STATEMENT REPORT

under the procedure for acquisition of the educational and scientific degree "Doctor"
by candidate **Lyubomira Lachezarova Miteva,**

of the PhD Thesis entitled: "Modelling and Control of an Anthropomorphic Robot Arm",
In the Scientific field: **4. Natural Sciences, Mathematics and Informatics**
Professional field: **4.6. Informatics and Computer Sciences**
Doctoral program: "Information systems" – Embedded and autonomous systems,
Department „Computer Informatics",
Faculty of Mathematics and Informatics (FMI), **Sofia University "St. Kl. Ohridski" (SU),**

The statement report has been prepared by: Prof. Dr. George Vencislavov Boiadjiev - FMI, SU,
(academic position, scientific degree, given names, surname - place of work)
as a member of the scientific jury for the defense of this PhD thesis according to Order № RD 38-114 / 06.03.2023 of the Rector of the Sofia University.

1. **General characteristics of the dissertation thesis and the presented materials**
   The presented dissertation contains 132 pages and consists of an introduction, 4 chapters, a conclusion and development perspectives. The number of titles in the presented bibliography is 98. The list of figures contains 75 figures, and the list of tables - 11. They include the wording of the contributions of the dissertation and the candidate's publications to it, which are 6 in number; the presented reports - 4 in number, and also the projects related to the topic of the dissertation, in which the candidate took part, which are 5 in number.

2. **Short CV and personal impressions of the candidate**
   The candidate graduated from secondary education in 2013 at the "Bertolt Brecht" language high school, Pazardzhik. After that, he was admitted to the Sofia University "St. Kliment Ohridski", Faculty of Mathematics and Informatics, where he received the bachelor's degree in software engineering (2013-2017), master's degree in informatics, specialty "Mechatronics and Robotics" (2017-2019), and from 2019 to 2023 is a full-time doctoral student in the doctoral program "Information Systems" - Embedded and autonomous systems. In the period 2020 - 2023, he is a part-time lecturer at FMI, SU, conducting exercises on "Introduction to Programming", an optional course for masters and "3D modeling and design and applications in robotics", an optional course for bachelors. He speaks English and German.
   The candidate's technical skills and competencies include working with MATLAB, AutoCAD, Windows, MS Office, Linux, C/C++, Python, PHP, UML, Robot Operating System, etc.

3. Content analysis of the scientific and applied achievements of the candidate, contained in the presented PhD thesis and the publications to it, included in the procedure

The applicant's contributions are analyzed below, with the numbering of publications related to a specific contribution following the numbering of the list submitted by the applicant. He himself formulated his contributions only as scientific-applied and applied. But taking into account the relatively small number of publications devoted to robots with additional degrees of freedom, which is an original and complex topic, the author of the opinion accepts some contributions as scientific. And they are: analysis of the workspace of a planar robot with additional degrees of freedom depending on the available obstacles (Chapter 2, [P4], [D4]); algorithms for trajectory planning of a planar robot with additional degrees of freedom and limited joint space based on graph theory (Chapter 3, [P1], [D3]) and for avoiding dynamic obstacles in the workspace of a planar robot with additional degrees of freedom in real time (Chapter 3, [P5]). Scientific-applied contributions include the created approach for classifying by type the solutions of the inverse problem of kinematics for a planar robot with additional degrees of freedom (Chapter 2, [P1], [D3]), the study of the service angle in the workspace of planar robot with additional degrees of freedom (Chapter 2, [P2]) and the established motion planning approach in the presence of static obstacles for a planar robot with additional degrees of freedom (Chapter 3, [P4], [D4]). Applied contributions include: the design of a hardware and software control system for a planar robot with additional degrees of freedom (Chapter 3, [P3], [D2]), created a computer experiment of the developed trajectory planning methods using Webots simulation software (Chapter 4, [Q6]) and conducted real experiments with a 3D printed prototype of a planar robot with additional degrees of freedom for the purpose of verification of trajectory planning algorithms in the presence of static or dynamic obstacles in the robot's workspace (Chapter 4, [Q4], [P5], [D4]).

4. Approbation of the results

The presented dissertation is based on 6 publications that are in refereed and indexed journals in Scopus and IEEE Xplore. For them, 6 declarations from the co-authors of the candidate's publications are presented, showing that the contribution of each of them is equal. 4 reports given at international conferences directly related to the dissertation are also indicated. In addition, a list of 5 projects in which the candidate has participated and which are related to the topic of the dissertation is presented. Two of the works published on the basis of delivered reports were awarded as the best report in the respective section.

Without any doubt it can be said that the scientific works meet the minimum national requirements (under Art. 2b, para. 2 and 3 of ADASRB*) and respectively to the additional requirements of Sofia University “St. Kliment Ohridski” for acquiring the educational and

scientific degree "Doctor" in the scientific field and professional field of the procedure; The results presented by the candidate in the dissertation work and scientific works to it do not repeat such from previous procedures for acquiring a scientific title and academic position. There is no plagiarism proven in the legally established order in the submitted dissertation work and scientific papers under this procedure.

5. Qualities of the abstract

The abstract, containing 37 pages, fully meets all the requirements for its preparation, correctly presenting the results and content of the dissertation work.

6. Critical notes and recommendations

I have no critical remarks regarding the reviewed works of the candidate. In them, the statement of the task is formulated clearly, the results are summarized as a result of a thorough analysis, which is proof of their completeness. The exposition is convincing, which shows the good methodological level of the relevant publication, as well as the quality and completeness of the cited literature, which is an indicator of the author's literary awareness.

7. Conclusion

Having become acquainted with the PhD thesis presented in the procedure and the accompanying scientific papers and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I confirm that the presented PhD thesis and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the Sofia University "St. Kliment Ohridski" (FMI-SU) for acquisition by the candidate of educational and scientific degree "Doctor" in the Scientific field: 4. Natural Sciences, Mathematics and Informatics, Professional field 4.6. Informatics and Computer Sciences. In particular, the candidate meets the minimal national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition.

Based on the above, **I strongly recommend** the scientific jury to award **Lyubomira Lachezarova Miteva** the educational and scientific degree "Doctor" in the Scientific field : **4. Natural Sciences, Mathematics and Informatics**, Professional field **4.6. Informatics and Computer Sciences**

Date: 22.05. 2023 Signature:. George Boiadjiev, Prof., PhD.

/name, academic position, scientific degree/