REVIEW

on the materials submitted for participation in a competition for **„Professor"** in the field of higher education **5. Engineering sciences**, Professional field **5.13. General engineering**, scientific specialty **"Applied mechanics"**, in the discipline **"Mechanics"**

In the competition for professor, published in the **State Gazette, issue 101 of December 27, 2019** and on the site of the University of Forestry with the **code WWI-P-1119-28** for the needs of the Department of Mathematics and Physics at the Faculty of Forest Industry, as a candidate participates **Associate Professor Georgi Yordanov Vukov**, PhD, **Faculty of Forest Industry, Department of Mathematics and Physics, University of Forestry, Sofia.**

Reviewer: Corresponding Member of the BAS, Prof. DSc. arch. Atanas Dimitrov Kovachev, Professor in a Professional Field **5.7 Architecture, Construction and Geodesy** from the **University of Forestry, Department of Landscape Architecture**.

1. Brief biographical data for the candidate

Assoc. Prof. Eng. Georgi Yordanov Vukov, PhD was born in 1960 in Sofia. He completed his secondary education in 1978, and in 1985 graduated from the Higher Mechanical and Electrical Engineering Institute (now Technical University) - Sofia, **majoring in Industrial Heat Engineering**.

In 1986-87 he specialized in Applied Mathematics at the Center for Applied Mathematics at the Institute for Applied Mathematics, Higher Mechanical and Electrical Engineering Institute, Sofia. He acquired the qualification "engineer-specialist" in the specialty "Applied mathematics".

In the period 1988-91 he is a full-time postgraduate student at the Department of Mechanics, Faculty of Transport at the Technical University - Sofia. **He defended his thesis on "Dynamic loads of thrust bearings of machines with cardan shafts"**, headed by Prof. Alexi Pisarev.

He worked consecutively as an engineer-technologist at the Technical University - Sofia (1987-88) and a lecturer in technical disciplines at a secondary school (1992-98).

In **1999 he started working in the University of Forestry - Sofia** as an assistant in the Department of Mechanical Engineering at the Faculty of Forest Industry. In 2000 he became a Ch. Assistant, and **in 2002 he was habilitated as an associate professor in the field of Applied Mechanics.**

2. Correspondence of the submitted documents and materials of the applicant according to the Rules of the Development of academic staff at the University of Forestry.

The submitted documents and materials of the candidate for participation in the competition for the occupation of the academic position of "Professor" are in accordance with the requirements according to the Rules for development of academic staff at University of Forestry. They are presented on paper and on a portable recorder (flash drive).

3. Assessment of the candidate's educational and pedagogical activities (work with students and PhD students)

The presented service note from the Faculty of Forest Industry for the academic load of Assoc. Prof. Georgi Vukov, PhD shows that he has the necessary academic load to participate in the competition for the occupation of the academic position of "Professor" and he has performed lectures and exercises for the period 2009 - 2019 in the disciplines **Mechanics, Theoretical Mechanics, Strength of Materials, Metal Science and Technical Diagnostics**, with reported annual employment exceeding the required 360 academic hours.

A summary of the prepared curricula by Assoc. Prof. Vukov, PhD, as a leading lecturer in the disciplines **Mechanics, Theoretical Mechanics, Strength of Materials, Metal Science and Technical Diagnostics**, is also presented.

Assoc. Prof. Georgi Vukov, PhD has been a scientific consultant to Ch. Assistant Professor G. Kovachev from the Department of Woodworking Machines in the development and successful defense of his thesis on "Dynamics of the cutting mechanism of a milling machine with lower spindle position", defended in 2015.

The overall assessment of the candidate's teaching activity includes **6 textbooks** he has developed (4 independently and 2 in co-authorship), as well as one Learning material in the studied subjects.

The educational and pedagogical activites of the applicant are at the required level and meet the requirements for occupation of the academic position "Professor".

4. Assessment of candidate's scientific, scientific-applied and publishing activities

General description of the presented materials

Candidate Assoc. Prof. Georgi Vukov, PhD participated in the competition with:

- Monographs - 1 pcs;
- Textbooks - 6 pcs;
- Learning materials - 1 pcs;
- Books - 0 pcs;
- Publications - 74 pcs.
- Projects - 10 pcs.

4.1 Participation in scientific, scientific-applied and educational projects

Assoc. Prof. Georgi Vukov, PhD is **the leader of 2 research projects** (E20-1 and E20-2) financed by the University of Forestry (a note from the NIS- University of Forestry is presented). He is a **participant in the teams of 8 other research projects** (E18-1 - E18-8) - 2 of them are financed by University of Forestry (official note from NIS- University of Forestry is presented) and 6 are funded by BAS (official notes are presented from the Institute of Mechanics - BAS).

4.2 Characterization of published scientific results

The publications can be classified as follows:

By type:

- Publications in scientific journals - **49** pcs;
  - publications in foreign journals referenced and indexed in SCOPUS or Web of Science - **9** pcs; + **7** pcs in Other databases;
  - publications in Bulgarian journals referenced and indexed in SCOPUS or Web of Science abstracts - 0 + **16** pcs in Other databases;
  - unreferenced – **17** pcs;

- Publications in proceedings of scientific - **25** pcs;
  - national - **11** pcs;
  - international - **14** pcs;
- Scientifically popular publications - 0 pcs.

By significance

- Articles in journals with Impact Factor - 0 pcs;
- Articles in journals referenced and indexed in Web of Science and SCOPUS - 9 pcs;
- Articles in journals without Impact Factor - 40 pcs;
- Papers in proceedings of scientific forums - 25 pcs;
- Plenary reports - 0 pcs.

Place of publication:

- Articles in Bulgarian and foreign journals referenced in Web of Science and SCOPUS – 9 pcs;
- Articles in Bulgarian and foreign journals referenced outside the Web of Science and SCOPUS - 23 pcs;
- Articles in non-referenced Bulgarian and foreign journals - 17 pcs;
- Publications in proceedings of international scientific forums - 14 pcs;
- Publications in proceedings of national scientific conferences, sessions and seminars - 11 pcs;
- Publications in scientific annals of universities and institutes - 0 pcs.

Publishing language:

- In Bulgarian - 26 pcs;
- In a foreign language - 48 pcs;

Number of co-authors:

- Stand alone - 13 pcs;
- With one co-author - 29 pcs;
- With two co-authors - 15 pcs;
- With three co-authors - 8 pcs;
- With four co-authors - 9 pcs.

Place in collective publications:

- First of all - 29 pcs;
- Second place - 28 pcs;
- Third place - 4 pcs;
- Next - 0.

In addition to the above publications, 5 another issues are presented, which are not included in Annexes 1 and 2, i.e. they do not carry points for the competition because they are in issues without ISSN and ISBN or are not in the National Referent list.

4.3 Reflection of Candidate's Scientific Publications in Literature (known citations)

- Total - 63 citations.

By type of citations:

- Citations in **journals with Impact Factor** (IF) - **13** pcs. (D12-1 - D12-13);
- Citations in journals referenced and indexed in Web of Science and SCOPUS - 4 pcs. (D12-14 - D12-17);
- Citations in journals referenced in other databases - 8 pcs. (D14-1 - D14-3; D14-7 - D14-10, D14-17);
- Citations in non-refereed journals and conference proceedings - 38 pcs.

In addition to the above citations, 19 additional citations are presented, which are not included in Annexes 1 and 2, i.e. they do not carry points for the competition because they are in issues without ISSN or ISBN.

4.4 Contributions to the candidate's work (scientific, scientific-applied, applied)

All publications from the submitted works of the candidate for review are accepted - 74 pcs.

The main scientific and scientific-applied results of the applicant are related to the creation of dynamic (mechanic - mathematical) models, analysis of obtained results from numerical and real-time experimental studies of machines and equipment, formation of grounded conclusions and recommendations for their practical exploatation.

The scientific-applied and applied contributions of the applicant are grouped in **three directions**:

1. Dynamics, strength and reliability of machines in the forest industry;
2. Dynamics and vibrations of drive units of wind turbines and vehicles;
3. Technical diagnostics.

Scientific contributions

1. A new, deductive way of deriving the second part of Hooke's generalized law is proposed, as well as the dependencies for the deformations in different directions [D8-64]

2. A methodology for vibration diagnostics and monitoring of technical equipment in the forestry industry is proposed [B-3].

Scientific - applied contributions

1. Dynamic models of a woodworking shaper are developed for the study of free and forced torsional vibrations of cutting mechanism [D8-6], [D8-13]; influence of wear of cutting mechanism elements on the accuracy and quality of production [D7-1], [D8-10]; loads of the main shaft's bearings [D8-30]; influence of the number of drive's belts on the operation of the cutting mechanism [D8-34]; free undamped, free damped, and forced spatial vibrations of woodworking shaper with 12 degrees of freedom [G8-8, D8-20, D8-22] and with 18 degrees of freedom [D7-3, D8-18, D8-19].

2. Dynamic models of a circular machine are developed for the study of free undamped, free damped and forced torsional vibrations of the cutting mechanism [D7-2, D8-16, D8-54]; impulse loads arising from cutting [D8-57] and hazardous operating modes [D8-42]; free vibrations of the circular saw by the finite element method [G8-14], the model being supplemented and further developed for testing also the vibrations of a saw with compensating channels [G8-12] and a saw with compensating and noise-reducing channels [G8-11].

3. Dynamic models of veneer machine are developed for the study of torsional vibrations of the drive mechanism [D8-55]; parametric torsional vibrations of the driving mechanism [G8-5]; amplitude-frequency characteristics of the driving mechanism [D8-44].

4. Dynamic models of wind turbine drive unit are developed for the study of torsional vibrations with 10 bodies and 8 degrees of freedom [G8-31, D8-61, D8-62]; torsional vibrations with 10 bodies and 11 degrees of freedom [D7-5, D7-6, D8-28]; spatial vibrations, taking into account the elasticity of the bearings in the multiplier at 11 bodies and 53 degrees of freedom [D8-27]; gear dynamics in the presence of cracked tooth and pitting [G8-7]; parametric torsional vibration from engagement failures [D8-29]; variable external loads [D8-1]; influence of the variable stiffness of the gearing in the extreme high-speed step [D8-45]; influence of some factors on the dynamic processes in the final gear stage [G8-50]

5. Dynamic models of axial fan are developed to investigate its free undamped [D8-24], free damped [D8-25] and forced spatial vibrations [D7-7].

6. A dynamic model of a helicopter is developed to investigate the torsional vibrations of its transmission . This model takes into account the moments of the gas turbine engine and the tail rotor, the elasticity of the transmission and the two cardan shafts [D8-26];

7. Criteria for evaluation of the technical condition and determination of the current workability of woodworking machines are formed [G8-9, D8-41, D8-40].

8. Measures are proposed to improve the methods of vibroacoustic diagnostics of equipment in woodworking and furniture production [G8-40] and of wind turbines [G8-52], as well as to optimize the performance of wind turbines [G8-53].

Applied contributions

1. Theoretically are obtained for a woodworking shaper the natural frequencies and mode shapes of the torsional vibrations of its cutting mechanism [D8-6]; characteristics of the forced torsional vibrations of this mechanism [D8-13]; dependencies on the effect of belt wear on the torsional vibrations of this mechanism [G8-10] and the main factors leading to increased belt wear [G8-43] have been identified; characteristics of free damped vibrations and forced vibration caused by wear of its elements [D7-4]; loads of main shaft's bearings [D8-30]; dependencies on the influence of the number of V-belts on the operation of the cutting mechanism [D8-34]; natural frequencies and mode shapes of free spatial vibrations [D8-23]; characteristics of the forced spatial vibrations from unbalance of the cutting tool [D8-21]; natural frequencies and mode shapes of the free spatial vibrations of the shaper, its spindle and the rotor of its motor [D8-18]; characteristics of the free damped spatial vibrations of the shaper, its spindle and the rotor of its drive motor [D8-19]; characteristics of the forced spatial vibrations from unbalance of the drive motor's rotor [D7-3].

2. Dependencies have been experimentally established for woodworking shapers for the effect of belt wear on the torsional vibration of its cutting mechanism [G8-10] and the factors leading to increased belt wear [G8-43] have been confirmed; effect of the torsional vibration caused by the wear of the machine components on the quality of production [D7-4]; loads of main shaft's bearings [D8-30]; influence of the number of belts on the operation of the cutting mechanism [D8-34]; correlation between major factors influencing the process of milling of solid wood and target functions [D8-33]; intensity of vibrations of the shaper at different

rotational speeds of its shaft [D8-35]; change in the overall vibrations of a woodworking shaper by determining the degree of influence of the individual studied factors [G8-36]; influence of selected factors on cutting power - details of beech (*Fagus sylvatica*) have been investigated and, for comparative analysis, of pine (*Pinus sylvestris*) [G8-37]; effect of cutting speed, feed speed and thickness of milling on the cutting force [D8-39]; sharpening of cutting tools made by TCT and determining the specific consumption of PCD abrasive [D8-38]; sharpening of flat blades with polycrystalline diamond abrasive tools [G7-8].

3. For circular machines are obtained dependencies for the study of maximum deformations of circular shafts [D8-58]; critical angular velocity calculation dependencies [G8-59]; natural frequencies and mode shapes of the torsional vibration of the cutting mechanism [D7-2]; its amplitude-frequency characteristics [D8-17]; natural frequencies and mode shapes of a circular saw obtained with the finite element method [G8-15], as well as results for a saw with compensating slots [G8-12] and with compensating and noise reducing slots [G8-11].

4. For veneer machines are obtained dependence on determining the variable inertia forces of its tool slide [G8-2]; the individual periods of operation of the saw unit with certain characteristics and duration [D8-3]; dependencies for determining the additional dynamic moment on the drive shaft [D8-4]; dependencies for the study of the dynamics and torsional vibrations at faults in the gear profile [G8-46]; diagrams of parametric torsional vibrations [G8-5] and amplitude-frequency characteristics [G8-44].

5. For wind turbine are obtained the equations describing the torsional vibrations [D7-5, D8-61, D8-62]; natural frequencies and mode shapes of its drive train [G7-5, G8-31]; characteristics of vibrations at constant wind and constant rotational speed of the rotor [G7-6], as well as in variable wind with turbulence in the time range [G8-61] and in the frequency range [G8-28, G8-62]; vibrations caused by a defect in the tooth engagement, which are compared with others of a proper tooth engagement [D8-29]; torsional vibrations of the drive train hull in the presence of defects in its elements [G8-7]; characteristics of the torsional vibration such as the contact forces between the gears are time dependent and are represented in Fourier's series [G7-6, G8-28] and at external forces from the wind and the generator [G7-6, G8-61].

6. For axial fans are obtained natural frequencies and mode shapes [D8-24], results of numerical study of free damped [D8-25] and forced spatial vibrations [D7-7].

5. Assessment of the applicant's personal candidate

Submitted reference for the applicant's publications shows his leading role and his main contribution to all presented works. Assoc. Prof. Georgi Vukov is stand alone author of **13** publications. In the collective publications, he is on first place in **29** papers, on second place in **28**, third place in **4** and in the following - **0**.

He is head of 2 research projects and participant in other 8. Four of the presented 6 textbooks on the studied disciplines are written stand alone (as well as 1 learning material). Assoc. Prof. Dr. Georgi Vukov is a presenter of two co-authored textbooks and it is noted in them that they have been compiled under his general editorship.

These data decisively confirm the applicant's personal contribution

6. Critical remarks

1. There is a repetition (or analogy) of certain interpretations, formulas and figures in some of the presented works. Although they relate to studied mechanical systems with different characteristics, it is good to emphasize on the specifics of each of them.

Recommendations:

1. The candidate should emphasize on developing and publishing articles in journals with Impact Factor in his future job.

2. The candidate should participate actively in the preparation and guidance of PhD students for the acquisition of the Doctoral degree at the Faculty of Forest Industry of the University of Forestry if possible.

3. Although it is not an object of this review, I think that the applicant may develop and defend a dissertation for the award of the **Doctor of Science degree** for which he has scientific potential.

7. Personal impressions

I know my colleague Georgi Yordanov Vukov and I have very good direct impressions of his scientific and teaching activity as well as his personal qualities.

I believe he is an erudite, experienced teacher who possesses all the qualities and skills to occupy the academic position "Professor".

8. Conclusion

The requirements of the Law of Development of the Academic Staff in Republic of Bulgaria, the Regulations to it and the normative documents of the University of Forestry regarding both its announcement and the presented materials are complied in this competition.

The research and teaching activity of Assoc. Prof. Georgi Vukov, PhD **is in compliance with the requirements of the Law of Development of the Academic Staff in Republic of Bulgaria, the Regulations to it and the normative documents of the University of Forestry in this field.**

The minimum national requirements for the research and teaching activity of the applicant 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** (Minimum required points by groups of indicators for different academic degrees and academic positions and Number of points achieved by indicators) are fulfilled.

The attached total production of Assoc. Prof. Georgi Vukov, PhD in the competition gives the following presentation, expressed in points:

The attached joint production of Assoc. Prof. Georgi Vutov, PhD in the competition gives the following picture, expressed in points:

Indicator A: Thesis for the award of the Doctorate degree (defensed) - **50 points (required - 50 points)**;

Indicator C: Monograph - **100 points (100 points required)**;

Indicator D: Scientific publications - **802.9 points (required - 200 points)**;

Indicator E: Citations - **262 points (required - 100 points)**.

Indicator F: Participation or leadership in a national scientific or educational project, published university textbook and university learning materials - **340 points (required - 150 points)**.

The total number of points received by the applied production is 1554.9 points (600 points are required). They fulfill and exceed 2.5 times the national minimum requirements for the applicant's research and teaching activity to occupate academic position "Professor" in the field of higher education: 5. Technical Sciences, professional field: 5.13. General engineering.

In connection with the above, I give my positive vote "FOR" and propose Assoc. Prof. Eng. GEORGI YORDANOV VUKOV to be elected "PROFESSOR" in the discipline "Mechanics" in the field of higher education 5. Technical Sciences, professional field 5.13. General Engineering, scientific specialty "Applied Mechanics".

Signature of the reviewer: ....

Corresponding Member of BAS. Prof. DSc. arch. Atanas Dimitrov Kovachev,

Foreign Member of the Russian Academy of Architecture and Construction Sciences

Review submitted to: 10.09.2020