



OPINION

on the materials submitted for participation in the competition for the occupation of the academic position "Professor" in the field of higher education 5. "Technical Sciences", professional field 5.13. General Engineering ", Applied Mechanics Science in Mechanics

In the competition for professor, announced in the State Gazette, issue. 101 / 27.12.2019 and on the website of the LTU with procedure code WWI-P1119-28 for the needs of the Department of Mathematics and Physics, Faculty of Forestry, with the participation of **Associate Professor Georgi Yordanov Vukov**, Faculty of Forestry, Department of Mathematics and Physics

Prepared by: **Arch. Yanko Tsvetkov Alexandrov, Professor**, Professional Degree 5.7.
Architecture, Construction and Surveying; / retired /

1. Brief CVs of the applicant

Associate Professor Vukov has 35 years of work experience; From 2002 till now (from 27.11.2002, following note CR-186-2 dated 17.01.2020) - Assistant Professor; Forestry University; 2000 - 2002; (01.02.2000 - 26.11.2002, following note CR-186-2 dated 17.01.2020) - Chief Assistant; Forestry University; 1999 - 2000; (02/22/1999 - 01/31/2000 following note CR-186-2 dated 17/01/2020) - Assistant; Forestry University; 1992 - 1998; Teacher position; Princess Evdokia PFC, At. Dalchev 8, Sofia, 1113, Bulgaria; 1988 - 1991; Full-time PhD student in cat. Mechanics - Technical University - Sofia; 1985 - 1988; Technological Engineer; Development of equipment for the learning process.

2. Conformity of the submitted documents and materials of the applicant with the required ones in accordance with the RAC Rules in the TU.

Article 65 of these Rules; Section V. Terms and Conditions for Occupation of the Academic Position "Professor", the candidate reports a total of **1554,9 points** for achievements, which are evaluated in aggregate. This covers the requirements of Art. 65 (1), 5 „5. (New - LTU 2018) to meet the minimum national requirements under Art. 2a, para. 2, 3 and 4; "

3. Assessment of the applicant's educational activities (work with students and doctoral students)

According to the reference No. FGP-239 # 1 of 14.01.2020 of the Faculty of Forestry, Associate Professor Dr. Eng. Georgi Vukov has prepared under the syllabus for 2019/2020 the Bachelor's degree programs for the following disciplines: -Mechanics, major in Engineering Design, 1 course, full-time education; - Theoretical mechanics, specialty "Technology of wood and furniture", 1 course, full-time and part-time training; - Materials resistance, specialty "Technology of wood and

furniture", 2 year, full-time and part-time training; Technical Diagnostics, Master's Degree Program.

According to the reference № FGP-239 # 2 of 14.01.2020 of the Faculty of Forestry, Assistant Professor Dr. Eng. Georgi Vukov has an audit and extracurricular workload for the academic year 2019-2020 in the Bachelor's Degree in teaching classes, equated to to exercises - 422 hours of study.

According to the official note FGP-239 dated 14.01.2020 of the Faculty of Forestry, Associate Professor Dr. Eng. Georgi Yordanov Vukov was a scientific consultant of successfully defended his PhD in 2012, COBISS.BG-ID-1281227236, G. Kovachev, on the topic "Dynamics of the cutting mechanism of a milling machine with a lower spindle arrangement", with the assoc. Prof. Dr. Vasil Vlasev from the Department of Woodworking Machines at the Faculty of Forestry at the University of Forestry.

According to an official note (NIS-225 dated 14.01.2020), Associate Professor Dr. Eng. Georgi Vukov has worked with students and PhD students in NIS: R. Bonova - PhD student; V. Mikhailov - student; M. Stoykov- student; (Contract No. 40 / 13.04.2009); on the subject "Study of the torsional oscillations in the mechanical gear of a class of wind generators", funded by the LTU for a duration of three years (2009 - 2011). D. Dimitrov - student; G. Ivanov - student; T. Stanev-student; (Contract FGP-2018-YU-4 / 19.03.2018) on the topic "Investigation of the main factors that cause vibrations and noise during the operation of the machine-tools", funded by LTU.

4. Evaluation of the applicant's scientific, applied and publication activities General description of the submitted materials

Associate Professor Dr. Eng. Georgi Yordanov Vukov participated in the competition with:

Monographs - 1 pc. (A1-1); Textbooks - 6 pcs. (E23-1 - E23-6); Tutorials - 1 pc. (E24-1); § Monographs - 1 pc .; (A1-1); § Textbooks - 6; (E23-1 - E23-6); § Study aids - 1; (E24-1); § Books -....;

§ Publications - 9 + 23 + 42 = 74 issues.

Publications in refereed and indexed scientific journals, series and

Conference Proceedings - Web of Science and SCOPUS - 9 issues.

Publications in scientific journals, series and conferences,referenced and indexed outside the Web of Science and SCOPUS databases - 23:

- in foreign abstracts - 7

- in Bulgarian abstracts - 16

Publications in non-refereed scientific journals and series - 42 issues, including:

- in foreign countries - 17

- in Bulgarian - 25

In addition, the publications (74 items) are not included in Annex 2 and 5 other publications by Assoc. Prof. G. Vukov - these are in publications without ISSN or ISBN (given separately).

§ Projects - 10 pcs.

4.1 Participation in scientific, applied and educational projects

Participation in research projects - 8 pcs. (E18-1 - E18-8);

Management of research projects - 2 pcs. (E20-1, E20-2).

4.2 Characteristics of published scientific results;

The scientific results correspond to the scientific interests of the applicant announced in the professional biography, which relate to: Dynamics, strength and reliability of machines and equipment. Vibrations and noise in the machines. Technical diagnostics;

1. Dynamics, strength and reliability of machines in the forest industry; Six projects (E 18-1 - E 18-6) were presented, as well as 54 scientific works, incl. in refereed journals (Web of Science or SCOPUS) - 6, and in other databases - 20. The works are cited in 29 papers - including 3 in refereed journals (Web of Science or SCOPUS) and 3 in other databases.

2. Dynamics and vibrations of wind turbine and vehicle propulsion units; Three projects (E 20-1, E 18-7, E 18-8) were presented, as well as 18 scientific works, incl. in refereed journals (Web of Science or SCOPUS) - 3, and in other databases - 4. The papers are cited in 29 papers - including 13 with Impact Factor, 1 in the Reference Journal (SCOPUS) and 5 in other databases.

3. Technical diagnostics; One monograph has been presented and 10 scientific papers have been published. The works are cited in 12 papers, including 1 in a refereed by Web of Science journal.

4.3 Coverage of candidate's scientific publications in literature (known citations) § Total - 63 citations. According to the type of citation: Quotations in Impacted Magazines - 13 pcs. Citations in refereed journals (SCOPUS, Web of Science) - 4 issues. Quoted in journals referenced in other databases 8 pcs. Quotations in non-refereed journals and conference proceedings - 38; In addition to the citations included in Appendix 2 (63), there are 19 other citations of scientific works by Assoc. Prof. G. Vukov - they are in editions without ISSN or ISBN outside Bulgaria and in dissertations in Bulgaria (given separately).

Quotations in rehabilitation work: - "Quality dimensioning of autoclaves and vacuum chambers for wood processing" with author Assoc. Prof. Sokolovski S., LTU - Sofia, 2009, is cited: 14. G. Vukov, "Theoretical Mechanics", LTU, Sofia, 2004, 160 pages. 4.4 Contributions to the applicant's work (scientific, applied, applied) The contributions are grouped by the applicant in the following areas: 1. Dynamics, strength and reliability of the machines in the forest industry: (woodworking milling machine, circular machine, veneer machine);

1.1. Woodworking mill studies;

Dynamic models for the study of: - the free torsional vibrations of the cutting mechanism of the machine take an important place in scientific and applied contributions; [D8-6] and the forced torsional vibration of the cutting mechanism caused by the alternating torsional moments of the drive motor and the cutting tool; [D8-13];

— the free damping and free damping spatial vibrations of the milling machine and its spindle (models have 12 degrees of freedom) [G8-8, D8-22]; - forced spatial vibrations of the milling machine and its spindle (12 degrees of freedom) from the unbalance of the cutting tool [D8-20]; - the free damping and free damping spatial vibrations of the milling machine, its spindle and the rotor of the drive motor (the models have 18 degrees of freedom) [D8-18, D8-19];

- It is essential for the quality of the furniture in the furniture that they are machined and the timber used. The applicant's research is focused on "...production accuracy and quality", in this connection establishing "the influence of the variable torque of the motor and of the variable torque of the cutting tool); [D7-1]; (In 1.1.1.);

- and in the Applied Contributions, it is theoretically established: - free damping vibrations and forced vibrations caused by the wear of the milling elements after prolonged use, with an influence on the quality of the machined surface of the torsional vibration components caused by the wear of the elements on the machine [D7-4]; (In 1.1.1.4);

- as in 1.1.5. Dependencies have been experimentally established for: - the effect of the torsional vibration caused by the wear of the machine elements on the quality of the machined surface of the workpieces [D7-4]; - the influence of selected factors on the cutting power of longitudinal milling of solid wood (cutting speed; feed rate; area of the layer taken off), by measuring the input power of the idle motor and the operating stroke with the help of modern equipment and software - details of beech (*Fagus sylvatica*) and for comparative analysis of white pine (*Pinus sylvestris*) [D8-37] have been investigated;

- the effect of cutting speed, feed rate and milling area on the cutting force of beech mill (*Fagus sylvatica* L), [D8-39].

1.2. Circular machine studies

In Scientific Applied Contributions: 1.2.1. Dynamic models have been developed to investigate:

- the free, non-attenuating torsional vibration of the cutting mechanism [D7-2]; - free damping and forced torsional vibration of the cutting mechanism [G8-16, G8-54]

Theoretically established are: - natural frequencies and natural shapes of the torsional vibrations of the cutting mechanism of a circular machine [G7-2], as well as diagrams of: natural frequencies and shapes; free damping vibrations; the forced oscillations of the cutting mechanism from malfunctions in the drive motor; its amplitude-frequency characteristics [D8-17] have been declared (in applied contributions: 1.2.2)

The applicant has investigated the impulse and shock loads that are a prerequisite for hazardous operating modes [G8-42] during the course of cutting in circular longitudinal cutting machines [G8-57]. The free vibrations of a circular saw, with compensation channels [G8-12] and with compensating and noise-reducing channels [G8-11], which are important for noise protection when working with this saw, were also investigated. For this purpose, the finite element method using four nodal 3D finite elements is applied [D8-14]. (1.2.1. Scientific contributions)

Within the scope of theoretical studies are: the maximum deformations of circular shafts generated by the external load [G8-58] for which dependencies are derived; as well as the critical angular velocities of circular longitudinal cutting machines [G8-59] for which calculation dependencies have been proposed; (in Applied Contributions: 1.2.2) It is suggested to minimize the deformation of the circular shafts [G8-58] through a strategy for optimizing the machine parameters.

1.3. Research on Veneer Machine In Scientific Applied Contributions:

1.3.1. Dynamic models have been developed to investigate: - the torsional vibrations of the drive mechanism of a horizontal veneer machine [G8-55]; - the parametric torsional vibrations of the drive mechanism of a veneer machine [G8-5] and to determine its amplitude-frequency characteristics [G8-44], which are theoretically justified in (1.3.3. Applied contributions) By studying the torsional vibrations, criteria for assessing the technical condition and current performance of the machine have been given, and measures have been proposed to improve the methods for monitoring its technical condition [D8-9] and 1.3.5)

The candidate has focused his attention on the practical definitions of signs for the detection of type defects in the drive mechanism of veneer machines [G8-51] and (1.3.6. Applied contributions) Static deformation modules of five tree species have been determined experimentally [G8-65] and (1.3.7. Applied contributions)

2. Dynamics and vibration of wind turbine and vehicle propulsion units. The destructive effect of the torsional vibrations on the gears of the gears is considered: In 2.1. Scientific and applied contributions from the developed dynamic models, of particular importance is the model for determining: - the dynamics of the mechanical gear in the presence of the most common defects in its elements - cracked tooth and the presence of pitting with theoretically justified reduction of the amplitude of the the corresponding gear from the planetary mechanism [G8-7];

In 2.2. Applicable contributions: Theoretically established by the applicant:

- equations describing the torsional vibration of a Lagrangian wind generator in which the contact forces between the gears are modeled as linear springs located in the plane of action of the contact line [D7-5, D8-61, D8-62];

- vibration of a wind generator in a defective gearing - a cracked tooth in a gearbox of the high-speed gearbox, also comparing with a regular gearing [D8-29].
- the torsional vibrations of the gear housing in the presence of the most common defects in its components - cracked tooth and presence of pitting [G8-7]; and - the helicopter transmission torsional vibrations [G8-26].

These contributions would be particularly useful in the future development of new gear solutions and even new types of machines with their involvement that eliminate defects such as "cracked tooth and pitting".

3. Technical diagnostics

The candidate, by examining the torsional vibration of a class of veneer machines, forms criteria for assessing their technical condition, and at the same time determines their instantaneous performance; [D8-9]; Another important aspect is related to the improvement of the methods for vibroacoustic diagnostics of equipment in woodworking and furniture production [G8-40] and of wind generators [G8-52];

Particularly valuable for the practice are the scientific and applied contributions:

- on the description of the most unfavorable processes when working with cutting mechanisms in the forest industry, and making recommendations for their elimination; [8-41], 3.3.)

as well as the derived dependencies and the proposed enhancement options

the operability of circular machines [8-42]. 3.4.) Modern tools for computer modeling and simulation of work processes are essential for the diagnosis and determination of the instantaneous operability of the equipment in the woodworking and furniture production; [8-47] and 3.5)

5. Assessment of the applicant's personal contribution

There is a wide range of theoretical studies. Torsional vibrations and torsional moments occupy a significant place in the candidate's scientific development. Important for the practice are the scientific results referred to as scientifically applied and applied contributions. The methodology for vibration diagnostics and monitoring of technical equipment in the forestry industry is presented in the monograph [B-3], which is the applicant's personal matter.

Scientific and applied contributions are related to: - clarification of theoretical issues; construction of dynamic (mechanical-mathematical) models; there is an analysis of the results of experimental studies in real conditions; these contributions are particularly useful for the practical operation of the tested technical equipment: (woodworking milling machine, circular machine, veneer machine), as well as propulsion units of wind turbines and vehicles.

6. Critical notes

- In "1.3. Research on Veneer Machine; Scientific and applied contributions: 1.3.1. Dynamic models have been developed to investigate: - the torsional vibrations of the propulsion mechanism

of a horizontal veneer machine [G8-55]; - the parametric torsional vibrations of the propulsion mechanism of a veneer machine [G8-5] and for determining its amplitude-frequency characteristics [G8-44] "and torsional vibrations" and "torsional vibrations" relate to the actuator and should be used, as a term only one of them.

- In Annex 1.3 of the Applicant's Self-Assessment Table for compliance with the minimum national requirements, the points are filled in in good faith and correctly, and in collective publications the indicators are divided by the number of participants. Two of the columns that are relevant for finalizing the applicant's research are not filled in as new gearbox solutions: E 25. Patent or utility model application published (20 points) and E 26. A utility model application recognized, patent or copyright certificate (40 points).

In this regard, the significant theoretical results of Assistant Professor Dr. Eng. Georgi Vukov should be directed in the future to specific innovative proposals with inventive step- new solutions of gears and even machines. To this end, gears have been published or patented by the Patent Office of the Republic of Bulgaria. For example, these are: - publications; Scientific Works of the University of Ruse - 2010, Volume 49, Series 1.2 - 69 - Tooth gears with a small number of straight teeth (Part II - gears with asymmetric involute-barrel gearing) - Ognian Alipiev and - Patents; [2] O. Alipiev, Patent for Invention, No. 66144, 2011. Cylindrical gear gear with external gearing. Patent Application No. 110302 Patent Office Official Bulletin No. 7, 2010; [] Alipiev, O., I. Nikolaev, G. Popov, D. Zafirov. Hydraulic Machine with Internal Engagement, Patent for Invention, No. 66143, 2011.

7. Personal impressions

I do not personally know the author, but the high quality of scientific research in itself speaks for his deep professional knowledge and skills in the field of applied mechanics. There is widespread reflection of the applicant's scholarly publications in the world and national literature (known citations - 63 in total, publications 74 in number, projects - 10 in number and others). As a result of active research, the applicant has achieved an impressive 1,554.9 points on the scientometric scoreboard of Annex 2 to the NACID.

8. Conclusion

In connection with the above, I propose **Associate Professor Dr. Eng. Georgi Yordanov Vukov** to be selected as a "Professor" in the discipline "Mechanics" in the professional field 5.13. General Engineering, Applied Mechanics Science.

Prepared by: Prof. Dr. Arch. Yanko Alexandrov

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