

## OPINION

by: **Prof. Stancho Petkov Petkov, Ph.D., IMETCHA- BAS,**  
**member of the scientific jury, appointed by Order No.53/01.03.2022. of the**  
**Director of IICT**

on dissertation work  
**on thesis: "INNOVATIVE METHODS FOR TECHNOLOGICAL**  
**DIAGNOSTICS OF AUTOMATIC MACHINES AND LINES"**

for obtaining educational and scientific degree "Doctor (Ph.D.)" scientific field:  
5. "Technical sciences" in doctoral program in scientific specialty 02.21.07.  
"Automated systems for information processing and management", professional  
field 5.2. „Electrotechnics, Electronics and Automation“

*author of the Dissertation thesis:*

**master eng. Miglena Marinova Paneva**

*Scientific Supervisor:*

**Prof. Dimitar Karastoyanov, Ph.D.**

The dissertation of mas. eng. Miglena Paneva is a promising scientific and scientifically applicable field for the use of innovative methods for diagnostics of computerized machines for tensile strength testing, spectral analysis and tomography in search of new technological systems in conditions of limited information for automated fault control.

I prepared my review on the basis of Order No 53/01.03.2022 of the Director of IICT and on the basis of the submitted documents, including:

- Application No / 18.01.2022, by mag. eng. Miglena Paneva PhD student in part-time form of study at the head of the RIUS section Assoc. Prof. Nikolay Stoimenov, Ph.D;

- Protocol No 13 / 22.12.2021 for expulsion from a remote meeting of the Scientific Council of IICT – BAS;

- Declaration of originality;

- Abstract;

- Order for pre-protection No 304/01.12.2021;

- Certificate for passed exams, according to individual curriculum;

- Order No 53/01.03.2022 for approval of the composition of the scientific jury;

- Publications related to the topic of the dissertation;

- Dissertation thesis;

- Electronic medium with materials for the procedure.

- List of publications;

- Information on the fulfillment of the minimum requirements of the ICT for the educational and scientific degree "Doctor".

The procedure for the defense of the dissertation for the award of educational and scientific degree "Doctor" is followed and is in accordance with applicable regulations. The materials presented by the candidate are prepared in accordance with the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Rules for Implementation of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Rules for Acquisition of Academic Degrees and IICT-BAS "Acad. G. Bochev".

### **Structure and volume of the dissertation**

The dissertation is in volume: Main part of 153 pages, which includes an introduction, 5 chapters for solving the formulated tasks, a list of the main



contributions, a list of publications on the dissertation and references. A total of 163 literature sources were cited. The main part includes 113 figures and 47 tables. The numbers of the figures and tables in the abstract correspond to those in the dissertation. Applications - a total of 38 pages.

Based on an order of the director of IICT-BAS, mas. eng. Miglena Paneva is enrolled in a part-time form of training in the scientific field in the scientific field 5. "Technical Sciences", "doctoral program in scientific specialty 02.21.07. "Automated systems for information processing and control", professional field 5.2 "Electrotechnics Electronics and Automation" for the development of a dissertation on "Innovative methods for technological diagnostics of automatic machines and lines".

In the dissertation work is made experience and realized through the design of automatic computerized machines and the use of innovative technologies - controllers, power supplies and optimized software to increase the reliability and productivity of operations in the production of components and products of tubular construction. The design and construction of innovative machines and lines complies with the standard for geometric requirements for the product ISO / TC 213, as well as the requirements for operational safety.

The demand for new materials and technologies, testing of various combinations, by updating standardization documents and the creation of new research procedures is done in order to improve the quality and productivity of products. The reasons given in the dissertation justify the relevance of the problem and the need for research in this area.

The requirements to the materials used in the constructions of the manufactured products are considered, the criteria used in research and evaluation of their possibilities and the modern scientific developments and the most important achievements in this field are analyzed.

**The main purpose** 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 fulfill this goal in the dissertation the following tasks are solved:

1. After a detailed review, an analysis and systematization of approaches and methods for integrating intelligent technologies in technical diagnostic procedures has been made.
2. The existing methods and means for modern diagnostics of automatic machines and lines are studied.
3. The influence of ICT on the methods of technical diagnostics has been studied.
4. Innovative methodologies for types of diagnostics of automatic machines and lines are proposed and substantiated.
5. Experiments and simulations of different methods in industrial environment have been conducted.
6. The obtained results are analyzed and tested.

In the developed dissertation the review, analysis and systematization of methods and means for technological diagnostics of automatic machines and lines are made. A technological regulation and approach for implementation and operation of the technological equipment for production of thin-walled electro-welded closed profiles from cold-rolled steel is proposed.

Methods for experimental preparation of a test body are proposed, through which tensile strength, spectral analysis and computed tomography are tested.

Experiments were performed with a universal tensile strength testing machine, which analyzes the mechanical properties of the metal.



The chemical composition of the raw material used for correct determination of the operating modes was studied by spectral analysis.

The present dissertation is structured as follows:

**CHAPTER 1** presents the need to establish the factory; Bulgarian and world producers of metal and pipes; hardware methods and tools for intelligent measurement and analysis of machine performance maintenance.

**CHAPTER 2** presents the innovative approach to the operation of technological equipment; the standards and brands of steels are presented, as well as the produced types of pipes and profiles; The innovative procedures for quality control in the production of thin-walled electric welded pipes and profiles, as well as the defects that occur in the production process are analyzed.

**CHAPTER 3** contains methodologies for using the necessary equipment; attention is paid to the main functions influencing the measurements. On the basis of the compiled methods the preparation of a test body for testing with spectral analysis, tensile strength in low-carbon steel and the production of high-strength steel is carried out; measurement of roughness and hardness, as well as the measurement of geometric parameters with a 3D computer tomograph.

**CHAPTER 4** sets out the results achieved by scientific research and research in production. An analysis of the chemical and mechanical indicators was made of low-carbon metal in its transformation from hot-rolled metal to cold-rolled metal, results from the production of high-strength steel, as well as analysis of measured parameters carried out during the technological process.

**CHAPTER 5** presents the future projects for the development of the factory.

## **Scientific-applied contributions of the dissertation**

This dissertation presents the results of detailed and in-depth research, analysis and research that have practical application for making appropriate decisions in the selection of methods for technical diagnostics and innovative methods for types of diagnostics of automatic machines and lines.

The contributions to the dissertation are mainly of scientific-applied character and are as follows:

1. After a detailed review, a critical analysis and systematization of methods and tools for technical diagnostic procedures are made.
2. Existing problems and solutions concerning the modern diagnostics of automatic machines and lines are discussed and the influence of ICT on the methods for technical diagnostics is studied.
3. Innovative approaches for diagnostics of automatic machines and lines are proposed.
4. Methods have been developed for: technical diagnostics (testing) through a test body of plastic deformation and tensile strength, graphs of carbon steel at tensile strength, transformation from hot-rolled to cold-rolled sheet, creation of high-strength cold-rolled steel for precision electric welds pipes.
5. Methods have been developed for: design of a new type of innovative test body holder, innovative measurement of geometric characteristics by 3D computed tomography, analysis of the characteristics of the test body before and after punch sharpening.
6. Methods have been developed for: spectral analysis of a metal test body, machining and research of the hardness and roughness of working rolls, testing of the roughness of low-carbon steel after cold rolling.
7. Experimental developments and simulations of different methods in industrial environment are made.
8. The results are analyzed and tested.



## **Coverage of the content and contributions in the dissertation work on scientific forums**

The main parts of the Dissertation have been reported at two international scientific conferences, at four national scientific conferences with international participation and at one with impact factor, SCOPUS Visible. Seven scientific articles have been published, four of which are independent.

## **Critical remarks and recommendations**

In general, the dissertation work is well structured, with precisely formed research goals and objectives, the subject of the research and the restrictive conditions.

The list of terminology used is complete and explains all the concepts used in the dissertation.

I recommend the candidate in his future publishing activity to pay more attention to the descriptions of the benefits of the developed programs and methodologies and the possibilities for their use in other fields of engineering and technical sciences.

I recommend that after obtaining the scientific degree "Doctor", the candidate should be more active in publishing the results in scientific journals with an impact factor.

The above remarks in no way diminish the value of the presented materials, which definitely impress and outline an in-depth scientific and research activity.

## **CONCLUSION**

The dissertation is an undoubted creative achievement, which as topics, implementation and theoretical and scientific contributions and summaries has its

undeniable importance for researching the progress and integration of new technologies in modern diagnostics of automatic machines and lines and innovative approach to testing methods. The claims for scientific contributions are substantiated and correspond to what has actually been achieved. The dissertation is written in competent technical and stylish language, well designed and illustrated.

In view of the research qualities of the candidate, the presented scientific output, the proven theoretical and practical contributions in the publications and the accumulated experience, allows to conclude that the dissertation fully meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the rules for its application, the authoress mas. eng. Miglena Paneva, deserves the award of educational and scientific degree "Doctor" in scientific field 5. "Technical Sciences", "in a doctoral program in scientific specialty 02.21.07. "Automated information processing and control systems", professional field 5.2 " Electrotechnics, Electronics and Automation".

Sofia

15.03.2022

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