based on single chip microprocessor system, contactless temperature measurement with photodiode operating in different operating modes, static characteristic nonlinearity error analysis;

- Methods for measurement of illuminance, time, pressure and angular velocity which served as a basis for the development of multifunctional illuminance-to-frequency converter used for conversion of the ratio between two illuminances into a number of pulses, system for determining the 24 hour error of a mechanical watch with Swiss running mechanism by measuring the vibrations on the case, analysis and comparison of methods and devices for measuring pressure, main parameters and characteristics of centrifugal tachometers as well as methods for determining the static characteristic of centrifugal tachometer are considered;

- Laser technologies for investigation of influence of parameters, such as power density, frequency, speed of marking different laser technological systems on the process of laser marking of parts made of different materials, development of methods and devices for measurement of laser radiation power, algorithms of the control programs of measuring devices, systemization of the main physical methods for measuring power and energy of laser radiation;

- Other publications consider methods for synthesis of gears with asymmetric tooth profile in small module gears used in instruments for measuring physical and mechanical quantities, method for determining the absorption of transparent and opaque plastic and implemented device for determining reflection factor and transmittance for different wave lengths when studying the motion of a sphere on a slope by examining the speed of motion as a function of the moment of inertia of the sphere.

5. General description of candidate's activity

5.1. Teaching and pedagogical activity

Chief assistant professor Tsanko Karadzhov, Ph.D. began his teaching career as assistant professor in the Department of Physics of TU-Gabrovo in 2006. In 2008 he was appointed chief

assistant professor in the same department and in 2009 he took the post of chief assistant professor in the Department of Mechanical and Precision Engineering where he currently reads lectures in 3 subjects and conducts seminars in 5 subjects related to devices for measuring physical and mechanical quantities, intelligent positioning systems, processing of measuring signals, industrial control systems, vibration analysis and noise protection - all of which are in the thematic area of the announced competition for awarding the academic position of “Associate Professor”. To further highlight the candidate’s teaching and pedagogical activity it should be pointed out that he actively participated in projects under Leonardo Da Vinci program 2008-1-BG-LEO03-00367 “Raising the qualification of the teaching staff in engineering pedagogy”, LLP –LTVPLM -07_BG -166226 “Training on laser technologies” in LIM, Germany, Erasmus+ KA2 project, Nr. 2017-1- LV01-KA202- 035483, Improving the professional skills in green constructions through online training, KA2 – Cooperation for Innovation and the Exchange of Good Practice; KA202 – Strategic Partnerships for vocational education and training; Project Nr. 2018-1-LV01-KA202-05695. Web-Based Laser Safety Modules for Vocational Education/Training.

The candidate’s teaching and pedagogical activity meets the requirements for holding the academic position of “Associate Professor” in TU - Gabrovo.

5.2. Scientific and applied research activity

The candidate chief assistant professor Tsanko Karadzhov participates as a researcher in the team of the Centre of Competence “Smart Mechatronic, Echo- and Energy Saving Systems and Technologies” laboratory complex “Smart Mechatronic Systems for Measurement and Control”, laboratory “Smart Mechatronic Systems for Measurement of Static and Dynamic Quantities”. Manager of contract for scientific and applied research services between University Center for Research and Technology of TU – Gabrovo and “Blazer Group Gabrovo” Ltd for measurement of parts. He has participated in projects for scientific research of the Technical University of Gabrovo, contracts M1308 “Investigation and modelling of optical, optoelectronic and production and organizational systems and devices”, 201, M 1404, “ Design and analysis of optical, electronic and laser devices” , 2014, M 1507 “ Devices for measurement and control of optical and mechanical quantities”, 2015, 1903M, “ Development and investigation of a system for measurement of angular coordinates of moving objects”, 2019.

5.3. Implementation activity

The candidate's results from his teaching, pedagogical, scientific and applied research activities have been implemented in the training process and practical classes held with undergraduates. Chief assistant professor Tsanko Karadzhov, Ph.D. took part in the commissioning of the measuring equipment of laboratory "Smart mechatronic systems for measurement of static and dynamic quantities", laboratory complex "Smart mechatronic systems for measurement and control" , "Smart mechatronic, echo- and energy saving systems and technologies" of the Center of Competence.

6. Contributions (scientific and applied research)

The candidate has presented applied research contributions in 5 thematic areas and a set of contributions with a high level of applicability that I fully accept. In thematic field "Methods and means for measurement of physical and mechanical quantities" the main characteristics of the measuring instruments have been analysed and a classification of measuring methods and error types based on that analysis has been drawn up; a classification of means of measurement of physical and mechanical quantities, and methods for improving measurement equipment accuracy has been developed; a generalized mathematical model of dynamic characteristics and methods for optimization of measuring systems and transducers has been proposed. In thematic field "Measuring transducers" a comparative analysis has been made between different measuring transducers and classifications of measuring transducers of physical and mechanical quantities based on that analysis have been developed; models, schematic solutions and methods based on analysis of the methods for reducing errors in measuring transducers have been proposed. In thematic field "Methods for measurement of noise and vibrations", methods for diagnostic of a reduction gear by means of vibroacoustic measurements and for determining gearing frequencies of the gears have been developed, finding applicability in vibroacoustic diagnostic of rotary and piston machines; computer measuring system for determining natural frequencies of mechanical distributed parameters systems has been developed; analytical method for calculating the second natural frequency of transverse oscillations of a beam with cross section varying in length has been devised; a methodology for studying the absorption of sound waves in various sound insulating materials has been developed; new methods for measuring dynamic parameters of moving objects have been synthesized and analysed. In thematic field

“Methods for contact and contactless measurement of temperature” a microprocessor system for signal processing of temperature sensors and automated devices for temperature measurement with improved parameters and characteristics have been developed; optimal algorithms for real time processing of measuring signals have been developed; method for contactless temperature measurement with two photo receivers with different spectrum sensitivity enabling expanding the temperature measurement range has been devised; basic models have been developed for the analysis of the static characteristic nonlinearity error of the measuring instruments. In thematic field ”Measurement of illuminance, time and angular velocity” a scheme for converting illuminance into frequency and ratio between two illuminances into a number of pulses has been devised, which has an improved linearity of the static characteristic and higher accuracy compared to converters illuminance -voltage; a system for determining the 24 hour error of a mechanical watch with Swiss running mechanism by measuring the vibrations on the case; the methods for measuring angular velocity and revolutions have been analyzed and a methodology for experimental determination of the static transmission characteristic of a centrifugal tachometer has been developed based on that analysis. The applied contributions are in thematic field “Laser technologies” where an investigation has been made about the influence of parameters such as power density, frequency, marking speed of different laser technology systems on the process of laser marking of parts of different types of materials, which have wide application in industry; concrete solutions for improving the quality of this process have been proposed and the methods for measuring the power of radiation of laser sources with different wavelength have been analyzed, and a classification has been proposed based on that analysis.

7. Evaluation of candidate’s personal contribution

The results of the scientific and applied research activity of chief assistant professor Tsanko Karadzhov, Ph.D. presented at prestigious international forums and published in referenced editions indexed in world renowned data bases of scientific information make me to believe that the aforementioned contributions are the candidate’s personal achievements.

8. Critical remarks and recommendations

I have no particular remarks or objections concerning the materials submitted by chief assistant professor Tsanko Karadzhov, Ph.D. and my assessment of them is entirely positive.

9. Personal impressions

Being familiar with candidate's research and teaching work as a colleague in the department of "Mechanical and precision engineering" and as a researcher in the team of the Center of Competence " Smart, mechatronic, echo- and energy saving systems and technologies", laboratory complex "Smart mechatronic systems for measurement and control", laboratory "Smart mechatronic systems for measurement of static and dynamic quantities", I am fully convinced that chief assistant professor Tsanko Karadzhov, Ph.D. is a highly qualified and well-read scientist and academic teacher.

10. Conclusion:

Drawing upon the content of the materials submitted for participation in this competition, the topicality and significance of accomplished scientific and applied research contributions, I propose to the esteemed jury that Chief Assistant Professor Tsanko Karadzhov, Ph.D. be awarded the position of "Associate Professor" in the higher education area 5. Technical sciences, professional field 5.1. Mechanical engineering, scientific major "Methods, converters and devices for measurement and control of physical, mechanical and geometric quantities".

Gabrovo, 29 October, 2021

MEMBER OF JURY: /signature/

/Prof. Iliya Zhelezarov, Ph.D./