

REVIEW

in competition for the academic position "Professor"
in professional field 5.2. Electrical Engineering, Electronics and Automatics,
specialty "Automated Information Processing and Control Systems"
announced in State Gazette No. 103 of 12.12.2023 for the needs of the section
"Distributed Information and Control Systems",
with the only candidate Assoc. Prof. eng. Nikolay Stoimenov, Ph.D.

Reviewer: Prof. Lubomir Vankov Dimitrov, Ph.D.
Technical University of Sofia.

Reason for the Review: Order of the Director of ICT-BAS No 42/09.02.2024 г.

1. General applications and bibliographical data.

Assoc. Prof. eng. Nikolay Stoimenov, Ph.D. was born on 23.07.1988. He graduated from the Department of "Automation of Discrete Production", Master's degree at the Technical University - Sofia, in 2013, and was awarded a "Diploma for achieving excellent grades". In 2016 he successfully obtained his Ph.D. thesis at the "Institute of Information and Communication Technologies" at the Bulgarian Academy of Sciences (ICT-BAS). Since 2012 he has been working at ICT-BAS, and since 2017 he has been appointed as a Senior Assistant Professor at the same institute. In 2020 he acquired the academic position of Associate Professor at ICT-BAS. From August 2021 until now he has been Head of Department at ICT-BAS, and from November 2021 until now he has been Deputy Director at the same institute.

The candidate has submitted a total of 57 scientific papers for review, including 56 publications and 1 chapter of a monograph. He has presented participation in a total of 6 scientific research projects, of which as a participant in 3 projects, in the other 3 he is a team lead. He has also submitted funding for research projects, one of which was with another leading organization, and Assoc. Prof. Stoimenov, Ph.D. is a team leader on the part of ICT-BAS. He has submitted one patent and two utility models. I accept for review all submitted scientific papers, patents and research projects, which can be divided into the following groups:

- 36 publications in indexed and refereed journals in world-renowned databases of scientific information;
- 1 published chapter of a collective monograph, which is not presented as a major habilitation work;
- 20 scientific publications in non-refereed peer-reviewed journals or edited collective volumes;
- 1 patent;
- 2 useful models;
- 6 scientific research projects.

According to the author's place in published scientific works:

- 1st place - 14 pieces;
- 2nd place - 19 pieces;

- 3rd place - 12 pieces;
- 4th place - 6 pieces;
- 5th place - 3 pieces;
- 6th place - 2 pieces.

Large parts of the accepted papers for review are focused in the field of the competition specialty. Assoc. Prof. Nikolay Stoimenov Ph.D. has 49 publications in the Scopus database and h-index 6, not taking into account self-citations in the database.

From the reference made it is clearly seen that the national minimum requirements, including the minimum requirements of the IICT for the academic position of Professor, have been exceeded.

In the table attached by the applicant, it can be seen that the national minimum requirements for all criteria have been exceeded, with an over 110% overachievement.

Table 1. Requirements for professor and indicators of Assoc. Prof. Nikolay Stoimenov, Ph.D.

Criterion	National requirements	Requirements of IICT	Number of points of the candidate
A	50	50	50
B	100	100	290
Г	200	220	365,3
Д	100	120	414
E	150	150	243,6
Total	600	640	1362,9

2. General characteristics of the candidate's scientific research, scientific- applied and pedagogical activities.

A large part of the candidate's scientific research and applied activities are focused on issues and specific tasks in the field of the announced competition. The candidate shows knowledge in the field of motion processes and behaviour of grinding bodies and media, subsequent factors influencing in the processes such as durability of 3D printed materials including composites, he is also familiar with 3D Simulation modelling, scanning and printing.

The candidate has obtained his Ph.D. thesis in 2013 in the scientific field 5.2. Electrical engineering, electronics and automation, scientific specialty "Automated systems for information processing and control" on the topic "**Study of movement and interaction of different shape bodies**" at the "Institute of Information and Communication Technologies" at the Bulgarian Academy of Sciences, and in 2020 holds the academic position of "Associate Professor" at IICT-BAS.

A check on the website of IICT-BAS shows that currently Assoc. Prof. N. Stoimenov, Ph.D. is a supervisor of one part-time and one full-time Ph.D. student at IICT-BAS in the specialty "Automated Information Processing and Control Systems".

The scientific works presented in the competition for the academic position of "Professor" show a profound development of the problems presented in the dissertation and the works submitted for the academic position of "Associate Professor".

The problems on which Assoc. Prof. Nikolay Stoimenov are relevant for the industry both globally and in our country. Under the competition, he has submitted participation in 6 scientific research projects, 3 of which he is the supervisor. He is known in scientific communities as a respected and highly qualified specialist in the field, actively working, as a clear confirmation of this is his research and implementation activities, having attached a list of the competition procedure of 13 works with 37 citations (total 370 points), and a reference in Scopus shows over 70 independent citations.

3. Main scientific, scientific and applied contributions.

The main scientific and applied contributions contained in the candidate's scientific works concern the motion processes and behavior of grinding bodies and media, wear resistance of 3D printed materials and 3D simulation modeling, scanning and printing.

The applied and scientific contributions contained in the candidate's scientific works can be attributed to the following groups:

- Determined the volume required to fill in a 2D laboratory ball mill. Critical speeds of a laboratory ball mill with different types of 3D printed grinding media and materials were investigated. The parameters required to achieve the operating modes of the laboratory ball mill were determined.
- The operating modes of a laboratory ball mill and the behavior of grinding bodies with different types of 3D printed materials were investigated.
- A comparative analysis of theoretical and experimental determination of critical speeds in a laboratory ball mill with different types of 3D printed materials of a laboratory ball mill with grinding bodies is made. The critical speeds of grinding bodies of different types of materials are experimentally determined.
- A methodology for determining factors such as critical speed, separation angle and angle of incidence in laboratory ball mills using a high speed chamber is proposed.
- The separation angles from the grinding media (lifters) of the grinding bodies with different types of materials including composite as well as the angle of incidence were determined. A difference in the studies based on the material characteristics was reported.
- The influence of rolling coefficient in different types of material pairs was investigated.
- An experimental method has been developed to determine gaps between grinding bodies in mills. The gaps between different sizes of grinding bodies were investigated and determined.
- The parameters of an experimental study on the wear of polymer composites are determined. Mass wear was measured and wear characteristics, wear intensity and wear resistance were calculated.
- Five types of materials were tested in four friction regimes: dry friction with sliding speed and friction with grease lubrication. The results of the tests obtained are presented in tabular and graphical form for the wear characteristics of each of the materials tested. Wear rate, wear intensity and wear resistance were calculated.

- Results and graphical relationships for mass wear, wear rate, wear intensity and wear resistance of each material under the four friction regimes were obtained. The results of abrasive wear resistance of materials under dry and boundary friction at the same sliding speed are compared. From the four abrasive friction regimes of all tested materials, the best antiwear properties of the materials were determined.
- It was found that the influence of the presence of lubricant and the magnitude of the sliding speed has a different character on the obtained dependencies and absolute values of the wear parameters for the different materials.
- It was found that PETG polymer materials have the best antiwear properties. The Carbonfil™ composite material was found to have the best antiwear properties among the polymer composite materials studied.
- 3D models of a laboratory ball mill and different types of grinding media and grinding bodies with preset characteristics, depending on the type of material, were developed.
- Parameters such as diameter, density, volume and number of grinding bodies required to create a simulation model were determined. The influence of recovery coefficients, friction and rolling friction in simulation models is reported.
- A 3D simulation model of a laboratory ball mill has been developed, allowing rapid reconfiguration of dimensions, grinding media, grinding bodies and properties of the materials used.
- Through 3D simulation modelling, critical laboratory ball mill speeds and operating modes were determined, the need for accurate determination of material characteristics was considered. A comparative analysis of theoretical and experimental data for laboratory mill speeds is made.
- In a 3D simulation environment, separation angles from the laboratory mill arm were determined.
- A scanning methodology for 3D printed lifters aimed at determining 3D printing accuracy and wear after operating in an aggressive environment is proposed. By using 3D technologies (3D modeling and 3D printing), a bench was developed to determine gaps at different sizes of grinding bodies.
- A drum of a laboratory ball mill in 2D mode (single row of grinding bodies) was constructed by 3D modeling and 3D printing, allowing the use of different types of grinding media. Transparent covers were used to allow monitoring of the movement and behaviour of grinding bodies and determination of operating modes, reporting of separation angles and angles of incidence.
- Different types of grinding media have been constructed, including an innovative one (lifters) by 3D modelling and 3D printing, allowing rapid loading with grinding bodies, including the possibility of automated loading.
- A 3D model of a high energy mill for mechanical alloying has been developed. A 3D simulation model of the motion of the mechanical alloying process in a high energy mill has been developed. The particle behaviour of a high energy mill for mechanical alloying of copper, boron and zinc was investigated.

The contributions are in the area of competition. They are formulated on the basis of what the author has done and faithfully reflect what has been achieved. The plan for future work of the candidate makes a good impression.

I accept the contributions presented in the applicant's report and assess them favourably.

4. Significance of contributions to science and practice.

The significance of the contributions in the scientific works of the candidate Assoc. Prof. Stoimenov, Ph.D. is expressed in the enrichment of the fundamental research and practice in the field of emerging processes in grinding bodies and media by applying methods and means for determining factors and parameters aimed at increasing energy efficiency and productivity. Proof of the practical orientation is the award given by the Eureka Foundation to Assoc. Prof. Nikolay Stoimenov, Ph.D. in 2020 "Diploma and commemorative statuette, "Winner of the EURICA YOUNG INVESTIGATOR Award 2019"". In this field, the candidate has received recognition not only in Bulgaria, but also abroad, as confirmed by citations in SCOPUS. Assoc. Prof. Stoimenov Ph.D. shows experience of working with modern methods and tools for research, design and creation of solutions in various fields in industry. From a social point of view, there are also developments in the field of art and heritage preservation through research and development to present information in an innovative way to disadvantaged people. His involvement as a youth project leader at the NSF, his leadership of projects at the NSF, and his participation in NSP and OP-NOIR projects demonstrates the importance of developing research contributions and published research papers.

The assessed works are applicable in practice.

5. Critical remarks.

I found no fundamental inaccuracies or errors in the research papers. Some omissions, incompletenesses, deficiencies, etc., are more typical:

- The scientific and applied contributions in some publications are not clearly revealed.
- In the enclosed self-report of contributions, these are presented in a generalized form, with insufficient attention paid to the verification of simulation modeling against experimental results and the efforts made to calibrate simulation models. By increasing the accuracy of simulation modelling, taking into account the experimental studies carried out on key parameters, this type of research would lead to a reduction in production costs and an increase in energy efficiency.
- I recommend in the future a greater number of self-publications in SCOPUS refereed journals and intellectual property protection.

6. Personal impressions.

I have known the candidate personally since he was a student. In my position as Dean of the Faculty of Mechanical Engineering, in 2014, I awarded him with a "Diploma for excellent academic performance" from the Technical University - Sofia, Bulgaria. I have followed his growth as a researcher and have personal impressions of his competence. He is a precise and thorough researcher, competent, extremely self-critical, responsible organizer and implementer with proven capabilities. He has the skills to work in a team with established experienced scientists and to attract young researchers to his team.

From the materials submitted by the candidate Assoc. Prof. Stoimenov, Ph.D. the following generalizations can be made:

- The research activity is focused and in-depth, with potential for implementation.
- A large part of the scientific works concern topical problems in the field of creating innovative methods and tools for research, analysis and optimization of motion, interaction and behavior of bodies with variable shape.
- The main publication activity of the candidate is in journals refereed in the global database SCOPUS, which is an indicator of publications that have passed through independent reviewers and verification systems that evaluate the content for authenticity, quality and added value on the subject.

Conclusion

On the basis of my acquaintance with the materials submitted for the competition, which meet all the requirements of the Act of the Development of the Academic Personnel of the Republic of Bulgaria, the Rules of the Academic Personnel of the Republic of Bulgaria, the Rules for the conditions and the procedure for acquiring scientific degrees and for the occupation of academic position in the Institute of Information and Communication Technologies of BAS, I would like to recommend to the esteemed scientific jury that the candidate's research activity, the relevance and significance of the scientific and applied contributions made, and the quality and relevance of the scientific and applied contributions achieved should be evaluated in the competition. In addition to my personal impressions of the candidate's research activity, the relevance and significance of the achieved scientific and applied contributions, **I confidently recommend the esteemed scientific jury to positively evaluate the scientific works under the competition and to propose to the Scientific Council of the Institute of Information and Communication Technologies to elect Assoc. Prof. eng. Nikolay Ivanov Stoimenov, Ph.D. for the academic position of "PROFESSOR" in the field of 5.2. Electrical Engineering, Electronics and Automation, Specialisation "Automated Information Processing and Control Systems".**

Sofia,

22.03.2024 г.

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