OPINION

on the dissertation for the acquisition of the educational and scientific degree "Doctor" in the professional field 5.1 Mechanical Engineering, scientific specialty "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. PhD. Eng. Pancho Krastev Tomov,
Technical University of Sofia, Mechanical Faculty,
Department of Discrete Manufacturing Automation.

1. Relevance of the problem developed in the dissertation.

The presented dissertation is dedicated to the analysis of the possibilities of reproducing the human hand, achieving functionalities as close as possible to the natural one. A concept for using 3D prototyping with independent drive of each finger is proposed. From the point of view of modern scientific and practical research, it is relevant and timely.

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

The list of sources used includes a total of 65 titles, which indicates a good knowledge of the problem considered in the dissertation. The list of literature used also includes 5 publications by the doctoral student, which shows that he has worked systematically on the problem in recent years. As a result of the review, the doctoral student formulates conclusions and determines the main tasks he sets for himself in the development.

3. Compliance of the chosen research methodology and the set goal and objectives of the dissertation with the contributions achieved.

The doctoral student divides the tasks into groups and forms an approach to solving the existing problems that corresponds to the goals of the dissertation. As a result, he successfully analyzes the necessary sensors and actuators for the implementation of the project, selecting the optimal ones based on a comparative assessment. Kinematic models of humanoid hands are considered and the appropriate ones for the implementation of the project are defined.

4. Contributions of the dissertation work.

The contributions of the dissertation are divided into Scientific-Applied and Applied contributions, some of which would be good to be more precise. I consider the developed "approach for creating assembled 3D printed fingers of a humanoid hand...." to be Scientific-Applied, and the analysis of the reachability zone in the

second scientifically applied contribution. With regard to the applied contributions, the performance of an experiment should not be defined as a contribution, but the analysis of the results of the experiment. I consider the remaining contributions to be useful for practice.

5. Evaluation of dissertation publications.

The main achievements and results of the dissertation work have been published in 5 scientific publications. It is impressive that there are publications throughout the three years of study, all of which were used as sources in the presented dissertation work. The publications presented ideas that were later used in the dissertation work.

6. Opinions, recommendations and notes.

In the dissertation work, I did not find any fundamental errors or incorrect use of other people's works. I accept the applied and scientific-applied contributions of the doctoral student, with the remark that the emphasis should be on the analysis and not on the experiment. In some places, the impersonal style of presentation is not observed, as the author uses a statement in the third person "The author uses the innovative technology 3D printing ...." (p. 17).

7. Conclusion

The dissertation work of MSc. Eng. Ivaylo Robertov Georgiev is on a current topic, has been completed in sufficient volume and is the personal work of the doctoral student. The goals of the dissertation are clearly defined and sufficient applied and scientific-applied contributions have been achieved in the development.

As a result of the above, I believe that the dissertation work fully satisfies the requirements contained in the current ZRASRB and in the Regulations of the Bulgarian Academy of Sciences for the conditions and procedure for acquiring scientific degrees, therefore I propose to the esteemed scientific jury to award MSc. Eng. Ivaylo Robertov Georgiev the educational and scientific degree "Doctor" in professional field 5.1. "Mechanical Engineering", scientific specialty "Robots and Manipulators".

Date: 18.11.2025 **Jury member:**

/Prof. PhD. Eng. Pancho Tomov/