

REVIEW

by

Prof. Vladimir Monov, PhD

Institute of Information and Communication Technologies,

Bulgarian Academy of Sciences

on a dissertation work for obtaining an educational and scientific degree "Doctor"

<u>Author of the dissertation work:</u>	M.Sc. Eng. Miglena Marinova Paneva
<u>Thesis of the dissertation work:</u>	„Innovative methods for technological diagnostics of automatic mashines and lines“
<u>Field of higher education</u>	5. Technical sciences
<u>Professional direction:</u>	5.2.„Electrotechnics, Electronics and Automation“
<u>Scientific specialty:</u>	“Automated information processing and management systems“
<u>Scientific Supervisor:</u>	Prof. Dimitar Karastoyanov, Ph.D.

By Order No. 53 / 01.03.2022 of the Director of IICT-BAS I have been confirmed as a member of the Scientific Jury for conducting the defense of the dissertation. By decision of the Scientific Jury at a meeting held on 08.03.2022 I was appointed reviewer of the dissertation. As a member of the Scientific Jury I received:

1. Dissertation for obtaining the educational and scientific degree "Doctor".
2. Abstract of the dissertation in Bulgarian and English.
3. Copies in full text of seven dissertation publications.
4. Certificate for registration of a utility model.
5. Information on the fulfillment of the minimum requirements of the IICT-BAS for the educational and scientific degree "Doctor".

The evaluation of the dissertation follows the normative requirements for obtaining the educational and scientific degree "Doctor", defined by the Law of the Development of Academic Staff in the Republic of Bulgaria (Article 6, paragraph 3), the Regulations for application of the law (Article 27 , paragraph 1 and paragraph 2), as well as the Regulations for the specific conditions for acquiring scientific degrees and holding academic positions at the Institute of Information and Communication Technologies (article 3, paragraph 1, item 1.1).

1. Structure and content of the dissertation work.

The dissertation has a volume of 153 pages and consists of Introduction, 5 chapters, Conclusion, Contributions and Bibliography. It contains 109 figures, 45 tables and a separate Appendix with production operational documents. The list of bibliographic sources includes 163 titles, including sources by Bulgarian and foreign authors, as well as Internet sites. The list of publications on the dissertation topic

contains 7 titles and a certificate for registration of a utility model. Chapter 5 of the dissertation is a plan for commercialization of the results. According to the requirements, a Declaration of originality of the obtained results is attached to the dissertation.

The dissertation was discussed and proposed for defense at an extended meeting of the section "Distributed Information and Management Systems" of IICT-BAS, held on 18.01.2022.

2. Relevance of the problem developed in the dissertation in scientific and scientific-applied terms.

The general goal of the dissertation is the integration of new technologies and creation of methods for testing and diagnostics of automatic machines and lines in the production of thin-walled electro-welded profiles from cold rolled steels. The researched production process is distinguished by the use of automatic metalworking machines, computerized equipment, diagnostic technologies and precise tests of both the source materials and the qualities of the final product. The active research activity and the increased technological development in this field, both in our country and internationally, undoubtedly determine the relevance of the dissertation research and the usefulness of the results obtained in scientific and scientific-applied terms.

3. Degree of knowledge of the state of the problem and creative interpretation of the reference sources.

The introduction and the analytical review made in Chapter 1 of the dissertation together with the set goal and tasks are presented on 46 pages. An overview of well-known domestic and foreign manufacturers of hot and cold rolled steel, steel pipes and profiles has been made. The methods and types of technological operations for metal processing, machines for testing strength, tensile, compression and bending are analyzed. Special attention is paid to modern intelligent methods and tools for measurements, control of physical quantities and study of the structure of materials. Possibilities based on international experience and practice for increasing the productivity of automatic equipment and the quality of the final product are outlined. The analytical review in the problem area of the dissertation shows a thorough knowledge of the subject and current problems, as well as potential opportunities for their solution. On this basis, the purpose and tasks of the dissertation are formulated.

4. Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the achieved contributions.

The formulated general goal of the dissertation is to study the progress and integration of new technologies in modern diagnostics of automatic machines and lines and to propose an innovative approach to creating test methods. To achieve this goal, the following tasks are formulated.

- After a detailed review to analyze and systematize approaches and methods for integrating intelligent technologies in technical diagnostic procedures.
- To study existing methods and tools for modern diagnostics of automatic machines and lines.

- To study the impact of ICT on technical diagnostic methods.
- To propose and substantiate innovative methodologies for types of diagnostics of automatic machines and lines.
- To conduct experiments and simulations of various methods in industrial environments.
- The obtained results should be analyzed and tested.

The methodology of the research includes systematization, extension and improvement of existing methods for technical diagnostics, the use of innovative approaches based on computed tomography and 3D printing, the creation of methods for testing and maintaining high performance of automatic machines. This approach fully corresponds to the general goal and specific tasks of the dissertation. The obtained results show that the doctoral student has successfully used the chosen research methodology in accordance with the set goal and the achieved scientific-applied contributions.

5. Characteristics of the dissertation work

The dissertation is characterized by in-depth knowledge of technology, automatic machines and lines and problems in the production of thin-walled electro-welded steel profiles. Rich experimental material, opportunities for research work and the use of innovative methods and approaches are presented.

Chapter 1 provides an overview of Bulgarian and world manufacturers of metal and steel profiles, analyzes hardware methods and tools for intelligent measurement and maintenance of machine productivity.

Chapter 2 presents an innovative approach to the operation of technological equipment, quality control in the production of thin-walled electric-welded pipes and profiles and the elimination of defects that occur in the production process.

Chapter 3 contains methodologies for the use of technological equipment, testing of initial material blanks, measurements of tensile strength, roughness and hardness, use of spectral analysis and 3D computed tomography.

Chapter 4 presents the results of research using the proposed methods in the production process. The chemical and mechanical parameters of low-carbon metal and high-strength steel products are analyzed, as well as the values of the measured parameters obtained during the technological process.

Chapter 5 presents a project for future work and use of the results in the production process of the Factory for the production of pipe profiles in Lovech.

In the Appendix to the dissertation are presented operational documents, which show that the doctoral student is familiar in detail with the technology of production of steel tubular profiles and the accompanying production documentation.

The final part of the dissertation summarizes the results obtained and lists the contributions that are essentially defined as scientific-applied.

6. Scientific and scientific-applied contributions of the dissertation

I accept and positively evaluate the scientific-applied contributions formulated in the dissertation and the abstract. In summary, they can be listed as follows.

- Systematization of methods and tools for technical diagnostic procedures has been made and innovative approaches for diagnostics of automatic machines and lines have been proposed.

- Methods for technical diagnostics (testing) of a test body for tensile strength, spectral analysis and computed tomography have been developed. The proposed methods are related to improving quality control in tests and experiments.

- An innovative test body holder and methods for measuring and analyzing its geometric characteristics using a 3D computed tomograph have been developed. The development is registered as a utility model in the Patent Office of the Republic of Bulgaria with registration № 3892 U1 / 23.09.2020.

- Methods for spectral analysis of a metal test body, machining and study of the hardness and roughness of working rolls, testing the roughness of low-carbon steel after cold rolling have been developed.

- Simulations and experimental studies have been performed, proving the effectiveness of the proposed methods in industrial environment.

A good attestation for the results obtained in the dissertation is the fact that they are used and applied in the technological processes of the Factory for production of pipe profiles in the town of Lovech.

7. Assessment of the degree of personal participation of the dissertation in the contributions

I know personally the doctoral student M.Sc. Eng. Miglena Paneva and I have direct impressions of both her independent work and the work of the team in which she participates. This gives me reason to believe that the dissertation and its contributions are her personal work, received under the direct guidance of the scientific supervisor.

8. Evaluation of the dissertation publications

7 publications on the dissertation topic were presented, of which 4 independent and 3 co-authored. Six of the publications are in English and one in Bulgarian. The publications are in prestigious Bulgarian and international editions, one of which is referenced in the Scopus database. All publications on the dissertation are in the period 2018-2021 and in terms of volume and quality meet the requirements for obtaining the educational and scientific degree "Doctor". With the publications and the useful model "Holder for test specimens" the results of the dissertation have become available to our and the international scientific community.

9. Significance of the results of the dissertation work in science and practice

In the dissertation research and results are obtained, connected with the development of innovative methods for technological diagnostics of automatic machines and lines for production of tubular steel profiles. Experimental research has been carried out, illustrating the advantages of the developed methods, the results obtained have been implemented in the Factory for production of pipe profiles in the

town of Lovech. In general, the dissertation contains contributions of scientifically applied nature, which relate to the development of new and improvement of existing methods and approaches, as well as the application of useful practical solutions.

10. Assessment of compliance of the abstract with the requirements for its preparation

The abstract is 44 pages long and meets the requirements for its preparation. Its content corresponds to the content of the dissertation and presents exactly the main results in the dissertation. An abstract of the dissertation in English in the volume of 28 pages is also presented.

11. Assessment for fulfillment of the minimum national requirements and the additional requirements under Article 1a, paragraph 2 of the Law on the Development of the Academic Staff in the Republic of Bulgaria

According to the Law for the Development of the Academic Staff in the Republic of Bulgaria for obtaining educational scientific degree "Doctor" in professional field 5.2 "Electrotechnics, Electronics and Automation " it requires a minimum of 50 points on indicator A and 30 points on group of indicators D. The same number of points is required in the Regulations for specific conditions for acquisition of scientific degrees and holding academic positions at IICT-BAS. From the submitted Certificate for fulfillment of the requirements for obtaining the educational scientific degree "Doctor" it is evident that the doctoral student fulfills the requirement according to indicator A, and according to indicators from group D she has reported 128.32 points, which significantly exceeds the required minimum number of points.

12. Opinion, recommendations and remarks

The dissertation is developed in detail and is a completed research work. The doctoral student has carried out an in-depth and systematic study of the problem and has proposed original scientific-applied results that fully meet the goal and tasks of the dissertation work.

I have no critical remarks on the substance of the dissertation and the results presented. Of an editorial and technical nature, inaccuracies and repetitions can be noticed in the numbering of the figures in Chapters 2 and 3, as well as spelling mistakes in the text.

These remarks are not on the essence of the work and do not reduce the value of the contributions to the dissertation.

My recommendation to the PhD student is to continue the research activity in accordance with the plan for future work presented in Chapter 5, as well as to publish the results in prestigious international journals.

CONCLUSION

I positively evaluate the work done and the results obtained in the dissertation. The dissertation meets all the requirements of the Law on the Development of the

Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, as well as the specific conditions for obtaining scientific degrees and holding academic positions at the Institute of Information and Communication Technologies. I strongly suggest to the esteemed Scientific Jury to give the M.Sc. Eng. Miglena Paneva educational and scientific degree "Doctor" in the field of higher education: 5. "Technical Sciences", professional field: 5.2 "Electrotechnics, Electronics and Automation", specialty "Automated systems for information processing and control".

Sofia

31.03.2022

НА ОСНОВАНИЕ

ЗЗЛА