OPINION

Regarding the competition for holding the higher academic post of
Associate Professor in Higher Education Area 5 Technical Sciences,
Professional Field 5.1. Mechanical Engineering,
Science Specialty *Mechanical Engineering, Material Resistance*,
published in the State Gazette, issue 68 of 31.07.2020, and on the website of Technical University – Gabrovo,
announced for the needs of the Department of Technical Mechanics at the Faculty of Mechanical and Precision Engineering, Gabrovo Technical University
Applicant: **Chief Assistant Engineer Vladimir Petrov Dunchev, PhD**.
Member of the Scientific Jury: Prof. Eng. Stanimir Mihailov Karapetkov, DSc., Technical University of Sofia

1. General characteristics of the applicant science and research applied activities

Chief Assistant Eng.Vladimir Petrov Dunchev, PhD participates in the competition for the academic position of Associate Professor with scientific output, which can be categorised into the following groups:

- PhD Abstract *Information and calculation system for offering and optimal design of metal structures of bridge cranes* [A.1];
- 8 scientific publications for acquisition of PhD degree;
- 10 related scientific publications in international scientific journals with Impact Factor, indexed by Web of Science, entitled *Increasing the fatigue strength of metal structural elements through static surface plastic deformation* [B.1 – B.10];
- 1 scientific article in an international journal, indexed by Web of Science and Scopus [G.1];
- 13 scientific publications in unreferred journals with scientific review or in edited collective volumes [G.2 - G.14];
- 2 e-textbooks [U.1, U.2].

An object of review for the competition are 24 scientific publications and 2 teaching aids, not connected with the scientific works for obtaining doctoral degree.

8 out of these works are independent and single-authored: 3 scientific articles in "Notices of TU - Gabrovo", 3 scientific reports at conferences and 2 e-textbooks. 18 scientific publications are co-authored and in 6 of them the applicant comes as a first author. All 24 scientific papers are in the field of the competition.

The number of articles published in reputable journals with Impact Factor or indexed by Web of Science is11.

The main submitted scientific papers in science areas are as follows:

1. Scientific publications, equivalent to habilitation work, referenced and indexed in world-famous databases with scientific information [B.1 - B.10].

10 publications are on *Increasing the fatigue strength of metal structural elements through static surface plastic deformation*. Thematically, they are dedicated to approaches and technologies for increasing the fatigue strength and fatigue life of metal structural elements through static surface plastic deformation (SSPD). The basis of the habilitation work is the idea of predicting and managing the fatigue behaviour and fatigue strength of structural elements of aluminum alloy 2024-T3, low-alloy structural steel 41Cr4 and high-alloy austenitic steel AISI316Ti in correlation with the main characteristics of Surface Integrity (SI), applying the processes of diamond smoothing and SSPD with a toroidal deforming roller. A large number of experimental studies have been conducted, based on planned experiments, variance and regression analysis, a series of fatigue tests of rotational bending, fractographic analysis and others. Numerical simulations for studying the stress and strain state in the surface layers occupy an important place in scientific works. They are based on both unilaterally connected and bilaterally connected (thermo-mechanical) 3D finite element models of the studied processes.

2. Works related to the construction of temperature-dependent constitutive models of the surface layers of different structural materials: aluminum alloy 2024-T3 [G.6], bronze CuAl8Fe3 [G.9] and high-alloy austenitic steel AISI316Ti [G.12] subjected to diamond smoothing.

3. Papers devoted to the study of the influence of the sliding speed in diamond smoothing on the Surface Integrity of low-alloy structural steel 41Cr4 [D.10] and high-alloy austenitic steel AISI316Ti [G.12 - G.14].

4. Works in group D in the field of modification of the surface layers and increase of the fatigue strength in samples of different materials, subjected to both diamond smoothing and ionic nitriding and hardening and grinding;

5. Work [G.1] concerning the study of the dynamic response of the main beam-hoist-load system caused by the movement of the hoist-rope-load system.

The reseach-applied activity of the applicant includes participation as a researcher in the following national projects: Center for competence *Intelligent mechatronic, eco- and energy-saving systems and technologies,* a project funded by the Operational Program "Science and Education for Smart Growth"; project funded by the National Research Fund.

Ch. Assist. Eng.Dunchev, PhD, as a participant in the research team, has implemented 5 university research projects. The topic of the university research projects is related to the problem of increasing the fatigue life of metal structural elements, which adds to the development of the scientific profile of the candidate. No implementation documents have been submitted.

Chief Assistant Engineer Vladimir Petrov Dunchev, PhD, completely fulfills the minimum national requirements for holding the position of "Associate Professor", set out in the

Regulations for the implementation of the law on the development of academic staff in the Republic of Bulgaria and the internal rules of TU-Gabrovo. Dr. Vladimir Dunchev's h-index = 5, is an indicator of the applicant significant scientific output.

2. Assessment of the pedagogical training and activity of the candidate

Ch. Assistant Professor V. Dunchev, PhD has conducted lecture courses in Strength of materials, Mechanics I, Mechanics II, and Mechanics, as well as laboratory and seminar exercises in the same courses and the disciplines Theoretical Mechanics, Technical Mechanics and Applied Mechanics. His *Methodical handbook for solving problems in statics* and the *Handbook for solving problems in kinematics* confirm his educational and pedagogical training.

3. Main scientific and research-applied contributions

I accept the following scientific contributions:

- The hypothesis that for materials reinforced under the action of cyclic deformation, to maximize the fatigue limit, the surface layer needs to reach a stabilized cycle [B.5] is substantiated and experimentally proven;

- It has been proven that different combinations of control basic and additional parameters lead to different static burnishing processes (smoothing, mixed and deep), characterized by different Surface Integrity (SI), which corresponds to different fatigue longevity and fatigue limit [B. 1, B.3, B.7, B.10].

I accept the author's claims regarding the scientific and research-applied contributions listed in his reference.

The applicant contributions belong mainly to the group of *Proving significant new aspects of already existing scientific fields, problems, theories and hypotheses by new means and devices*.

4. Significance of contributions to science and practice

The obtained contributions represent more knowledge in science and have the potential for implementation in engineering practice in the field of the problem of increasing the fatigue strength and fatigue life of metal structural elements. The level of scientific output of the applicant corresponds to the world level in the field of modification of the surface layers of metal components as an approach for extending the strength resource of dynamically loaded structural components. Proof of this are the large number of publications in international scientific journals with a high Impact Factor (11 publications) and the large number of citations in publications referenced and indexed in world-famous databases of scientific information (Web of Science and Scopus).

The candidate participates in the competition with 15 citations in international scientific journals with Impact Factor, which significantly exceeds the minimum national requirements for group E.

5. Critical remarks and recommendations

I have no critical remarks or recommendations based on nature and principles of science research.

6. Conclusion

Based on the analysis of the submitted scientific papers, their significance, the scientific-applied and research-applied contributions in them, the applicant pedagogical training in compliance with the national requirements and regulations, I find it reasonable to propose to the honorable Scientific Jury Chief Assistant Engineer Vladimir Petrov Dunchev, PhD to hold the academic position of ***Associate Professor*** in the professional field 5.1 Mechanical Engineering, science specialty *Mechanical Engineering, Material Resistance*.

Date: **Member of the Scientific Jury: /signature/**

December 16, 2020 /Prof.Eng. S.Karapetkov, DSc/