



OPINION

on the materials submitted for participation in a competition for **Associate Professor** in the field of higher education 6. Agricultural Sciences and Veterinary Medicine, Professional field 6.5. Forestry, scientific specialty „Machinery and equipment for the forestry, logging, woodworking and furniture industries” in the discipline “Woodworking machines”

In the competition for a professor, published in the State Gazette issue 102/08.12.2023 and on the site of the University of Forestry with the code WWI-AsP-1123-116 for the needs of the Department of "Woodworking machines" at the Faculty of Forest Industry, as a candidate participate Chief. Assist. Prof. Valentin Atanasov Atanasov, PhD., Faculty of Forest Industry, Department of Woodworking Machines.

Prepared the opinion: Pavlin Bisserov Vitchev, Ph.D., Associate Professor in a Professional Field 6.5. Forestry, from the University of Forestry.

1. Brief biographical data for the candidate

Chief Assist. Prof. Valentin Atanasov Atanasov, PhD, was born in 1981. In 2008, he graduated from the University of Forestry, majoring in "Woodworking and furniture production", OCS "bachelor", and in 2009, the same specialty, optional module "Furniture production", OCS "master". In 2014, he defended his PhD thesis on the topic "Research of the operational indicators of mobile horizontal platforms", with which he obtained the ONS "doctor". In 2017, he obtained a second master's degree in "Computer Design and Technologies in Mechanical Engineering" at TU-Sofia. In 2014, after successfully passing a competition, he started working at the Forestry University as an assistant at the "Woodworking Machines" department, where in 2016 he acquired AD "chief assistant" and works in the same department to this day. From 2019 Chief Assist. Prof. Valentin Atanasov, PhD also works as a part-time teacher at the Department of Mechanical Engineering and Metal Cutting Machines. In the period of his academic biography Chief Assist. Prof. Valentin Atanasov, PhD, worked and developed his teaching and scientific activities in the field of the current competition for associate professor. Conducts classes with students from the "Wood and Furniture Technology" majors, OCS "Bachelor" in the "Woodworking Machines" discipline, and OCS "Master" in the "Design and Testing of Woodworking Machines" discipline, and to students from the "Engineering Design" major, OKS "bachelor" discipline "Machines for the production of furniture and furnishings". In order to increase his qualification Chief Assist. Prof. Valentin Atanasov, PhD took part in five international courses and trainings within the framework of the COST program. He is fluent in English and Italian and has good digital, communication and presentation skills.

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 documents and materials submitted by the candidate Chief Assist. Prof. Valentin Atanasov Atanasov, PhD for participation in the announced competition for obtaining the academic position of "Associate Professor" fully meet the requirements of Art. 65, para. 1 of the Regulations for the Development of Academic Staff in a University of Forestry, as well as Art. 29 of the Law on the Development of the Academic Staff in the Republic of Bulgaria.

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

From 2014 until now Chief Assist. Prof. Valentin Atanasov, PhD, is a lecturer at the Woodworking Machines Department of the Forestry University, having successively held the positions of: assistant (2014÷2016); chief assistant (2016 to present). As a teacher at the same department, he gives lectures and leads practicals in the disciplines: "Woodworking machines", "Furniture and furniture production machines", "Design and testing of woodworking machines", "Operation and maintenance of woodworking machines", "Pressing machines and surface treatment" and "Computer simulation modeling".

Chief Assist. Prof. Valentin Atanasov, PhD is the author of the of six updated study programs in the disciplines:

- "Woodworking machines", curriculum code: WWI 419, specialty "Wood and furniture technology", OCS "bachelor", full-time and part-time studies;

- "Machines for the production of furniture and furnishings", curriculum code: WW1424, specialty "Engineering Design", OCS "bachelor", full-time education;

- "Design and testing of woodworking machines", curriculum code: WWI414, specialty "Wood and furniture technology", OCS "master", optional module DMS, regular and part-time education;

- "Operation and maintenance of woodworking machines", curriculum code: WW1403, specialty "Wood and furniture technology", OCS "master", optional module DMS, regular and part-time education;

- "Machines for press and surface treatment", curriculum code: WW1411, specialty "Wood and furniture technology", OCS "master", optional module DMS, full-time and part-time education;

- "Computer simulation modelling", curriculum code: WW1405, specialty "Computer technologies in the furniture industry", OCS "bachelor", full-time study, co-authored with Assoc. Prof. Neli Staneva, PhD.

During his years as a teacher at the "Woodworking Machines" department Chief Assist. Prof. Valentin Atanasov, PhD fulfilled his academic and extracurricular workload. For the period from 2017 to 2022 Dr. Valentin Atanasov is the supervisor of 3 graduated students successfully defended their theses and was a reviewer of 4 diploma theses.

Based on the above, I strongly believe that the pedagogical and teaching activities of Chief Assist. Prof. Valentin Atanasov, PhD are at a high level and fully correspond to the academic position of "Associate Professor". Chief Assist. Prof. Valentin Atanasov, PhD is a respected lecturer by the students and the academic community alike, devoted to his work with students.

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

General description of the presented materials

Candidate Chief Assist. Prof. Valentin Atanasov, PhD participated in the competition with the following scientific and scientific-applied production, as follows:

- Monograph – 1 number;
- Publications – 33 numbers;
- Projects – 9 numbers.

All publications are published in recognized prestigious international scientific journals and peer-reviewed collective scientific volumes. The total score of the candidate Chief Assist. Prof. Valentin Atanasov, PhD is 708, which exceeds the required score of 400 points for the academic position “Associate Professor”, according to the presented report under Art. 2a, para. 2 of the National Minimum Requirements (NMI).

4.1 Participation in scientific, scientific-applied and educational projects

Chief Assist. Prof. Valentin Atanasov, PhD has participated in total of 9 scientific, scientific-applied and educational projects distributed as follows:

- scientific projects, financed by the University of Forestry, in accordance with Decree 9 – 2 projects as a member of the scientific team;
- scientific-applied projects – 7 numbers, for 5 of which, he was a project leader.

4.2 Characterization of published scientific results

The publications presented by Chief Assist. Prof. Valentin Atanasov, PhD for participation in the current competition for the academic position of "Associate Professor" can be classified as follows:

By type:

- Monographs – 1 number;
- Publications in scientific journals – 12 numbers;
- Publications in collections of scientific forums – 21 numbers.

By significance:

- Articles in journals with Impact Factor (IF) – 1 number;
- Articles in journals referenced and indexed in Web of Science and SCOPUS – 14 numbers;
- Articles in journals not referenced and indexed in Web of Science and SCOPUS Web of Science и SCOPUS – 18 numbers;

Publishing language:

- In Bulgarian – 1 number;
- In a foreign language – 33 numbers.

Number of co-authors:

- Stand alone – 4 numbers;
- With one co-author – 9 number.;
- With two co-authors – 9 numbers;
- With three or more co-authors – 12 numbers.

I am a co-author in 11 publications, therefore, I am not providing my evaluation of this publications.

For collective publications, there are no protocols presented for the individual participation in the development of each of the authors, so I assume that it is equal.

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

Chief. Assist. Prof. Valentin Atanasov presented a **total of 27** known citations.

By type of citations:

- In scientific publications with IF or impact rank – 13 numbers.;
- In peer-reviewed monographs and collective scientific volumes – 3 numbers.;
- In non-referred peer-reviewed journals– 11 numbers.

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

The scientific work of the candidate Chief Assist. Prof. Valentin Atanasov, PhD contributed in solving theoretical and practical problems, related to woodworking cutting machines and are in the following directions: 1) research on the power-energetic indicators of milling machines, which can be implemented in the design of the machine's main mechanisms; 2) kinematics of the milling process and kinematic design of cutting and feeding mechanisms of milling and longitudinal milling machines; 3) dynamic behaviour of milling machines; 4) research of some operational indicators in order to improve the construction parameters of other wood-working machines.

His contributions and can be summarized as follows:

1. Scientific contributions:

1.1. A methodology for research and analysis of the cutting power during processing of medium-density fibreboard and plywood from various wood types, used widely in the wood-working industry: oak (*Quercus petraea*), beech (*Fagus sylvatica L.*), Scots pine (*Pinus sylvestris L.*), walnut (*Juglans regia*), spruce (*Picea abies*), meranti (*Shorea leprosula*), koto (*Pterygota macrocarpa*), has been adopted. Regression equations, that can be applied in determination of the cutting power of milling and longitudinal milling machines, have been derived.

1.2. The factors, leading to a different size of the forces for the individual cutting edges of the teeth of the tool when processing wood with a universal milling cutter have been investigated. A substantiated hypothesis is proposed for their determination under real operating conditions of the machines.

1.3. The range of speed variations of the working movements of longitudinal plane milling machines, depending on the quality of the processed wood material: Scots pine (*Pinus sylvestris L.*), beech (*Fagus sylvatica L.*) and meranti (*Shorea leprosula*) have been determined.

1.4. A detailed solution of a statically indeterminate problem of spring mechanism tension in bandsaw blade sections has been presented. The following points have been thoroughly analysed, among others: the concentration of distributed loads, the subcritical friction, the solution of the main integral, the application of L'Hôpital's rule etc.

2. Scientific-applied contributions:

2.1. The required cutting forces and power for processing materials from different wood types have been determined. Based on the experimental results, graphical dependences,

showing the influence of the examined factors: cutting speed, feed speed and processed surface area, have been derived.

2.2. A methodology has been proposed, according which when setting up the power of the cutting and feeding mechanisms of universal milling and longitudinal milling machines, the power consumption by an electric motor during idle is 30%.

2.3. It has been established that, by considering the activity coefficients of the mechanical gears, the power, necessary to drive the main parts of the machines can be determined. The obtained cutting forces are applicable in strength and deformation dimensioning of milling elements.

2.4. The influence of the cutting shaft knives construction in longitudinal milling machines has been determined. The experimental results show that the knife shafts with replaceable carbide plates (helical cutterhead), allow a higher feed speed and therefore, higher productivity of the machine by 20-30%.

2.5. On the basis of a mechano-mathematical model and numerical analysis, a systematized methodology for determination of the forced spatial oscillation, generated by a universal milling machine and its spindle, due to an imbalance of the cutting tool as well as by the actual cutting forces, has been proposed. This methodology can also be applied to investigate the free spatial oscillations.

3. Applied practical contributions:

3.1. The optimal working conditions, with regards to the power-energetic parameters of universal milling machine have been defined. It was determined that, when compared to the cutting power, the feed speed may reach $15 \text{ m}\cdot\text{min}^{-1}$, even when solid wood types had been processed. A methodology has been developed to optimise the design process, both by applying fundamental methods as well as modern CAD/CAE systems, to calculate the force, power, strength and deformation of basic elements and assemblies of milling machines.

3.2. It has been determined that when processing tropical wood species or those with greater density, it is advisable to use machines with knife shafts with replaceable carbide plates (helical cutterhead)/ knife shafts with replaceable plates, arranged along a helical curve and a lower frequency of rotation.

3.1. Based on a large number of experiments, it has been concluded that the surface roughness (R_z) rarely exceeds $50 \mu\text{m}$, even at feed speed of $15 \text{ m}\cdot\text{min}^{-1}$. This means that in order to achieve higher productivity of the machines, this value may be exceeded but not above $20 \text{ m}\cdot\text{min}^{-1}$ for universal milling machines and reamers, and not above $25 \text{ m}\cdot\text{min}^{-1}$ for milling machine. The lower feed speed limit for all milling machines should begin at $5 \text{ m}\cdot\text{min}^{-1}$, since below this speed, the differences in roughness values are minimal and in addition, the motor operates in a non-standard mode, that results in decrease of the productivity of the machine.

3.2. The natural frequencies and forms of the free spatial vibrations, generated by the wood-working milling machine and its shaft have been numerically analysed. This analysis allows to give recommendations for changing the construction of the machines, in order to avoid working modes, creating vibrations. This, on the other hand increases the processing reliability and quality.

3.3. The spatial oscillations, generated by the disbalance of the cutting tool have been numerically analysed, in order to increase the processing reliability and quality.

3.4. It has been experimentally determined that during milling of wood-based materials – medium-density fibreboards and plywood, the greatest influence on the dynamic behaviour of the machine (vibration speed) has the processed area, followed by the feed speed.

3.5. The influence of the main factors, detrimental for the milling process, such as feed speed and processed area, on the accuracy of the operation of a milling machine, depending on the magnitude of the mechanical vibrations of its spindle, has been evaluated. Recommendations for selection of technological factors, when processing wood specimens from koto (*Pterygota macrocarpa*) and oak (*Quercus petraea*), as well as wood-based materials – medium-density fibreboards and plywood, have been formulated.

3.6. It was determined that during processing of Scots pine (*Pinus sylvestris L.*) wood with universal milling machine, when accounting for the magnitude of the total spindle's vibrations, the optimal cutting speed should be in the range of $40\div 45 \text{ m}\cdot\text{s}^{-1}$, the feed speed - up to $5 \text{ m}\cdot\text{min}^{-1}$, and the cut-out layer – up to 8 mm.

3.7. It was determined that the universal milling machines generated higher vibrational speed values, in particular at the upper spindle bearings. The performed experiments have shown that the vibrations were greatly influenced by the cutting speed, followed by the feed speed and the cut-out layer.

3.8. It was determined that no force in the direction of feed should be applied when checking the beating of the band saw blade. This would lead to significant displacement, especially during longer operation of the bearings and would not allow proper reading of the axial run-out of the band saw blade.

3.9. The influence of the feed speed on the roughness of the surface area and on the machining accuracy of circular saw machine for logs has been experimentally determined. The results can be used to optimise the range of variations of the feed speed, which is the main parameter, related to the productivity of the circular saw machines.

3.10. The influence of the number of V-belts on the performance of the cutting mechanism of a universal milling machine at idle and in operation modes has been determined. It was found that by increasing the diameters of the belt pulleys, the number of belts as well as their cross-section can be reduced. The pre-stressing tensile forces were also reduced, which is beneficial for the bearings. As a result, this improves the working performance of the cutting mechanism, decreases vibrations, improves the roughness of the surface area, enhances the reliability and safety at work.

3.11. The changes in the sound pressure level of circular sawmill with carriage, depending on the type and thickness of the wood – Scots pine (*Pinus Sylvestris L.*) and beech (*Fagus Silvatica L.*), on the rotational speed of the spindle and on the cutting tool overhang have been determined. Based on the obtained results, graphical dependences between the studied parameters and the changes in the sound pressure levels have been derived. The results show that the noise levels are higher during processing of wood specimens from Scots pine, compared to the wood specimens from beech. The difference is about 2 dB(A) at different working modes. The parameter, that influences the most the sound pressure level is the rotational speed of the spindle.

3.12. A construction of belt sander mechanism with fixed belt support has been developed. The mechanism can be made in non-specialised mechanical repair shops or workshops and has a low cost.

5. Assessment of the applicant's personal candidate

It is worth noting that the presented scientific papers are published in English in internationally recognised journals, a majority of which referred in internationally recognised data basis. This is regarded as a recognition of the scientific contribution of the candidate Valentin Atanasov, PhD.

I consider that the scientific achievements of the candidate Chief Assist. Prof. Valentin Atanasov, PhD, as reflected in the submitted materials for participation in the competition are the result of his personal work or with his active participation and/or his leadership.

6. Critical remarks

The materials, presented by Chief Assist. Prof. Valentin Atanasov, PhD, for participation in the competition for the academic position "Associate Professor" are well classified and structured, according to the requirements. No errors and inaccuracies in terms of methodologies and analysis of results were found. All scientific works of the candidate are correctly structured in terms of theoretical introduction, methodology, interpretation and analysis of the obtained results and with correct indication of the literature used.

I would like to draw the attention of the candidate, to the way of how the contributions of his scientific work have been formulated and presented. I believe that they could have been formulated and presented in a better and more robust way. Some of the formulated contributions sound more like part of conclusions of an experimental study. I regard this as a result of the candidate's willingness to present in a detailed and exhaustive manner the results of his theoretical and experimental work.

I strongly urge Chief Assist. Prof. Atanasov to continue sharing the experience gained in his work with students, PhD students and the academic community both in Bulgaria and abroad.

7. Personal impressions

I have known Chief Assist. Prof. Valentin Atanasov, PhD, since his enrolment as a PhD student at the department of "Woodworking machines". Already then, he stood out with his diligence and responsibility in the implementation of various scientific tasks. Latter, during the years he has established as a teacher and specialist in the field of the woodworking machines, respected by students and by the academic community. As a result of his scientific contribution in prestigious scientific articles and participation in international scientific fora, Chief Assist. Prof. Atanasov is recognised in the international scientific circles in the field of wood and wood-based materials processing technologies and machines.

8. Conclusion

In connection with the above, I propose that Chief. Assist. Prof. Valentin Atanasov Atanasov be elected as an "Associate Professor" in the discipline "Woodworking Machines" in the Professional field 6.5. Forestry, scientific specialty, scientific specialty "Machinery and equipment for the forestry, logging, woodworking and furniture industries".

Prepared the opinion: _____

/Assoc. Prof. Pavlin Vitchev, PhD/

Opinion delivered to: