

## OPINION

on a dissertation for obtaining an educational and scientific degree "doctor"

Professional field: **5.1 Mechanical Engineering**

Doctoral program: **Robots and manipulators**

Author of the dissertation: **MSc. Eng. Ivaylo Robertov Georgiev**

Topic of the dissertation: **Design and Control of a 3D Printed Humanoid Hand**

Member of the scientific jury: **prof. Eng. Ivo Malakov, DSc**

The dissertation submitted for opinion is 115 pages long and is structured in 5 chapters, conclusion, contributions, list of publications on the dissertation, bibliography, declaration of originality and appendix. The bibliography includes 65 literary sources. In connection with the work, 5 scientific publications are presented, all co-authored. The work was developed at the Institute of Engineering - Bulgarian Academy of Sciences under the scientific supervision of Prof. Dr. Eng. Ivan Chavdarov.

### **1. Relevance of the problem developed in the dissertation in scientific and applied scientific aspects.**

The dissertation is in a promising and current area of design and research of anthropomorphic hands, which are widely used in various fields of science, medicine and industry. Despite the fact that the first samples were created many years ago, the artificial hands of Götz von Berlichingen, Ambroise Poirer, Pierre and Henri-Louis Droz, Jean-Frédéric Lescott and other talented inventors of the Middle Ages are known, their improvement is the subject of continuous research and any innovation that improves their characteristics is useful for science and engineering practice. The proposed design of a humanoid hand in the dissertation, the methods and tools used for design, prototyping, management and research, enrich and further develop the knowledge and methods for solving problems in the area under consideration, lead to the improvement of the functions performed, shortening the design process and creating prerequisites for expanding the areas of application.

All this determines the relevance and significance of the research in scientific and applied terms.

### **2. Degree of knowledge of the state of the problem.**

The dissertation has studied and cited 65 literary sources, a significant part of which are from the last ten years. Both the overview and the research part of the work show a good knowledge of the current state of scientific research and practical developments in the field under consideration. The citation is correct, accompanied by analysis and creative interpretation of the literary material. The author has presented

the essence, analyzed and systematized the main solutions in the specialized literature related to the topic of the dissertation.

I believe that the candidate knows the current state of the field under consideration very well and has the necessary capacity to obtain new results.

### **3. Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the achieved contributions.**

The chosen research methodology is adequate to the set goal and tasks of the dissertation. It is well-founded and its reliability can be judged by the achieved results, which are mainly of a practical nature. Solving the tasks set in the dissertation is based on the successful use of modern methods and tools for design and engineering analysis, for virtual and physical prototyping, experimental research, etc. The set goal and the tasks related to it have been implemented correctly, in the required volume and content.

The social significance of the achieved results should also be emphasized. The developed anthropomorphic hand has potential for future development and application and can serve as a good basis for building prostheses.

### **4. Scientific and/or applied scientific contributions to the dissertation.**

I accept the scientific and applied contributions formulated by the doctoral student and determine them as significant and sufficient for the acquisition of the educational and scientific degree "doctor".

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

The doctoral student has presented 5 collective publications on the dissertation, a significant part of which are in editions indexed in the global databases Scopus and Web of Science. No separation protocol for the collective publications on the dissertation has been presented, but it can be concluded that the author has an equal participation in them. I have no information about the citations of the author's works, but I am confident that they will be reflected in the scientific community.

The presented publications sufficiently fully and accurately reflect essential aspects of the dissertation and popularize the work done.

### **6. Opinions, recommendations and remarks.**

I have no significant remarks with which to dispute the main scientific and applied contributions in the dissertation work.

Notes and recommendations:

- It is recommended that the goal and objectives of the work be formulated after an analysis of the existing situation.
- The work would benefit if a number of alternative variants of the designed anthropomorphic hand were developed, from which, after evaluation according to appropriate criteria, an optimal variant could be selected while complying with previously set requirements and limitations.



- I recommend that the candidate continue work on improving the developed humanoid hand and seek opportunities for intellectual property protection.

## **7. Conclusion.**

Based on my familiarization with the dissertation work and the materials on it, the fulfilled educational goal of the doctoral studies, the relevance and significance of the achieved scientific and applied contributions, I give a POSITIVE assessment of the dissertation work. The requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, the Regulations on the conditions and procedure for acquiring scientific degrees and for occupying academic positions at the Bulgarian Academy of Sciences and the internal rules for the development of the academic staff of the Institute of Robotics at the Bulgarian Academy of Sciences in terms of scope, volume and quality of the dissertation work have been met.

**On these grounds, I propose that MSc. Eng. Ivaylo Robertov Georgiev to be awarded the educational and scientific degree "Doctor" in professional field 5.1 Mechanical Engineering, scientific specialty "Robots and Manipulators".**

05.11.2025  
Sofia

Member of the Scientific Jury.  
(prof. Eng. Ivo Malakov, DSc)