

# REVIEW

by

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

Author of the dissertation work: **M.Sc. Eng. Peter Pavlov Panev**

Thesis of the dissertation work: **„Innovative technologies to increase efficiency in the production of tubular furniture“**

Field of higher education **5. Technical sciences**

Professional direction: **5.2.„Electrotechnics, Electronics and Automation“**

Scientific specialty: **“Automated information processing and management systems“**

Scientific Supervisor: **Prof. Dimitar Karastoyanov, Ph.D.**

By Order No. 54 / 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 is developed on the basis of 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 133 pages and consists of Introduction, 5 chapters, Conclusion, Contributions and Bibliography. Contains 103 figures, 18 tables and an Appendix with photos of technological equipment. The list of bibliographic sources includes 100 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 future projects. 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 problem developed in the dissertation is related to the introduction of new technologies to increase the efficiency and productivity of tubular furniture through modern research methods and innovative means of production. The research is focused on the technology of production of furniture and components for the furniture industry, packaging and transport of products to end users. The production process of the "Factory for the production of tubular furniture and components" in Lovech, working together with IKEA International Group of Sweden AB, was studied. The conducted research on the introduction of new technologies in the furniture industry, meeting the high international standards of the company IKEA outlines the relevance of the dissertation 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 in 42 pages. An in-depth analysis and systematization of problems and solutions in the production process of tubular furniture has been made. The development of the Factory for the production of tubular furniture and components in the town of Lovech and the creation of innovative production technologies in accordance with international standards have been examined. The main technological operations of the production process such as guillotine cutting, pressing, punching and bending of raw materials, laser welding, powder coating and packaging of products are analyzed. Possibilities 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 goal 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 general goal of the dissertation is to study the progress and to initiate the introduction of new technologies to increase the efficiency and productivity of tubular furniture through modern research methods and innovative production tools. To achieve this goal, the following tasks are formulated.

- After a detailed review, to analyze the various methods and tools for punching, welding and packaging of tubular furniture and components.
- To study existing methods and means for the production of tubular furniture.
- To design automatic machines to increase the productivity and quality of tubular furniture products.
- Based on the developed projects, to design automatic machines to increase the productivity of automatic table leg machines.
- To propose approaches and methodologies to increase the efficiency and productivity of automatic machines for table leg.
- To conduct experiments and simulations of various methods for design and construction in industrial environments.
- The obtained results to be analyzed and tested.

The methodology of the conducted research includes research and improvement of existing methods for the production of tubular furniture, constructive improvement of the productivity of automatic machines and lines, experiments and testing in real production conditions. The obtained results show that the doctoral student has successfully used the 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 and machines for the production of tubular furniture and components, as well as opportunities to develop and implement innovations related to increasing the productivity and efficiency of the process.

Chapter 1 provides an overview and analysis of the tubular furniture manufacturing process, including the processing of raw materials, the use of automatic machines and lines, the selection and quality of packaging materials.

Chapter 2 presents methods and means for the production of elements for tubular furniture: cutting of pipes, punching and welding of details, painting and packaging of the entire product. The degree of suitability for automation, the actual and desired performance of the equipment were studied.

Chapter 3 develops methodologies for designing machines that increase the productivity of the work process with the use of 3D CAD software Solid Works, as well as methods for achieving high productivity of the packaging process.

Chapter 4 presents the results of the implementation of an innovative automatic machine for mounting a punched part (cup with bolt), automatic laser welding machine, semi-automatic and automatic packaging lines. The productivity of the machines is calculated.

Chapter 5 presents a project for future implementations in the production process of the Factory for the production of tubular furniture and components in Lovech.

The results in the dissertation are illustrated in detail with graphical diagrams and tabular data, the mathematical dependences for determining the operating speed and

productivity of the machines are presented. In an Appendix to the dissertation is presented photographic material of the main units of the production equipment.

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.

- The various methods and means for realization of processes of punching, welding and packing of tubular products are analyzed and systematized.

- Innovative approaches and methodologies for designing machines for automatic punching of the heel and cup on the table are proposed in order to increase the efficiency and productivity of automatic machines.

- Designed, developed and implemented in the production is an innovative automatic assembly machine in two versions.

- Innovative methods have been developed to increase the productivity of packaging. An innovative semi-automatic packaging line was designed, developed and implemented in the production, a project of an automatic packaging line was developed.

- A utility model "Test body holder" registered in the Patent Office of the Republic of Bulgaria with registration number 3892 U1 / 23.09.2020 has been developed.

- Simulations and experimental studies have been carried out to determine the effectiveness of the proposed developments in the industrial environment.

In general, the obtained results were used and applied in the technological processes of the Factory for the production of tubular furniture and components in the town of Lovech with a proven effect on the productivity and quality of the final products.

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

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

## **8. Evaluation of the dissertation publications.**

Seven publications on the dissertation topic were presented, of which 3 independent and 4 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 they meet the requirements for obtaining the educational and scientific degree "Doctor". With the publications and the useful model "Test body holder" 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.**

The dissertation presents research and obtained results related to the development of innovative methods and the design of high-tech machines for the production of tubular furniture and components. Implementation and experimental research have been carried out, illustrating the advantages of the results obtained at the Factory for the production of tubular furniture 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 formation.**

The abstract is in volume of 37 pages 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 30 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 on 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 " requires a minimum of 50 points on indicator A and 30 points on group 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 he has reported 113.32 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 nature, I have the following remark.

The dissertation lists 15 scientific-applied contributions, but their formulation is not very precise and it includes activities that cannot be considered as significant contributions (for example, "Existing problems are discussed", "The impact of ICT is studied", " "Methodological assistance has been provided...", etc.). With a more precise

formulation, the number of listed contributions should be reduced by emphasizing the main results that have made a significant contribution to the thematic area of the dissertation.

These remark does not affect 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 to the M.Sc. Eng. Peter Panev 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