

REVIEW

to occupy the academic position:

"Professor"	X
"Associate Professor"	
	one of the academic positions indicated shall be marked with the sign "X"

Candidates to occupy the position:

1	Ass.Professor	PhD	Valentin	Raynov	Slavov	UCTM
№	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5	Technical Sciences
code	Name

Professional area:

5.1	Mechanical Engineering
code	Name

Scientific specialty:

Applied Mechanics

The competition has been announced:

67	04.08.2023	Applied Mechanics	Metallurgy
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

Professor	DSc	Kliment	Blagoev	Hadjov	UCTM
academic position	scientific degree	name	middle name	last name	workplace

1. Review for the candidate:

Ass.Professor	PhD	Valentin	Raynov	Slavov
academic position	scientific degree	name	middle name	last name

1.1. Completion of the provided documents:

A) The competition documents are in full compliance with the Regulations	3 points	X
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B) The documents are complete but do not fully comply with the requirements of the Regulations	2 points	
C) The documents are not completed in accordance with the requirements of the Regulations	0 points	
		one of the answers given is marked with the sign "X"

Missing documents and violated requirements must be described if response C is marked.

1.2. Meeting the minimum requirements under the Regulations:

A) The candidate meets the minimum requirements	20 points	X
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.

The candidate falls short of 18% to cover the requirement of NACID under indicator 3 for a minimum of 10 publications in journals that are referenced and indexed in the global database. According to the requirements, he presents the Habilitation work: Slavov, V. Application of the matrix methods for research in the 3D space of the kinematics, dynamics and oscillations of machines represented as multi-mass mechanical systems. Avangard Prima, Sofia, 2023, ISBN 978-619-239-911-5, 157 pages.

The habilitation work, in my opinion, is sufficient to cover the requirements for a professorship.

1.3. Relevance of scientific and / or applied research:

A) The research is relevant. Part of the research is pioneering (no results are known on the topic by other authors)	7 points	
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	5 points	
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	3 points	X
D) The smaller part of the research is relevant	2 points	
E) Research is not relevant	0 points	

		one of the answers given is marked with the sign "X"
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The evaluation of the relevance of the research must be substantiated.
<p>Research concerning the kinematics, dynamics and oscillations of machines and structures, presented as multi-mass mechanical systems or as mechanical systems with distributed parameters, are always relevant. The objects of research are: transport machines, woodworking machines, agricultural machines, road construction machines, robots, fans, sewing machines, mechanical modules and separate structures - railway locomotives and woodworking tools.</p> <p>The problems to be solved are important and are related to the adverse impact of vibrations on the human organism and machine structures.</p> <p>The relevance of the candidate's research can be further argued and commented with the help of the following facts: There are 16 citations after the doctorate (PhD) in specialized publications, of which 9 are in refereed publications. There are 52 publications for the relevant period, of which 6 are in refereed editions. This number should increase.</p>

1.4. Knowledge of the problems subject of research:

A) The candidate knows in detail the achievements of other authors on the researched topics and/or applications	6 points	
B) The candidate is partially familiar with the achieved results on the researched topics and / or applications	4 points	X
C) The candidate has no prior knowledge of the status of the researched problems	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.

1.5. Type of research:

A) Theoretical	4 points	
B) Applied	4 points	X
C) Theoretical with application elements	4 points	

D) It does not correspond to the level specified in the Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations	0 points	
		one of the answers given is marked with the sign "X"

The level of research must be substantiated if answer D is marked.
Matrix approaches in mechanics enable easy transition to programming and this makes them useful for practicing engineers. Simultaneously, these approaches raise the level of the research.

1.6. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	X
B) Realistic, but not of scientific and / or applied interest	4 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with the sign "X"

Objectives must be specified. The type of the set objectives must be justified.
Research goals are mechano-mathematical modeling in 3D space and development of formulas and algorithms for analysis and synthesis, which are used in the design and research of machines and other structures. The geometrical, mass, inertial, elastic, damping and force characteristics of the mechanical systems are reported. The goals thus set are of scientific and markedly applied interest

1.7. Methods of research:

A) Adequate to research and set scientific objectives and /or applications	8 points	
B) Partially appropriate, enabling part of the scientific objectives and / or applications to be achieved	4 points	X
C) Inappropriate methods	0 points	
		one of the answers given is marked with the sign "X"

Methods must be specified. The type of methods used is justified.

Thematically, the research is structured in two main directions depending on the approach in creating the dynamic model:

1. Studies of the kinematics, dynamics and oscillations of machines represented as multi-mass mechanical systems. In these studies, a discrete dynamic model was created, in which it is assumed that the bodies of the executive mechanism are perfectly rigid and possess mass and inertial characteristics, and the relationships between them are elastic and massless. This is justified when the elasticity coefficients of the bodies are several orders of magnitude greater than those of the links. This approach was used in view of both the practical requirements and the trade-off between achievable accuracy and computational complexity.
2. Studies of oscillations of structures represented as mechanical systems with distributed parameters. Such study of various types of structures are based on the use of modern CAD-CAE computer programs for 3D design and engineering studies. The main advantage of these computer programs is the presence of a second program core for simulation study of the developed models. At the basis of these studies, calculation using the finite element method (FEM) is included. It provides reliable numerical algorithms for the analysis of engineering structures. 3D (volumetric) finite elements (FEM) were used for static, kinematic, dynamic and frequency engineering analyses. The methods used to achieve the set goals are adequate for achieving a large part of them in a scientific aspect and fully suitable for their practical application.

1.8. Candidate research contributions:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	
C) They are of scientific and / or applied interest	12 points	X
D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.

The contributions of the candidate Assoc. Prof. Slavov are:

Scientific and applied

1. Original dynamic models for the study of multi-mass mechanical systems have been created

2. Mechano-mathematical modeling in the 3D space of the oscillations of mechanical systems was carried out, taking into account almost all their characteristics.
3. Algorithms for calculation with a computer and a mathematical software product have been compiled.
4. A methodology has been developed and modeling in 3D space with finite elements of vibroacoustics of various structures with consideration of the geometric shape for various types of materials has been implemented.

Applied Contributions

1. The geometric, mass, inertial and elastic characteristics of mechanical systems with specific parameters are determined.
2. The eigenfrequencies and eigenforms for small oscillations of mechanical systems with specific parameters have been determined.
3. The characteristics of the damping elements are defined for specific mechanical systems. Numerical calculations of the spatial free damped oscillations of the same mechanical systems have been performed.
4. For specific mechanical systems, generalized disturbing forces are defined. Numerical calculations of spatial forced oscillations of the same mechanical systems have been performed.
5. For specific constructions and specific materials of the details and assemblies, the vibroacoustic parameters were obtained.

The research results can be grouped as follows:

1. Results obtained in the study of the kinematics of machines represented as multimass mechanical systems. They represent the main kinematic characteristics: position vectors; vectors of linear velocities and accelerations of characteristic points of the bodies of the mechanical system; vectors of angular velocities and accelerations of bodies from the mechanical system. They are used to study the dynamics and oscillations of mechanical systems. Received in symbolic form, which provides the opportunity to study a whole class of machines.
2. Results obtained during the study of the dynamics and free undamped oscillations of machines presented as multimass mechanical systems. The natural frequencies and natural forms of the oscillations are obtained. Defined the resonance zones that must be avoided when operating the machines. The optimal elasticity coefficients are determined.
3. Results obtained in the study of the free damped oscillations of machines represented as multi-mass mechanical systems. The damping coefficients are determined. After solving the differential equations with specific parameters, an assessment was made according to the "minimum damping time" criterion and the optimal damping coefficients were selected.
4. Results obtained during the study of the forced oscillations of machines represented as multi-mass mechanical systems. The amplitudes of the forced oscillations were obtained. After solving with specific parameters the differential equations for such mechanical systems, an assessment of the impact of oscillations on the human organism and the construction of the corresponding machine was made.
5. Results obtained during the study of the oscillations of structures presented as mechanical systems with distributed parameters. The results of these studies are stresses, strains, natural

frequencies and natural shapes. The first six obtained natural frequencies were evaluated. These are the natural frequencies that are likely to coincide with the frequencies of the forced oscillations and cause resonance to occur.

Algorithms for calculation with a computer and a mathematical software product have been compiled for all the results listed up to this point.

1.9. Participation of the candidate in the achievement of the presented results:

A) The candidate has at least an equal participation in the submitted papers	8 points	
B) The candidate has at least an equal participation in most of the submitted papers	7 points	X
C) The candidate has a secondary participation in most of the submitted papers	4 points	
D) The candidate participation is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items C or D is marked.

1.10. Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at high professional level.	8 points	X
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	
C) The pedagogical activity and / or textbooks issued are insufficient (do not meet the requirements of the Regulations)	0 points	
		one of the answers given is marked with the sign "X"

Pedagogical activity must be provided if the item C is marked.

He has written one textbook, two exercise books and three study notes. One monograph has been published, which has an educational and scientific character. The monograph contains

157 pages and impresses with its content and specific topics. Developed formulas and algorithms for analysis and synthesis are proposed, which are applicable in the design and research of various types of machines. He supervised four doctoral students who successfully defended their dissertations. Here is the place to note the good knowledge of the German language and the various courses read by Assoc.Prof. Slavov in the German specialty of UCTM.

1.11. Critical notes:

A) Lack of critical notes	8 points	
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved in a small part of the research	5 points	X
D) Critical notes that would partially improve the results achieved in most of the research	3 points	
E) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C, D or E is marked.

Here I will allow myself to make some comments which, in my opinion, would improve the results of such studies. Regarding the damping properties, more sophisticated models of viscoelastic behavior such as hereditary theories could be used. In some cases, large deformations and the associated deterioration (damage) of the materials over time could also be considered.


I would recommend colleague Slavov to publish more often in journals referenced in the world database.

1.12. Conclusion

A) The evaluation of the candidate's activity is POSITIVE	This evaluation is assigned to a total number of at least 65 points	X
B) The evaluation of the candidate's activity is NEGATIVE	This evaluation is assigned to a total number below 65 points	
		one of the answers given is marked with the sign "X"

To be filled in if requested by the reviewer

The points collected by the candidate are 78. From the examinations made and everything I have said so far, my opinion of Assoc. Professor Dr. Valentin Slavov is very good and I strongly recommend to my colleagues from the jury to award him the requested academic position "PROFESSOR".

17 .11.23	The review was written by: Prof.DSc. Kliment Hadjov	 (Prof.D.Sc. Kliment Hadjov)
Date		signature