R E V I E W

on a competition for the occupation of an academic position "Professor ", scientific field 5. Technical sciences, professional direction 5.1 Mechanical engineering, scientific specialty in the discipline "Programming of machines and systems with CAM" , announced in SG No. 67 of 04.08.2023

candidate: **Assoc. Ph.D. Eng. Stoyan Dimitrov Slavov**, Associate Professor in the Department of TMMM at MTF

Reviewer: **Prof. Dr. Eng. Dimitar Damianov**

1. General conditions and biographical data

Associate Professor Stoyan Dimitrov Slavov, Ph.D is born in the city of Varna on 01.10.1973. He completed his secondary education at "Anton Ivanov" Vocational Technical High School, Varna, majoring in "Robotic and flexible automated production systems". He completed his higher education at TU-Varna, majoring in "Technology of Mechanical Engineering and Metal Cutting Machines". In 2003 started working at "Flag Alex", Sofia as a consultant, and until 2012 works in various companies as a specialist and consultant in quality and engineering technologies. In 2004 acquired level "Doctor" , with scientific specialty 02.01.10 "Technology of mechanical engineering". Since 2006 works at TU-Varna, and since 2012, with a competition, he has successively held the academic position of "Chief assistant" in the Department of Mechanical Engineering and Metal Cutting Machines and the academic position of "Associate Professor" in the same department, where he is currently working.

2. General description of the presented materials

To participate in the competition, Assoc. Dr. Eng. Stoyan Slavov submitted a total of 24 publications as follows:

- Monograph (**B 3 .1**) one issue with the title "Formation of regular reliefs using CNC machines". The monograph meets the requirements for such work with a theoretical-practical orientation.

The candidate has also submitted a list of titles of 23 pcs scientific works, which are distributed as follows:

- Scientific publications in referenced and indexed global databases (Scopus and/or WoS) - databases - 11 pcs. (D7.1 - D7.11)
- Scientific publications in non-refereed journals with scientific review or edited collective volumes - 12 pcs. (D8.1 – D8.12)

In summary, the scientific Publications submitted for participation in the competition are divided into three groups :

- The first one group (B3.1), represents habilitation work (monograph) on the topic: Formation of regular reliefs with the help of CNC machines
- The second group (D7.1– G7.11), presents total 11 scientific labor , of which all in referenced and indexed databases independent and co-authored.
- The third group is 12 pieces (D8.1 - D8.12) are publications in non-refereed journals with scientific review, of which 3 are independent, and the rest are co-authored .

Thematically the works by group and are systematized mainly in the field of programming machines and systems with CAM. All are on the theme of the contest and I accept them for review.

3. General characteristics of the candidate's scientific research and applied scientific activity

From the reviewed documents, submitted for participation in the competition for the academic position "Professor", it is clear that Assoc. Dr. Eng. Stoyan Slavov works in several directions. They, in turn, provide the opportunity to appear as an author, researcher and educator with very good teaching and research skills and approaches. He took part in the development of scientific educational projects, of which in 8 of them he acted as a contractor and in 6 as a leader. He managed one international project and attracted a total of BGN 110,902. for TU-Varna. Table 1 gives the minimum requirements points by groups indicators for occupying the academic position "Professor", area 5. Technical sciences , prof . direction 5.1. Mechanical engineering.

Table 1

A group of metrics	Content	Professor	Total no. points Prof. Slavov
A	Indicator 1	50	50
B	Indicator 2	-	-
C	Indicator 3 and 4	100	100
D	Sum of indicators 5 to 11	200	289.3
I	Sum of indicators from 12 to 15	100	514
F	Sum of indicators from 16 to 28	150	394
G	Indicator 29	120	768.2
	Total Points:	**720**	**2115.50**

As can be seen from Table 1, all indicators are met and some exceeded, which covers it completely scientometric ones requirements

Quoted
The list of citations submitted for participation in the competition meets the requirements and includes: Citations in scientific publications referenced and indexed in world-renowned databases with scientific information and citations in non-refereed publications with scientific review (D 12.1-17, D13 1-2, D14.1 -3)

4. Evaluation of the pedagogical preparation and activity of the candidate

Horarium ut on led you in TU- Varna lectures for the last ones three years is 768.2 hours. actual hours spent with a correction and reduction factor of which: in the first academic year 254.4 hours, in the second academic year 266 hours, and in the third academic year 247.8 hours. Pedagogical candidate preparation I appreciate by the activities reflected in the creative his autobiography and works related to it activity . There is enough teaching experience like assistant chief assistant and associate professor in the TMMM department. Having given presented reference for the study workload that is significant over the norm I accept that the pedagogical his the experience is rich. He has published two textbooks on programming of metal-cutting machines and three teaching aids on the problem of programming metal-cutting machines.

In the proposed for review materials with the nape and the used technical language are true and scientifically accurate. There is a pedagogical one competence and scientific awareness combined with the used engineering terminology.

5. Basic scientific and applied science contributions

Contributions are reduced to scientific, scientific applied and applied, with which new aspects of already existing scientific tasks, technologies, constructions, problems and theories are proven. I welcome all contributions so worded.

A. Scientific contributions

1. A modern concept is proposed to achieve the necessary complex planar and spatial trajectories of the deforming tool to form various types of regular reliefs, through a surface plastic deformation process using CNC machine tools on workpiece surfaces with different shape and contour profile - B 3-1, D 7-2;

2. The need for forced reciprocating movements of the deforming element in the classical process for vibrational surface plastic deformation is overcome by using the interpolation of the axes of metal cutting machines with a digital programming device, which greatly simplifies the design and dimensions of the tools for this type of operations. This enables the final operation to be performed on the same machine immediately after the preceding forming operations - B 3-1, D 7-2;

3. On the basis of obtained mathematical models for calculating the coordinates of characteristic points of the trajectory of the deforming element, the possibility of automatically creating corresponding control programs for turning , turning -milling and milling multi-axis processing centers with a digital program device for performing operations has been proven for the formation of partially and completely regular reliefs through the process of surface plastic deformation, suitable for processing details having:

a) flat surfaces - B 3-1, D 7-2, D 7-4, D 7-5, D 8-2, D 8-9;
b) cylindrical and conical outer surfaces - B 3-1, D 7-1, D 7-2, D 8-2, D 8-11;
c) uneven (spatial) surfaces - B 3-1, D 7-2, D 8-1, D 8-6.

4. Three original approaches have been developed for automated identification of the number of cells of completely regular reliefs (G 8-12) and determination of their topographic characteristics, based on standardized (in ISO 21920-2 and ISO 25178-2) criteria . with the help of parallel measured profilograms by the contact method and a combination of them and obtained digital images of PP through an optical microscope - B 3-1, D 7-9, D 7-11;

5. A group of uncorrelated three-dimensional criteria has been identified , according to the ISO 25179-2 standard , describing the complex topographical characteristics of PP obtained after surface plastic deformation with used on machines with a digital program device - B 3-1, D 8-

B. Scientific - applied contributions

1. Computer models were developed and applied in practice for calculating tool trajectories when forming regular reliefs by surface plastic deformation on different types of surfaces, depending on the contour of the processing domain - B 3-1, D 7-1, D 7-2, D 7-4, D 7-5, D 8-1, D 8-2, D 8-6, D 8-9.

2. An algorithm was created to optimize the length of the trajectory of the deforming tool during surface plastic deformation, so that it is obtained with the minimum necessary unfolded length, depending on the shape and dimensions of the processed surface - B 3-1, D 7-2 , D 7-10.

3. An algorithm was developed for direct generation of control programs for lathes centers with digital program control for forming regular reliefs by surface plastic deformation on cylindrical and conical outer surfaces - B 3-1.

4. An algorithm for constructing polylines has been developed (polylines) in the DXF (Autodesk) format widely supported by CAD and CAM software products , describing the tool path of the deforming element , in order to import them into appropriate CAM software and use them for automated programming of the operation for surface plastic deformation and output of UP for the corresponding machine with digital program control - B 3-1.

5. An algorithm was developed for filtering the high-frequency components of the measured profilograms , through a filter with a "finite impulse response" and a resampling algorithm , allowing adequate spatial recreation of the topography of regular reliefs as a 3D model of the roughness or undulation - B 3-1.

6. A generalized algorithm has been developed for the analysis of the degree of significance of the effects and the nature of influence of the mode parameters of the surface plastic deformation process, as well as the trajectory of the deforming tool, on:

  − the characteristics of the topography of regular reliefs by two-dimensional criteria according to ISO 21920-2 – D 7-9;

  − the characteristics of the resulting three-dimensional topography of regular reliefs based on the identified topographical criteria according to ISO 25178-2 - B 3-1, D 8-7;

  − the variability of the force of deformation during processing of flat surfaces and those with a complex spatial shape - D 8-1, D 8-6.

C. Applied Contributions

1. On the basis of an overview and analysis of existing constructions of tools for vibration and smooth surface plastic deformation, new, simpler and compact constructions of tools for forming regular reliefs, intended for work with lathe and milling centers with a digital program device, have been created. They are equipped with sensors for measuring force and allow measuring the deforming force in the process of processing through surface plastic deformation - D 7-7, D 8-4, D 8-8.

2. On the basis of conducted planned experimental studies, the potential for increasing the number of cycles to fatigue failure of samples of austenitic steels AISI 304L and AISI 316 , having regular reliefs formed by surface plastic deformation, compared to untreated ones by this method, has been established samples - D 7-3, D 8-5.

3. Through experimental studies, the recommended values of the mode parameters of the surface plastic deformation process have been established to obtain the maximum number of cycles until fatigue failure of austenitic steels AISI 304L and AISI 316 with a formed regular relief in the stress concentrator - D 7-3, D 8-5.

4. The influence of the size of the deforming force and the feed rate during surface plastic deformation of aluminum samples made of aluminum alloy, brand 2024 on the topographic characteristics of the resulting regular reliefs on cylindrical samples - D 7-1 was experimentally determined.

D. Methodological contributions

1. Methods have been created and tested for obtaining a three-dimensional topographic representation of the forming regular reliefs through surface plastic deformation on flat surfaces, using the capabilities of a micrometric table or a three-axis milling machine with a digital program device for obtaining parallel profilograms (B 3-10), as well as digital images and profilograms measured in optimal sections using a roughness measuring device - D 7-11, D 8-7.

2. A methodology has been created for modeling the characteristics of regular reliefs through a modern method of rapid prototyping , namely creating three-dimensional models of regular reliefs and printing them as physical objects, using a 3D printer - D 8-3, D 8-10.

3. Methods have been developed for measuring the deforming force and transmitting the data for its values, both via a cable connection and wirelessly to computerized devices for collecting and processing the measured data, in order to control and/or monitor the main mode parameter of the process surface plastic deformation during the operation - D 7-7, D 8-4.

4. A methodology has been developed for establishing the influence of the main parameters of the processing mode by means of surface plastic deformation and of the sinusoidal trajectory of the deforming element, on topography parameters (B 3-1, D 8-7) and the number of cycles to failure from fatigue of the material for flat surfaces having regular reliefs (G 7-3, G 8-5), with a minimum number of experimental trials, using the so-called " Bayesian statistics" and Taguchi experimental designs .

6. Significance of contributions for science and practice

The contributions are significant for science and practice. The scientific, scientific-applied and applied contributions contained in the candidate's works are essential for the development and enrichment of scientific research in the field of the announced competition.

I believe that, in terms of volume and quality, the scientific-teaching, scientific-research and scientific-applied activities of the candidate fully satisfy the requirements for occupying the academic position "Professor".

7. Critical notes and recommendations

I have no significant critical remarks to dispute the main scientific, scientific-applied and applied contributions of the candidate . Minor technical deviations are noted.

However, I recommend the candidate to start working in a team with other European and global scientists who have interests in the field of modern industrial technologies and the requirements of the Fourth/Fifth Industrial Revolution. I recommend that in the future the efforts in the research work should be directed not only to the conventional principles of programming with CAM, but also to the study and analysis of the latest forms of development and modeling of highly automated technologies in this direction.

8. Personal impressions and opinion of the reviewer

I do not personally know the candidate for the announced competition, but from the presented materials I can conclude that he is an established scientist who knows how to work independently, has developed professionally over the years and has the necessary qualities to acquire the academic position of "Professor".

CONCLUSION

The presented scientific works are at the necessary scientific level and are an element of the subject that corresponds to the requirements of the competition in PN 5.1. "Mechanical Engineering". Sufficient scientific, scientific-applied and applied contributions have been realized in them. All the requirements of the "Regulations on the terms and conditions of holding academic positions" in TU-Varna have been observed . All necessary documents and references are presented.

Based on the above, I find it reasonable to propose that Stoyan Dimitrov Slavov, Assoc. Ph.D. Eng. be awarded the academic position "Professor" in professional direction 5.1. Mechanical Engineering, scientific specialty in the discipline "Programming of Machines and Systems with CAM" .

01.2024

Review