

OPINION

by Prof. Galya Velikova Duncheva, DSc – Technical University of Gabrovo

**of the materials submitted for participation in the competition
for acquiring the academic position of "Associate Professor" in
Field of higher education - 5. Technical sciences,
Professional direction - 5.1. Mechanical Engineering,
specialty - Methods, transducers and devices for measurement and control of physical-
mechanical and geometric quantities**

In the competition for associate professor, promulgated in SG № 50 / 15.06.2021 and on the website of Technical University of Gabrovo for the needs of the Department of Mechanical and Precision Engineering at the Faculty of Mechanical and Precision Engineering, as the only candidate participates Ch. Assistant Professor Dr. Tsanko Vladimirov Karadzhov - Technical University - Gabrovo.

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

The candidate is a PhD in the scientific specialty "Quantum and Optoelectronics". Outside the scientific publications on the PhD dissertation, Ch. Assistant Professor Dr. Tsanko Vladimirov Karadzhov, participated in the competition with a total of 37 scientific works, divided into groups of indicators according to ZRAS/2018, as follows:

▶ Group A, indicator 1: 1 number PhD dissertation on the topic "Research, modelling and scheme design of multi-element photodetectors" (2007);

▶ Group B, indicator 3: 1 number published scientific work, presented by the candidate as a habilitation work - monograph on the topic "Methods and tools for measuring physicomachanical quantities" (2021) (B.3);

▶ Group Γ

■ Indicator 7: A total of 12 scientific publications, which according to the place of publication are distributed as follows:

● 1 article in "Infrared Physics & Technology" - an international scientific journal with Impact Factor, published by Elsevier (Web of Science, IF2020 = 2.638) (Γ.7.10);

● 9 reports published in the editions of the 12th and 13th International Scientific and Practical Conference, Rezekne, Latvia, indexed by Scopus (SJR 0.11)- respectively 2 reports in 2019 (Γ.7.1; Γ.7.2) and 7 reports in 2021 (Γ.7.3 – Γ.7.7; Γ.7.11; Γ.7.12);

● 2 reports at the "Conference on Applications of Mathematics in Engineering and Economics, AMEE 2020", AIP Conference Proceedings, indexed by Scopus (SJR 0.177) (Γ.7.8; Γ.7.9);

■ Indicator 8: A total of 21 scientific publications, which according to the place of publication are distributed as follows:

● 2 articles in the "International Journal of Emerging Technologies in Computational and Applied Sciences", published by the International Association of Scientific Innovation and Research (USA), 2013 (Γ.8.11) and 2015 (Γ.8.13);

● 1 article in the "American International Journal of Research in Formal, Applied & Natural Sciences", 2016 (Γ.8.18);

● 1 report in the "Proceedings of the 2016 International Conference on Hydraulics and Pneumatics – HERVEX", Baile Govora, Romania, 2016 (Γ.8.17);

● 4 articles in the journal "Machinebuilding and Mechanical Engineering", Varna, 2015 (Γ.8.14; Γ.8.15) and 2016 (Γ.8.16; Γ.8.20);

● 1 report at the "XLVI International Scientific Conference on Information, Communication and Energy Systems and Technologies" - ICEST 2011, Serbia (Γ.8.6);

- 1 article in the “Journal of the Technical University of Gabrovo”, 2010 (Г.8.3);
- 6 reports at the International Scientific Conference “UNITECH” - Gabrovo, 2007 (Г.8.1), 2009 (Г.8.2); 2010 (Г.8.4), 2011 (Г.8.7); 2012 (Г.8.9) and 2014 (Г.8.12);
- 1 article in “Fundamental Sciences and Applications”, published by the Technical University - Sofia, Plovdiv branch, 2011 (Г.8.5);
- 1 article in the journal "Elektrotehnika & Elektronika E + E", published by the Technical University of Sofia, 2013 (Г.8.10);
- 2 reports at the Scientific Session of the National Military University "Vasil Levski", 2012 (Г.8.8; Г.8.19);
- 1 article in the “Proceeding of the University of Ruse” - 2018 (Г.8.21);
- ▶ 1 textbook and 1 textbook, respectively: " Computer Design in Mechatronics" co-authored with Assoc. Prof. Dr. Genadi Tsvetanov (the candidate is second author) and "Instruments for measuring physicomachanical quantities" - Manual for laboratory exercises by Ch. Assistant Professor Dr. Tsanko Vl. Karadjov.

Out of a total of 33 scientific articles and reports, 18 have been published in English. Ch. Assistant Professor Dr. Tsanko Vl. Karadjov is the sole author of 7 scientific works, incl. the presented as monograph scientific work (B.3), manual for laboratory exercises and publications Г.8.4; Г.8.5; Г.8.7; Г.8.13; Г.8.15.

▶ Group II

The presented list of citations includes a total of 15 citations, 12 of which were in publications that were referred/ indexed by Scopus.

2. General characteristics of the candidate's activity

2.1. Educational and pedagogical activity

Ch. Assistant Professor Dr. Tsanko Karadzov has led lecture courses in 3 disciplines ("Instruments for measuring physicomachanical quantities"; "Intelligent positioning systems"; "Processing of measuring signals") and laboratory exercises in 5 disciplines, including the indicated lecture courses, as well as on "Industrial control systems" and "Vibroanalysis and noise protection". The candidate has developed three curricula in the disciplines: "Processing of measuring signals" for students majoring in "Mechanical Engineering and Instrumentation", Bachelor's degree; "Instruments for measuring physical and mechanical quantities" for students majoring in "Mechatronics" and "Mechanical Engineering and Instrumentation", Bachelor's degree; "Instruments for measuring physical and mechanical quantities" for holders of "professional bachelor", preliminary training for "master" in the specialty "Mechatronics". A Certificate issued by IGIP Summer School 2007 for acquired qualification in the fields of engineering education, pedagogical psychology, pedagogical sociology, e-learning, multimedia "Workshop" and laboratory didactics and methodology was presented. No guidance document was provided for graduate studentss. *This confirms the convincing pedagogical and professional expertise of Ch. Assistant Professor Dr. Tsanko Vl. Karadzov in the field of the competition.*

2.2. Scientific and scientific-applied activity

The scientific work presented for a monograph (B.3) and the predominant part of the scientific publications in Group Г - a total of 23 scientific works (Г.7.1 – Г.7.6; Г.8.1 – Г.8.4; Г.8.6 – Г.8.11; Г.8.13 – Г.8.16; Г.8.18; Г.8.19; Г.8.21) are thematically oriented towards the development of methods for measurement of physico-mechanical and geometric quantities, noise and vibrations, technical provision of the respective measurements, measuring converters of physicomachanical quantities and measurement error analysis. Exactly this part of scientific works forms the scientific profile of the candidate as a researcher with convincing expertise in the field of the competition.

In accordance with ZRAS/2018 and this competition, the scientific work presented for habilitation work - monograph on the topic "Methods and means for measuring physicomachanical quantities" is of decisive importance. In the context of Field of higher Education 5. Technical Sciences and the Regulations for obtaining scientific degrees and holding academic positions at the Technical University of Gabrovo, the main criteria for the scientific level of the monograph is the presence of an original contribution based on own developments. The first three chapters contain systematic information on the foundations of methods, principles and technical means for measuring physicomachanical quantities. On this basis and in the context of the analyzes made, in the fourth, fifth and sixth chapters the author has presented his own works. Summarizing, in my opinion, as structure, content and contributions, the scientific work (B.3) corresponds to the scientific level inherent in a monograph.

Some of the scientific publications, incl. the article, published in a journal with Impact Factor ($\Gamma.7.10$; $\Gamma.8.5$, $\Gamma.8.17$; $\Gamma.8.20$), are thematically oriented to the laser marking process. Taking into account the applied aspect of these publications with an emphasis on measuring the power of laser radiation and the saturation of the marked area and background, they have an interdisciplinary character. Therefore, I believe that they are in the field of competition. Scientific works numbered $\Gamma.7.7 - \Gamma.7.9$ and $\Gamma.7.12$ are in the field of Precision Engineering, as they are aimed at geometric synthesis and analytical study of conventional and planetary low-modulus involute cylindrical gears with an asymmetric profile. In the author's reference of the contributions the candidate has not included contributions for the last group of publications. Given the subject matter and interdisciplinary nature of the other publications, I accept that they are in the field of competition.

According to the citation reference, most citations (12 numbers) are in publications referred by Scopus. The citations are mainly from Bulgarian author groups, which traditionally work in the field of the competition.

Ch. Assistant Professor Dr. Tsanko VI. Karadjov is the manager of a contract regarding measurements concluded between UCNIT - Technical University of Gabrovo and BLAZER GROUP Gabrovo EOOD.

Therefore, in the context of the competition, the candidate satisfies the minimum national requirements of ZRAS/2018 and the Regulations for obtaining scientific degrees and holding academic positions at the Technical University of Gabrovo.

2.3. Implementation activity

An official note is presented, certifying the candidate's contribution to the design and processing of a foundation for reducing noise and vibration in rotary machines.

3. Contributions and their significance for science and practice

I propose the following classification and formulation of the main contributions in scientific works:

3.1. Scientific- applied contributions

A. Creation of new classifications, methods, approaches, algorithms, constructions, models

- *A classification of methods for measuring physicomachanical quantities in correlation with the types of errors has been created [B.3];*
- *Classifications of measuring instruments and measuring transducers of physicomachanical quantities in correlation with the methods for increasing their accuracy have been created [B.3; $\Gamma.8.14$];*
- *A generalized mathematical model of the dynamic characteristics and methodologies for optimization of measuring systems and transducers have been developed [B.3];*

- *Models, scheme solutions and methods for reducing the errors of the measuring transducers have been developed (B.3);*
- *Method for vibroacoustic diagnostics of gears [Г.8.16];*
- *A computer measuring system for determining the natural frequencies of mechanical systems with distributed parameters has been developed [B.3; Г.8.3];*
- *An analytical method for calculating the second natural frequency of transverse oscillations of a beam with a changing cross section in the axial direction has been developed [B.3; Г.8.10];*
- *A methodology for studying the absorption of sound waves in various sound insulating materials has been developed [B.3; Г.8.1];*
- *New methods for measuring dynamic parameters of moving objects have been synthesized [Г.7.2; Г.8.2];*
- *A microprocessor system for signal processing from temperature sensors, automated devices for temperature measurement and optimal algorithms for real-time signal processing have been developed [B.3; Г.8.4; Г.8.10; Г.7.1; D.7.3];*
- *A method for non-contact temperature measurement with two photodetectors with different spectral sensitivity has been developed [Г.7.6];*
- *Basic models for non-linearity error analysis of the static characteristic of the measuring instruments have been developed [Г.8.21];*
- *A scheme for converting illuminance into frequency and ratio between two illuminances in number of pulses has been developed [Г.8.6] [Г.8.7];*
- *A system for determining the round-the-clock error of a mechanical watch with a Swiss running mechanism by measuring the vibrations on the case has been created [Г.8.19];*
- *A methodology for experimental determination of the static transmission characteristic of a centrifugal tachometer has been developed [Г.8.15];*

B. Obtaining and proving new facts

- *It was found that the developed scheme for converting illuminance into frequency and ratio between two illuminances in number of pulses has improved linearity of the static characteristic and higher accuracy in comparison with the existing converters illuminance - voltage [Г.8.6; Г.8.7];*

3.2. Applied contributions

- *Database for the influence of the power density, frequency and marking speed of different laser technological systems on the process of laser marking of details made of different types of materials [Г.7.10; Г.8.17; Г.8.20];*
- *Classification of methods for measuring the radiation power of laser sources with different wavelengths and different power [Г.7.4; Г.7.5; Г.8.9].*

4. Evaluation of the personal contribution of the candidate

In my opinion, Ch. Assistant Professor Dr. Tsanko Vladimirov Karadzhov has a decisive contribution to the results in scientific works and modernization of the research base in Department of Mechanical and Precision Engineering.

5. Critical remarks and recommendations

- *There is a discrepancy between the title and the summary of the scientific paper Г.7.9 in English and the translation made in Bulgarian. As the article is published in English, the meaning of the title is relevant: "Determination of elastic displacements *in plain strained condition*". In the summary, this title is translated into Bulgarian: "Determination of elastic displacements in the plane stress state in involute cylindrical gears with an asymmetric profile".*

However, this discrepancy is of a fundamental nature. The plane strain condition corresponds to a three-dimensional stressed state, and therefore, contradicts the known planar gearing in cylindrical gears, i.e. the one and same stressed and strained state in the different sections in the direction of the width of the gears.

- Publications in journals with Impact Factor in quantitative and qualitative terms are an internationally recognized indisputable criterion for the scientific production level. From this point of view, in the future I recommend Dr. Tsanko Vladimirov Karadzhov to publish the his research results in journals with Impact Factor. This will naturally provide citations in high-rated journals and promote its scientific results.

6. Personal impressions

Based on my personal impressions, I believe that Ch. Assistant Professor Dr. Tsanko Vladimirov Karadzhov is a responsible and highly qualified scientist and researcher in the field of methods, transducers and devices for measuring and controlling physical-mechanical and geometric quantities.

7. Conclusion

Based on the above, I propose Ch. Assistant Professor Dr. Tsanko Vladimirov Karadzhov to be elected "Associate Professor" in
Field of higher education - 5. Technical sciences,
Professional direction - 5.1. Mechanical Engineering,
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25.10.2021

Member of the scientific jury: /signature/
/ Prof. Galya V. Duncheva, DSc /